

Regulations & Syllabi 2025-26



**ASSAM
DON BOSCO
UNIVERSITY**

ASSAM DON BOSCO UNIVERSITY

REGULATIONS AND SYLLABUS 2025-26

FOR

**FOUR YEAR UNDERGRADUATE
PROGRAMMES AS PER NEP 2020
FIVE YEAR INTEGRATED PROGRAMMES
TWO YEAR POST GRADUATE
PROGRAMMES**

ASSAM DON BOSCO UNIVERSITY

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NOTE

This handbook contains important information to help guide and inform you during your programme of study. We recommend that you keep this handbook for the duration of your studies in the University so that you can refer to it as needed. Please note that the onus of ignorance of the regulations and information contained in this handbook will be on the student and will not be ground for any consideration. You are also required to keep abreast of the amendments and additions to the regulations and syllabus that will be officially notified from time to time.

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REGULATIONS FOR FOUR YEAR UNDERGRADUATE PROGRAMMES

ASSAM DON BOSCO UNIVERSITY REGULATIONS 2025-2026

GRADUATE DEGREE PROGRAMMES

(Applicable to All B.TECH, BA, BSC, BCOM, BBA and BCA)

Subject to the provisions of *NEP 2020 with Multiple Entry and Multiple Exit*, following are the regulations of Assam Don Bosco University concerning the Graduate Programmes leading to the award of the Bachelor's Degree in various disciplines of Engineering, three-Year (Bachelor's Degree) and/or Four-Year (Honours/Research).

1.0 Academic Calendar

- 1.1 Semester: Each academic year is divided into two semesters of approximately 90 working days: An Autumn Semester (July – December) and a Spring Semester (January – June). The Autumn Semester shall ordinarily begin in July for students already on the rolls and the Spring Semester shall ordinarily begin in January. However, the first semester (autumn, for newly admitted students) may begin later depending on the completion of admission formalities.
- 1.2 Summer Term: A summer term is for eight weeks during summer vacation. Internship/apprenticeship/work-based vocational education and training can be carried out during the summer term, especially by students who wish to exit after two semesters or four semesters of study. Regular courses may also be offered during the summer on a fast-track mode to enable students to do additional courses or complete backlogs in coursework.
- 1.3 The schedule of academic activities approved by the Academic Council for each semester, inclusive of the schedule of continuous evaluation for the semester, dates for the conduct of end-semester examinations, the schedule of publication of results, etc., shall be laid down in the Academic Calendar for the semester.

2.0 Admission

2.1 All admissions to the Graduate Degree Programmes of the University shall be on the basis of merit. There may, however, be provision for direct admission for a limited number of NRI/FN students.

2.2 Eligibility Criteria: To be considered for admission to a Graduate Degree Programme a candidate should have passed the Higher Secondary examination of a recognized Board of Higher Secondary Education or an equivalent examination of any University / Board/ or equivalent stage of education corresponding to Level-4 * (cf. 3.1)

2.2.1 Admission will be on the basis of performance of the candidate at the qualifying examination, entrance test and/or personal interview and/or CUET Score/JEE /CEE/ any other entrance tests approved by the competent authority.

2.2.2 All Engineering Programmes shall follow the AICTE guidelines for grade/marks and subjects requirement from qualifying examinations for the respective engineering disciplines.

2.3 Reservation of seats for the programme shall be as per the guidelines laid out in the Statutes of the University (As approved by the competent authority) .

2.4 Admissions shall ordinarily close after a specified period from the date of commencement of the first semester, through a notification. However, in exceptional cases, admission of a candidate after the last date may be recommended to the University with justification, by the School / Departments concerned. Under such an event, this period shall not exceed four weeks from the date of commencement of the first/third semester.

2.4.1 The attendance of such students shall be computed from the date of admission.

2.4.2 Such students may be offered the opportunity of taking part in in-semester assessment modules which may have already been completed.

2.5 All candidates shall be required to satisfy the norms prescribed by the University for Medical Fitness prior to admission.

2.6 Anti-Ragging Affidavit: Students and Parents Undertaking Affidavit In compliance of the UGC Regulations, it is compulsory for each student and every parent to submit an online Anti-Ragging undertaking affidavit every academic year. The Link to fill out the online undertaking affidavit by students and parents is : www.antiragging.in/affidavit_registration_disclaimer.html
www.c4yindia.org/Home/Undertaking

2.7 B.TECH Lateral Entry into Programmes

2.7.1 Polytechnic diploma holders in any branch of Engineering and Technology and B.Sc. Degree holders having Physics, Chemistry and Mathematics shall be eligible for admission to degree courses in Engineering and Technology in the third semester B.TECH Programme against vacancies and/or seats in addition to the sanctioned intake in the first year.

2.7.2 Such diploma holders should have been bonafide students of polytechnics duly approved by the government and should have pursued an AICTE approved three-year diploma curriculum in an appropriate branch of Technology.

2.7.3 Only diploma holders who have secured a minimum of 45% in the aggregate in the relevant discipline and B.Sc. students who have secured a minimum of 45% marks in the aggregate shall be eligible for consideration for admission. The students belonging to B.Sc. Stream would have to clear the subjects: Engineering Graphics/Engineering Drawing and Engineering Mechanics of the First Year Engineering Programme along with the Second year subjects.

2.7.4 Such admissions shall be on the basis of merit in the ADBU entrance test and a personal interview.

3.0 Programmes of Study

3.1 The University follows an outcome based learning approach following National Higher Education Qualification Framework (NHEQF)*, explicitly defining the course/programme outcomes and programme specific outcomes, in the curriculum for all the Graduate Degree Programmes. (* available at https://www.ugc.gov.in/pdfnews/2990035_Final-NHEQF.pdf)

3.2 The Non Engineering Undergraduate Programme (UG) is structured with multiple exit options of Certificate, Diploma, basic Bachelor' Degree at the completion of first, second and third years respectively. The students who complete four years Undergraduate Programme, either in one stretch or through multiple exits and re-enter would get a Bachelor's Degree with Honours. If the student completes a rigorous research project in their major area(s) of study during the fourth year of a Bachelor's Degree will be awarded Honours with research.

3.3 The Engineering Undergraduate B.TECH Programme is structured with multiple exit options of Certificate, Diploma, B.Sc Engineering/ B. Voc Degree at the completion of first, second and third years respectively. The students who complete four years Undergraduate Programme, either in one stretch or through multiple exits would get a Bachelor's Degree in Engineering.

3.4 B.TECH Honours

A student of B.Tech can obtain Honours by completing additional 18-20 credits in emerging areas of the same discipline of study. Departmental Board of Studies shall finalize the emerging areas of study. (Refer 8.1)

3.5 B.TECH Minor Engineering

A student of B.Tech can obtain Minor by completing additional 18-20 credits in emerging areas of another discipline of study. Departmental Board of Studies shall finalize the emerging areas of study. (Refer 8.2)

4.0 Duration of the Programme

4.1 The duration of the Undergraduate (UG) programme for all non-engineering disciplines is 4 years or 8 semesters. Students who desire to undergo a 3-year UG Programme may opt to exit after completion of the 3rd year.

4.2 Students choosing to exit after the first or second year will receive a UG Certificate or UG Diploma, respectively, contingent upon fulfilling the required number of credits as outlined in *Table 1*.

4.3 Students who exit with a UG certificate or UG diploma are permitted to re-enter within three years and complete the degree programme.

4.4 Students may take a break from their studies, provided that the total duration of their programme does not exceed 7 years.

4.5 Students who successfully complete their Bachelor's Degree with Honours, with suitable grades are eligible to enter the doctoral (Ph. D) Programme in the relevant discipline or enter the "Two-semester" Master's Degree Programme. (Ref12.5)

4.6 The duration of the Bachelor of Technology (B.TECH) programme is 4 years or 8 semesters.

4.6.1 Students who do not meet some degree requirements in their first attempt may be granted an additional 4 semesters (2 years) to fulfill all programme requirements

4.6.2 Under exceptional circumstances and depending on the merit of each case, a period of 2 more semesters (1 year) may be granted for the completion of the programme. (Ref. 12.5)

4.7 The provisions outlined in clauses 3.2 and 3.3 are also applicable to all engineering graduate programmes.

4.8 Students can earn B.TECH Honours or B.TECH Minor engineering by completing additional 18-20 credits during their Engineering graduate programme.

5.0 Curriculum Components

5.1 **Non Engineering disciplines:** The curriculum consists of major courses, minor courses and courses from other disciplines, language courses, skill courses, and a set of courses on Environmental education, understanding India, Digital and technological solutions, Health & Wellness, Yoga education, and sports & fitness.

5.1.1 At the end of the second semester, students can decide either to continue with the chosen major or request a change of major. (Ref 7.3)

5.2 **Engineering disciplines:** The curriculum for graduate degree programmes in engineering is organized into two categories: Core Courses and Elective Courses

5.2.1 **Core Courses:** Core courses are those in the curriculum, the knowledge of which is deemed essential for students who are pursuing the said Degree Programme.

5.2.1.1 Students are required to complete all core courses offered in their programme.

5.2.1.2 The number of credits required from core courses shall be as prescribed by the competent academic authority.

5.2.1.3 Core courses include Professional Core Courses (DC), Engineering Science Courses (IC), Basic Science Courses (IC), Humanities and Social Science Courses (IC), Mandatory Courses (IC), Project Work, Seminar and Internship in Industry.

5.2.2 Elective Courses: Elective courses provide opportunities for specialization and cater to students' interests and career goals. These courses may be selected by the student and/or offered by the department conducting the programme, following the norms set by the competent academic authority.

5.2.2.1 The number of credits which may be acquired through elective courses shall be prescribed by the competent academic authority.

5.2.2.2 Elective courses include Professional Elective Courses and Open Elective Courses.

5.2.2.3 It shall be the prerogative of the department not to offer an elective course which has less than 5 students opting for it.

5.2.3 At the end of the second semester, students can decide either to continue with the chosen engineering discipline/branch or request a change of branch. (Ref 7.4)

6.0 Credit hours and Course structure

6.1 The medium of instruction, as well as examinations and project reports shall be in English except for Modern Indian language courses.

6.2 The course structure and syllabi of the Graduate Degree Programmes shall be approved by the Academic Council of the University. Departmental Boards of Studies (DBOS) shall discuss and recommend the syllabi of all the courses offered by the department from time to time. The proposals from the departments are forwarded to make recommendations to the Academic Council for consideration and approval.

6.3 The workload for a course is quantified in terms of credit hours, which represent the unit of measurement for coursework. A credit indicates the number of hours of instruction required per week over the duration of a semester. Courses may include:

- lecture and tutorial components
- lecture and practicum components
- lecture, tutorial, and practicum components
- only practicum components

6.3.1 A one-credit Lecture/tutorial in a course is equivalent to 15 hours of engagement.

6.3.2 A one-credit course in practicum or lab work or Seminar or Internship or Studio activities or Field practice/projects or Community engagement and service, and fieldwork is equivalent to 30 hours of engagement.

6.4 Type of Courses and Credit distribution:

6.4.1 Non Engineering disciplines: The UG programme will consist of the following categories of courses and the minimum credit requirements for 3-year UG and 4-year UG (Honours) or UG (Honours with Research) programmes are given below:

Table 1: Course Categorization and Credit Distribution for UG/Bachelor's Programme

S. N o	Category of Courses	Minimum Credit	
		Requirement	
		3-year UG	4-Year UG
1	Major Courses	60	80
2	Minor Courses	24	32
3	Multidisciplinary Courses	9	9

4	Ability Enhancement Courses (AEC)	8	8
5	Skill Enhancement Courses (SEC)	9	9
6	Common Value Based Courses for all UG	4	4
7	Community Engagement (CE)	4	4
8	Summer Internship	2	2
9	Research Project / Dissertation	-	12
10	Mandatory Courses/Audit Courses	-	-
	TOTAL	120	160

Note:

- Exit option with UG Certificate (with the completion of courses across semesters 1, 2 and additional 4 credits in skill based vocational courses offered during summer term or internship equal to a minimum of 44 credits)
- Exit option with UG Diploma (with the completion of courses across semesters 1-4 and additional 4 credits in skill based vocational courses offered during first year or second year summer term equal to a minimum of 84 credits)
- Exit option with 3- year UG Degree (with the completion of courses across semesters 1-6 including 2 credits of Internship offered during second year summer term equal to a minimum of 120 credits)
- Students will be awarded UG Degree (Honours) /UG Degree (Honours) with Research in the relevant Discipline (with the completion of courses equal to a minimum of 160 credits)

6.4.2 Engineering disciplines: Here is the combined table with a range of credits* for various categories across B.TECH in the disciplines of Mechanical Engineering (MNE), Computer Science and Engineering (CSE), Electronics and Communication Engineering (ECE), Civil Engineering (CVE), Electrical and Electronics Engineering (EEE) and Artificial Intelligence and Machine Learning (AIML)

Table 2: Course Categorization and Credit Distribution for B.Tech Programmes

S.No	Category of Courses	MNE	CSE	ECE	CVE	EEE	AI ML
1	Humanities and Social Sciences including Management courses	12	16	15	6	15	10
2	Basic Science courses	29	23	23	24	20	16
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer, etc.	27	29	17	20	14	8
4	Professional core courses	58	59	61	62	47	71
5	Professional Elective courses relevant to chosen specialization/branch	9	12	12	26	47	16
6	Open subjects – Electives from other technical and/or emerging subjects	9	9	12	12	14	6

7	Project work, seminar, and Summer internship in industry or elsewhere	16	15	20	16	16	38
8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Knowledge Tradition]/ Audit Courses	(non-credit)	(non-credit)	(non-credit)	IKS 02	(non-credit)	(non-credit)
	Total	160*	163*	160*	168*	173*	165*

Note:

(*) indicate credits that may be modified in accordance with AICTE guidelines to meet the specific needs of the respective discipline

6.4.3 **Internship/apprenticeship** can be carried out during the summer break mandatorily for students who exit after two semesters or four semesters of study in addition to the skill based courses.

6.4.4 **Audit Courses:** Students who secure a CGPA of at least 8 at the end of the 4th semester may opt to take one audit course per semester from any Department from the 5th semester onwards, provided the course teacher permits the auditing of the course. This shall be done under the guidance of the Departmental Faculty Advisor/mentor. The student is free to participate in the evaluation process for such courses. However, an attendance of 75% is necessary for obtaining a P grade for such courses. When auditing courses are offered by other departments, it shall be the responsibility of the student to attend such courses without missing courses of one's own department and semester.

6.4.5 **Bridge Courses:** The Departments shall make provision for Bridge Courses to facilitate admission of students from varied backgrounds to a programme of their choice.

6.4.6 **Value-added Courses:** Each department shall offer value-added courses. Value-Added courses are part of the curriculum designed to provide necessary skills to increase the employability quotient and equipping the students with essential skills to succeed in life. Certificates will be awarded to those who successfully complete the course.

6.4.7 In addition to the prescribed credit requirement, a student shall have to complete Institutional mandatory courses with Pass grade, as prescribed by the competent academic authority, from time to time, which shall be recorded in the Grade sheet but not taken into account for computing the SGPA and the CGPA.

6.4.8 In addition, students may also opt for additional courses in consultation with their mentors (Cf. 6.4.9). Courses may also be chosen from SWAYAM/NPTEL. Students are required to participate in the evaluation process of such courses. The grades obtained for such courses shall be recorded in the grade sheet, but not taken into account for computing SGPA and CGPA. (Ref. 6.2)

6.4.9 **Faculty Advisor/Mentor:** A faculty advisor/mentor (and a co-mentor to perform the duties of a mentor during the absence of the mentor) shall be assigned for each student. Generally the faculty advisor/mentor shall be assigned by the concerned department, in consultation with the Director of the School concerned. (Faculty advisors/ mentors shall help their mentees to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them.

6.5 Academic Bank of Credits (ABC) a national-level facility for "credit transfer" is created for students to transfer and consolidate the credits earned by them by undergoing courses from any recognized HEIs. The ABC allows for credit redemption through the process of commuting the accrued credits in the Academic Bank Account maintained in the ABC for the purpose of fulfilling the credits requirements for the award of certificate/diploma/degree by the authorized

HEIs. Upon collecting a certificate, diploma or degree, all the credits earned till then, in respect of that certificate, diploma or degree, shall stand debited and deleted from the account concerned. The procedure for depositing credits earned, its shelf life, and redemption of credits would be as per UGC (Establishment and Operationalization of ABC scheme in Higher Education) regulations and its amendments, 2021.

7.0 Major and Minor disciplines:

7.1 Major discipline is the discipline or subject of main focus and the degree will be awarded in that discipline. Students should secure the prescribed number of credits (about 50% of total credits) through core courses in the major discipline.

7.1.1 Minor discipline helps a student to gain a broader understanding beyond the major discipline. For example, if a student pursuing an Economics major obtains a minimum of 12 credits from a bunch of courses in Statistics, then the student will be awarded B.A. degree in Economics with a Minor in Statistics.

7.2 In order to qualify for a Graduate Degree, a student is required to complete the minimum credit requirements as prescribed by the competent academic authority. (Refer 4.4)

7.3 Change of Major Discipline: The University may permit a student to change from one major discipline of study to another after the first two semesters.

7.3.1 Students shall be allowed a change in major discipline provided that the strength of a Programme offering the specific Major discipline should not fall below the existing strength by more than ten percent and should not go above the sanctioned strength by more than ten percent.

7.3.2 Only those students shall be eligible for consideration of a change of major discipline, who has completed all the credits required in the first two semesters of their studies, in their first attempt. (Ref 6.4.5 for fulfilling any deficient and/or prerequisite courses to be completed)

7.3.3 Applications for a change of major discipline must be made by intending eligible students in the prescribed form. The Office of the Registrar shall call for applications at the beginning of the third semester and the completed forms must be submitted by the last date specified in the notification.

7.3.4 Students may enlist up to two choices of major disciplines, in order of preference, to which they wish to change over. It shall not be permissible to alter the choice after the application has been submitted.

7.3.5 Change of major discipline shall be made strictly in order of merit of the applicants. For this purpose the CGPA obtained at the end of the second semester shall be considered. In case of a tie, the following shall be considered in the given order: the SGPA of the second semester, the SGPA of the first semester, grades obtained by the applicants in the courses of the second semester in an order given in the grade and approved by the Office of the Registrar.

7.3.6 A committee consisting of the Directors and Head of Departments of the concerned School, chaired by the Registrar shall examine the applications and consider them on the basis of the criteria laid out above.

7.3.7 The details of major discipline changes effected shall be notified to the students by the Registrar, within 7 days of the submission of applications.

7.3.8 All changes of major discipline shall be final and binding on the applicants. No student shall be permitted, under any circumstance, to refuse the change of major discipline offered.

7.3.9 All changes of major discipline made in accordance with the above rules shall be effective from the third semester of the applicants concerned. No change of branch shall be permitted after this.

7.4 B.Tech Change of Branch:

7.4.1 Normally a student admitted to a particular branch of the B.TECH programme shall continue studying in that branch till completion. However, in special cases the university may permit a student to change from one branch of studies to another after the first two semesters.

7.4.2 Students shall be allowed a change in branch subject to the limitation that the strength of a branch should not fall below the existing strength by more than ten percent and should not go above the sanctioned strength by more than ten percent.

7.4.3 Only those students shall be eligible for consideration of a change of branch, who have completed all the credits required in the first two semesters of their studies, in their first attempt.

7.4.4 Applications for a change of branch must be made by intending eligible students in the prescribed form. The Office of the Registrar shall call for applications at the beginning of the third semester and the completed forms must be submitted by the last date specified in the notification.

7.4.5 Students may enlist up to two choices of branch, in order of preference, to which they wish to change over. It shall not be permissible to alter the choice after the application has been submitted.

7.4.6 Change of branch shall be made strictly in order of merit of the applicants. For this purpose the CGPA obtained at the end of the second semester shall be considered. In case of a tie, the following shall be considered in the given order: the SGPA of the second semester, the SGPA of the first semester, grades obtained by the applicants in the courses of the second semester in an order to be determined by the Office of the Registrar.

7.4.7 A committee consisting of the Director and heads of departments of the concerned School, chaired by the Registrar shall examine the applications and consider them on the basis of the criteria laid out above.

7.4.8 The details of branch changes effected shall be notified to the students by the Registrar, within 7 days of the submission of applications.

7.4.9 All changes of branch shall be final and binding on the applicants. No student shall be permitted, under any circumstance, to refuse the change of branch offered.

7.4.10 All changes of branch made in accordance with the above rules shall be effective from the third semester of the applicants concerned. No change of branch shall be permitted after this.

8.0 B.TECH Honours and B.TECH Minor Engineering:**8.1 B.TECH Honours**

A student of B.Tech can obtain Honours by completing additional 18-20 credits in emerging areas of the same discipline of study. Departmental Board of Studies shall finalize the emerging areas of study. Students eligible for Honours programme shall have a CGPA of 6.5 till 2nd Semester. In case of lateral entry students, they should have 1st class in their qualifying examination. Students will be permitted to enroll for Honours in 3rd or 4th semester which may continue till 8th semester until they complete 18-20 credits. In any semester, they will be advised to take not more than 6 credits of courses.

**** Students may be allowed to opt from SWAYAM/NPTEL courses. Teaching and evaluation of the courses will be as per university norm followed for any other courses.**

For the students, who opted for Honours but could not earn the minimum 18 credits till 8th semester examination, all the courses completed shall be printed in the Transcript to recognize the additional effort of the students. The opportunity of additional chance may be given to the willing students whose deficiency is marginal (at the most 6 credits).

8.2 B.TECH Minor Engineering

A student of B.Tech can obtain Minor by completing additional 18-20 credits in emerging areas of another discipline of study. Departmental Board of Studies shall finalize the emerging areas

of study. Students eligible for Honours programme shall have a CGPA of 6.5 till 2nd Semester. In case of lateral entry students, they should have 1st class in their qualifying examination. Students will be permitted to enroll for Minor in 3rd or 4th semester which may continue till 8th semester until they complete 18-20 credits. In any semester, they will be advised to take not more than 6 credits of courses. Students may be allowed to opt from SWAYAM/NPTEL courses. Teaching and evaluation of the courses will be as per university norm followed for any other courses.

For the students, who opted for Minor but could not earn the minimum 18 credits till 8th semester examination, all the courses completed shall be printed in the Transcript to recognize the additional effort of the students. The opportunity of additional chance may be given to the willing students whose deficiency is marginal (at the most 6 credits).

9.0 Transfer of Admission

Transfer of admissions is permissible only for autumn semesters (at the end of second, fourth and sixth semesters for students of other universities and within the University.

9.1 Evaluation Committee for Multiple entry and Exit: With the provision of multiple entry and exit, students from other HEIs will be allowed entry to appropriate Level. Evaluation Committee will be set up to see the eligibility of such students who desire to join the University from other HEIs with a lateral entry.

9.1.1 Applications for exit received on or before 31st March after completion of first year/second year/third year, shall be evaluated by the Evaluation Committee.

9.2 The Conditions for transfer admission of students of other Universities

9.2.1 A Candidate migrating from any other University may be permitted to join odd semester of the degree programme provided he/she has passed all the subjects of previous semesters with 4 credits of internship completed. Such candidates must satisfy all other conditions of eligibility stipulated in the regulations of the University.

9.2.2 His/her transfer admission shall be within the intake permitted in the University.

9.2.3 He/she shall fulfill the attendance requirements as per the University Regulation.

9.2.4 The candidate who is migrating from other Universities is eligible for overall SGPA/CGPA or Class and not for ranking. He/ She shall complete the programme as per the regulation governing the maximum duration of completing the programme as per this regulation.

10.0 University Registration

10.1 Candidates who are admitted to a programme shall have to register as bona-fide students with the University as per the University regulations within a period specified by the University, by a formal application routed through the Director of the School concerned.

11.0 Attendance

11.1 To be permitted to appear for the end-semester examination of a particular course, a student is required to have a minimum attendance of 75% for that course.

11.2 Deficiency in attendance up to 10% may be condoned by the Director of the School in the case of leave taken for medical and other grievous reasons, which are supported by valid medical certificates and other requisite documents.

11.3 Some students, due to exceptional situations like their own serious sickness and hospitalization or death of members of the inner family circle (restricted to only father, mother, siblings), may have attendance below 65%. Such students may be given bonus attendance percentage for a particular course based on his/her attendance for that course during the remaining days of the current semester, as given in the following table:

Attendance during the remaining days of the current semester	Bonus percentage available in the current semester
95% or more	5
90% or more but less than 95%	4
85% or more but less than 90%	3
80% or more but less than 85%	2
75% or more but less than 80%	1

They shall be permitted to appear for the end-semester examination of the course if on the strength of this bonus attendance percentage, they obtain 65% attendance for that course.

11.4 If the sum of the credits of the courses for which a student is unable to appear at the end-semester examinations exceeds 50% of the total credits allotted for the semester, he/she shall not be permitted to appear for the entire endsemester examinations.

11.5 The School may propose to set aside a certain portion of the in-semester assessment marks for attendance. The number of marks and modalities of their allotment shall be made known to the students at the beginning of each semester.

11.6 Leave

11.6.1 Any absence from classes should be with prior sanctioned leave. The application for leave shall be submitted to the Office of the Director of the concerned School on prescribed forms, through proper channels, stating fully the reasons for the leave requested along with supporting documents.

11.6.2 In case of emergency such as sickness, bereavement or any other unavoidable reason for which prior application could not be made, the parent or guardian must promptly inform the office of the Director of the concerned School.

11.6.3 If the period of absence is likely to exceed 10 days, a prior application for grant of leave shall have to be submitted through the Director of the concerned School to the Registrar of the University with supporting documents in each case; the decision to grant leave shall be taken by the Registrar on the recommendation of the Director of the concerned School.

11.6.4 The Registrar may, on receipt of an application, also decide whether the student be asked to withdraw from the programme for that particular semester because of long absence.

11.7 It shall be the responsibility of the student to intimate the concerned teachers regarding his/her absence before availing the leave.

12.0 Grading System

12.1 Three types of courses are offered in the Graduate programmes:

Graded courses: For the majority of the courses, students shall be assessed and given grades.

Pass/Non-Pass courses: There are some courses for which the students are expected to obtain a P grade to be eligible for the degree.

Audit Courses: A third category of courses are audit courses. These are optional. However, students who opt for these courses must have the required attendance to obtain a P grade in the course.

12.2 Based on the performance of a student, each student is awarded a final letter grade in each graded course at the end of the semester and the letter grade is converted into a grade point. The correspondence between percentage marks, letter grades and grade points is given in the table below:

Marks (x) obtained (%)	Grade	Description	Grade Points
$90 \geq x \leq 100$	O	Outstanding	10
$80 \geq x < 90$	A+	Excellent	9
$70 \geq x < 80$	A	Very Good	8
$60 \geq x < 70$	B+	Good	7
$50 \geq x < 60$	B	Above Average	6
$41 \geq x < 50$	C	Average	5
$x = 40$	P	Pass	4
$x < 40$	F	Fail	0
	AB	Absent	0
	PS	Pass	0
	NP	Not Passed	0
	X	Not Permitted	0

12.2.1 Audit Courses can be graded as 'PS' Pass and 'F' Fail¹ without any credits

12.2.2 In addition, a student may be assigned the grades 'P' and 'F' for pass marks and non-passing marks respectively, for Pass/No-pass courses, or the grade 'X' (not permitted).

12.2.3 A student shall be assigned the letter grade 'X' for a course if he/she is not permitted to appear for the end semester examination of that course due to lack of requisite attendance.

12.2.4 A letter grade 'F' or 'X' in any course implies failure in that course.

12.2.5 A student is considered to have completed a course successfully and earned the credits if she/he secures a letter grade other than 'F', or 'X'.

12.3 At the end of each semester, the following measures of the performance of a student in the semester and in the programme up to that semester shall be computed and made known to the student together with the grades obtained by the student in each course:

12.3.1 The Semester Grade Point Average (SGPA): From the grades obtained by a student in the courses of a semester, the SGPA shall be calculated using the following formula:

$$SGPA = \frac{\sum GP_i \times NC_i}{\sum NC_i} \quad i=1 \text{ to } n$$

Where, GP_i = Grade points earned in the i^{th} course

NC_i = Number of credits for the i^{th} course

n = the number of courses in the semester

12.3.2 The Cumulative Grade Point Average (CGPA): From the SGPA's obtained by a student in the completed semesters, the CGPA shall be calculated using the following formula:

$$CGPA = \frac{\sum SGPA_i \times NSC_i}{\sum NSC_i} \quad i=1 \text{ to } n$$

Where,

$SGPA_i$ = Semester Grade point of the i^{th} semester

NSC_i = Number of credits for the i^{th} semester

n = the number of semesters completed

12.3.3 The CGPA may be converted into a percentage by multiplying CGPA by 10.

12.3.4 Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such. Whenever these CGPA are to be used for official purposes, only the rounded off values shall be used.

12.4 In the case of an audit course, the letters 'P' or 'F' shall be written alongside the course name in the Grade Sheet. Such courses are not taken into account in the calculation of the SGPA or CGPA. However, the award of the degree is subject to obtaining a 'P' grade in all such courses. A student is not required to register again for passing the failed audit courses.

12.5 Only those students who secure CGPA of 7.5 and above in the first six semesters may choose to undertake research in the fourth year

13.0 Assessment of Performance

13.1 A student's performance is evaluated through a continuous system of evaluation comprising tests, quizzes, assignments, seminars, minor projects, major projects and end-semester examinations.

13.2 **Theory Courses:** Theory courses shall have two components of evaluation – in- semester assessment of 40% weightage and an end-semester examination having 60% weightage.

13.2.1 The modalities of the conduct of in-semester assessment and weightages attached to its various components shall be as published by the School at the beginning of each semester.

13.3 **Lab Courses:** Lab courses shall be evaluated on the basis of attendance; assessment of tasks assigned and end semester test/viva voce. The weightage assigned for these components of the evaluation is given in the following table:

Component	Weightage
Attendance	10
Assessment of Tasks Assigned	30
End-semester test / viva voce	60

13.3.1 The modalities of the conduct of evaluation under the heading "Assessment of tasks assigned", its components and the weightages attached to its various components shall be published by the department concerned at the beginning of each semester.

13.3.2 The evaluation of the end-semester test for a lab course may be done on the basis of criteria and weightage to be specified in the question paper, among which are included

- Organisation of the experiment
- Actual conduct of the experiment assigned and accuracy of the result
- Extent of completion
- A comprehensive viva-voce which examines the overall grasp of the subject

13.4 End Semester examinations

13.4.1 End-semester examinations for the theory courses, generally of three hours' duration, shall be conducted by the University. The Director of the concerned school and the Examination department shall make the arrangements necessary for holding the examinations.

13.4.2 In the end-semester examinations, a student shall be examined on the entire syllabus of the courses.

13.4.3 A student shall not obtain a pass grade for a course without appearing for the end-semester examination in that course.

13.5 Industry Training/Internship Programme

13.5.1 Departments require students to undergo industry training/internship programmes.

13.5.2 Departments are to notify the students at the beginning of their programmes about the details of industry training/internship.

13.5.3 After the Industry Training/Internship programme, the student shall furnish a certificate from the organisation where he/she underwent the programme as proof of successful completion.

13.5.4 The student shall submit a training/internship report to the department in a format to be laid down by the concerned department. He/she shall also give a seminar to present the learning outcomes of the programme in the presence of the faculty members and students of the department. The student shall be evaluated on the basis of the report, the seminar and interaction during the seminar and grades shall be assigned. These grades shall be given a weightage of two credits in the subsequent semester.

13.6 Field-based learning/ Minor project:

13.6.1 Minor project work is conducted during the sixth semester of the programme, and is to be done individually or in groups within the campus/Outside the campus with due permissions.

13.6.2 Each department shall constitute a Departmental Project Evaluation Committee (DPEC) consisting of the Head of the Department, Project Co-ordinator and two senior teachers from the department, with the Project Co-ordinator as the convenor. The DPEC shall co-ordinate the conduct and assessment of the project.

13.6.3 The DPEC shall notify the schedule and modalities for the following stages in the implementation of the project.

- Submission of the topic of the project
- Notification for assignment of project supervisors
- Submission of the synopsis
- Schedule and modality for the submission of weekly activity reports
- Schedule for the seminar presentation of synopsis
- Schedule for Progress Seminars, submission of progress reports and viva voce examination
- Date for the submission of the project report and a brief summary
- Dates for the external evaluation of the project

13.6.4 The DPEC may ask a student to resubmit a synopsis if the same does not get its approval.

13.6.5 The Convener of the DPEC shall submit to the Controller of Examinations a panel of at least three names of external examiners at least three weeks before the external examination. The Controller of Examinations shall appoint the external examiner(s) from this panel. The project supervisor shall be the internal examiner.

13.6.6 Each student shall submit to the DPEC three bound, typed copies of the project report, and prepared according to the prescribed format, after the pre-submission seminar, by the due date. The student shall also submit three copies of a brief summary of the project that shall be forwarded to the concerned examiners.

13.6.7 The DPEC shall make the arrangements necessary to conduct the external evaluation in consultation with the examiner(s) appointed by the University, during the dates notified.

13.6.8 The DPEC shall forward the in-semester assessment marks to the Controller of Examinations by the date specified by the Examination Department.

13.6.9 The end-semester assessment shall have the following components:

- Project implementation: 40 marks
- Seminar presentation: 20 marks
- Viva voce examination: 20 marks

- Project documentation: 20 marks

13.6.10 Those who obtain an 'F' grade for the minor project shall be required to re-enroll for it in the subsequent semesters.

13.7 Major Projects /Dissertation

13.7.1 Students of the B.TECH programme shall undertake a Major Project during the course of their graduate studies. The B.TECH major project work is normally conducted in two phases during the seventh and eighth semesters of the programme and is to be done individually or in groups within the campus. A department may substitute this with two independent projects in the seventh and eighth semesters with prior permission from the statutory authority.

13.7.2 Each department shall constitute a Departmental Project Evaluation Committee (DPEC) consisting of the Head of the Department, Project Co-ordinator and two senior teachers from the department, with the Project Co-ordinator as the convenor. The DPEC shall co-ordinate the conduct and assessment of the project.

13.7.3 The DPEC shall notify the schedule and modalities for the following stages in the implementation of the project.

- Submission of the topic of the project
- Notification for assignment of project supervisors
- Submission of the synopsis
- Schedule and modality for the submission of weekly activity reports
- Schedule for the seminar presentation of synopsis
- Schedule for Progress Seminars, submission of progress reports and viva voce examination
- Date for the submission of the project report and a brief summary.
- Dates for the external evaluation of the project

In the case of the B.TECH project, some of these activities may be performed during semester VII (Phase I) and others during Semester VIII (Phase II) as shall be notified by the DPEC.

13.7.4 The DPEC may ask a student to resubmit a synopsis if the same does not get its approval.

13.7.5 The Convenor of the DPEC shall submit to the Controller of Examinations a panel of at least three names of external examiners at least three weeks before the external examination. The Controller of Examinations shall appoint the external examiner(s) from this panel. The project supervisor shall be the internal examiner.

13.7.6 Each student shall submit to the DPEC three bound, typed copies of the project report, and prepared according to the prescribed format, after the pre-submission seminar, by the due date. The student shall also submit three copies of a brief summary of the project that shall be forwarded to the concerned examiners.

13.7.7 The DPEC shall make the arrangements necessary to conduct the external evaluation in consultation with the examiner(s) appointed by the University, during the dates notified.

13.7.8 Phase I of the project shall be evaluated through in-semester assessment only. The modality and components of the assessment and their weightages shall be determined by the School and the same shall be notified at the beginning of each semester.

13.7.9 Phase II of the project shall be evaluated through in-semester and end-semester assessments of equal weightage. The in-semester assessment shall be done by the DPEC and the project supervisor and the end-semester assessment shall be done by the external examiner(s) and the project supervisor, assisted by the DPEC. The modality and components of the in-semester assessment and their weightages shall be determined by the school and the same shall be notified at the beginning of each semester.

13.7.10 The DPEC shall forward the in-semester assessment marks to the Controller of Examinations by the date specified by the Examination Department.

13.7.11 The end-semester assessment shall have the following components:

- Project implementation: 40 marks
- Seminar presentation: 20 marks
- Viva voce examination: 20 marks
- Project documentation: 20 marks

13.7.12 Independent projects as envisaged in clause 13.7.1 shall be evaluated in the same manner as Phase II of the major project.

13.7.13 Those who obtain an 'F' grade for the major project shall be required to re-enroll for it in the subsequent semesters.

13.8 Minor and Mini Projects

13.8.1 Students may be assigned minor and mini projects by the department from the fourth semester onwards to ensure that their learning becomes a hands-on experience. These projects shall be executed by the students individually or in groups under the guidance of faculty members appointed by the department.

13.8.2 The mode of evaluation of these projects shall follow the pattern of evaluation of Lab Courses (vide clause 8.3) and the modalities for the conduct of evaluation, its components and the weightages attached to these components shall be published by the department concerned at the beginning of each semester.

13.8.3 The students may be required to submit project reports in the format specified. The evaluation of the Minor and Mini Projects shall take into consideration these project reports.

13.9 The evaluation of performance in non-credit courses shall be done by the authorities conducting them and they shall communicate the grades to the Director of the concerned School who shall forward them to the Controller of Examinations.

13.10 The Director of the concerned School shall forward the marks obtained in the in-semester evaluation to the Controller of Examinations within the prescribed time as may be notified.

13.10.1 All evaluated work in a course except the end semester answer scripts shall be returned to the students promptly.

13.9 Eligibility for appearing in the end-semester examinations: A student shall be permitted to appear for the end-semester examinations, provided that

13.9.1 A student has not been debarred from appearing in the end semester examinations as disciplinary action for serious breach of conduct.

13.9.2 He/she has satisfactory attendance during the semester according to the norms laid out in the clause 8 of these regulations.

13.9.3 He/she has paid the prescribed fees and any other dues of the university within the date specified.

13.10 Registration for end-semester Examinations

13.10.1 The University shall, through a notification, invite applications from students to register for the end-semester examinations.

13.10.2 Students who have registered with the University (vide clause 9) and those who have applied for such registration may apply to appear for the end- semester examinations of the university, in response to the notification issued by the University, provided that they fulfill the eligibility norms as laid down in clause (ref 12.9)

13.10.3 All eligible candidates shall be issued an admit card for the relevant examination and for specified courses. A student who does not have a valid admit card may not be permitted to write the end-semester examinations.

13.10.4 A student who secures an 'F' grade in any course in a semester may register for the end-semester examination for that course in a subsequent semester when that course is offered again, within the maximum period of time allotted for the completion of the programme. The in-semester assessment marks obtained by him/ her in the last semester in which the said course was attended by him/her shall be retained.

13.10.5 Similarly, in case of an 'NP' grade in non-credit courses the student shall have to re-register for it in the appropriate semester of the next academic session.

13.10.6 When a student re-registers for the end semester examination of a course, in accordance with clause 10.10.4 above, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

13.11 Conduct of Examinations: The University shall conduct the end-semester examinations in accordance with the applicable regulations on such dates as are set down in the Academic Calendar or as notified.

13.12 Declaration of Results: The University shall declare the results of a semester and make available to the students their grade sheets within the time-frame prescribed by the relevant regulations of the university and specified in the academic calendar.

13.13 The University may withhold the results of a student for any or all of the following reasons

- he/she has not paid his/her dues
- there is a disciplinary action pending against him/her
- he/she has not completed the formalities for University Registration according to the requirement of section 5 of these Regulations.

13.14 Re-examining of answer scripts

13.14.1 If a student feels that the grade awarded to him/her in a course is not correct, he/she may apply to the University for the re-examining of his/her answer script.

13.14.2 Re-examining of scripts may be of two different categories – scrutiny and re-evaluation.

13.14.3 **Scrutiny:** The activities under this category shall ordinarily be confined to checking correctness of the total marks awarded and its conversion into appropriate letter grades whether any part/whole of a question has been left unevaluated inadvertently correctness of transcription of marks on the tabulation sheet and the grade sheet issued in respect of the course under scrutiny.

13.14.4 **Re-evaluation:** Re-evaluation of the answer script by independent experts in the concerned subject(s).

13.14.5 Application for re-examining of answer scripts

- A student may apply for scrutiny or re-evaluation for one or more courses of the just-concluded end-semester examinations within seven calendar days from the date of publication of its results in the application form prescribed for this purpose.
- He/she shall pay the prescribed fee to the University as notified.
- A student applying for scrutiny/re-evaluation shall expressly state on the application form whether the application made is for Scrutiny or for Re- evaluation. In each case, the student may also request to see his/her answer script. All applications for scrutiny/re-evaluation must be routed through the Director of the concerned School.

13.14.6 If in the process of re-examining, the grade obtained in a course changes, the better of the two grades shall be assigned to the course. If there is a change, the new grade shall be recorded and a new grade sheet shall be issued to the student.

13.14.7 Without prejudice to any of the clauses of section 10.14, a student who has been found to have used unfair means during an examination shall not be eligible to apply for scrutiny or re-evaluation of answer scripts.

13.15 Repeat Examination: The University shall conduct repeat examination for those with F grade at a different time slot, as set down in the Academic Calendar or as notified. Such students should register for these examinations.

13.16 Improvement Examination

13.16.1 After the completion of the entire programme of study, a student may be allowed the provision of improvement examinations. These are to be availed of only once each in the Autumn and Spring semesters that immediately follow the completion of the programme, and within the maximum number of years permissible for a programme.

13.16.2 A student who has taken migration from the University shall not be eligible to appear for Improvement Examination.

13.16.3 A student may not choose more than the number of courses specified below for improvement examinations.

Programme	Number of Courses for Improvement Examinations		
	Autumn Semester	Spring Semester	Total
BCA	4	4	8
BCOM	4	4	8
BBA	4	4	8
BA	4	4	8
BSc	4	4	8
B.TECH	6	6	12

13.16.4 After the improvement examination, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

13.16.5 If the student improves his/her grades through the improvement examination, new grade sheets and comprehensive transcripts shall be issued to the student.

13.17 Special Examination

13.17.1 The University shall conduct Special Examinations to benefit the following categories of students:

13.17.1.1 Students who, on the completion of the final semester, have some 'F' graded courses in the two final semesters, but no 'F' graded courses in any of the previous semesters

13.17.1.2 Students who have only one 'F' graded course in a semester other than the two final semesters and do not have 'F' graded courses in the two final semesters.

13.17.2 The Special Examinations shall ordinarily be conducted each year within a month of the declaration of the results of the Spring Semester.

13.17.3 Students who fail to secure 50% of the credits offered in the final semester shall not be eligible to appear for the special examinations. Such students will be governed by the provisions of clause 10.5 of these regulations. However, this restriction shall not apply in the case of students who are unable to appear in the end semester examinations due to exceptional situations like their own serious illness and hospitalisation or death of members of the inner family circle (restricted to only father, mother, siblings).

13.17.4 Students who have 'X' graded courses only in the last two semesters may be offered the opportunity for participating in a Tutorial Programme which may be conducted during the semester break immediately following the end- semester examinations of the final semester and students who earn 85% attendance for the programme shall be permitted to appear for the Special Examinations. Separate fees shall be charged for the Tutorial Programme.

13.17.5 Students who do not obtain pass grades in any course at the special examinations shall have to apply in the prescribed format and appear for the end-semester examination of these courses when they are scheduled by the University during subsequent relevant end-semester examinations.

14 Enrolment (for semesters other than the first)

14.10 Every student is required to enroll for the relevant courses before the commencement of each semester within the dates fixed for such enrolment and notified by the Registrar.

14.11 Students who do not enroll within the dates announced for the purpose may be permitted late enrolment up to the notified date on payment of a late fee.

14.12 Only those students shall be permitted to enroll who have cleared all University, Departmental, Hostel and Library dues and fines (if any) of the previous semester, Paid all required University, Departmental and Hostel fees for the current semester, and not been debarred from enrolling on any specific ground.

14.13 No student may enroll for a semester if he/she has not appeared, for whatever reason, in the end semester examinations of the previous semester.

14.14 Students who due to lack of due attendance have been debarred from exams in any semester (including first and second) will have to re-enroll for the same.

15 Eligibility for the Award of the Graduate Degree

15.10 A student shall be declared to be eligible for the award of the four –year Graduate Degree for which he/she has enrolled if he/she has

15.10.1 completed all the credit requirements for the degree with grade 'C' or higher grade in each of the mandatory graded courses and grade 'PS' in all mandatory non-graded courses;

15.10.2 satisfactorily completed all the non-credit requirements for the degree viz., Extra Academic Activities, Industry Training, Field Work, Internship Programme, etc. (if any);

15.10.3 Obtained a CGPA of 5.00 or more at the end of the semester in which he/she completes all the requirements for the degree;

15.10.4 Owes no dues to the University, School, Department, Hostels; and

15.10.5 Has no disciplinary action pending against him/her.

15.11 The award of the Graduate Degree must be recommended by the Academic Council and approved by the Board of Management of the University.

15.11.1 Degree will be awarded, to student completes least fifty per cent of the credits from the University awarding the degree or diploma or certificate

(https://www.ugc.gov.in/pdfnews/9327451_Academic-Bank-of-Credits-in-Higher-Education.pdf)

16 Termination from the Programme

16.10 If more than the number of years permitted for the completion of a programme have elapsed since the student was admitted, and the student has not become eligible for the award of Degree, the student shall be removed from the programme.

16.11 A student may also be required to leave the Programme on disciplinary grounds on the recommendations of the Students' Disciplinary Committee of the concerned School.

SCHEME OF IN-SEMESTER ASSESSMENT GRADUATE DEGREE PROGRAMMES

EVALUATION OF THEORY COURSES

For theory courses, in-semester assessment carries 40% weightage. Different components along with the weightage of each are given in the table below:

Component	Weightage	Remarks
Class Test (Two Class tests of one and a half hour duration)	20	Average of the two marks shall be considered
Assignment (Individual and Group)	10	Group assignments for two courses and individual assignments for the remaining courses
Non-formal evaluation	5	Based on response and interaction in class, quizzes, open book tests, etc.
Attendance	5	For norms regarding attendance cfr. clause 11 of the Regulations for Undergraduate Programmes

There shall be no re-test for In-semester assessment under any circumstance. The original marks of all the In-semester assessment components shall be retained for all further repeat examinations.

ATTENDANCE

Marks for attendance will be given according to the following scheme:

Attendance Percent (x)	Marks Allotted	
	Theory	Lab
$75 \leq x < 80$	2	4
$80 \leq x < 90$	3	6
$90 \leq x < 95$	4	8
$95 \leq x \leq 100$	5	10

EVALUATION OF LABORATORY COURSES/ SKILL ENHANCEMENT COURSES/INTERNSHIPS

All Laboratory courses, Skill enhancement course, internships are evaluated on the basis of attendance; performance of tasks assigned and end semester test/viva voce examination. The distribution of marks within these components will be specified by individual departments along the lines of the break-up given below:

Component	Weightage
Attendance	10
Assessment of tasks assigned	30
End Semester Test and/or Viva-Voce Examination	60

Total	100

EVALUATION OF PROJECTS

The guidelines for the conduct and evaluation of Minor and Mini Projects shall be laid down by the Department. The components of evaluation and allotment of marks may be as follows:

In Semester Evaluation (weightage 60)	Marks	End Semester Evaluation (Weightage 40)	Marks
Synopsis	10	Project Implementation	16
Seminar presentation of synopsis (Analysis and Design)	15	Seminar Presentation	8
Progress Seminar (Implementation)	15	Viva Voce Examination	16
Project Documentation	10		
Attendance	10		
Total	60		40

RULES, PROCEDURES AND BEHAVIOURAL GUIDELINES

1. Dress Code and Identity Card

1.1 The dress code of the University consists of shirt / top (of the prescribed colour and material), trousers (of the prescribed colour and material), shoes (black) and socks (dark grey), a belt (black/dark brown, if required) and a tie (blue, with diagonal stripes). Students are required to come to the University following this dress code. The tie will be required to be worn only on formal occasions. An apron (of the prescribed colour) is to be worn in the Chemistry Lab and during Workshop Practice. During winter, students may wear only a blazer and/or a sweater (full sleeve or sleeveless) of the prescribed colour and material.

1.2 The Student Identity Card is to be brought to the University every day and is to be produced whenever asked for. Entry to the University campus shall be only on production of the Identity Card. The Identity Card is also the Library Card.

1.3 All students should wear the ID card around the neck from entry in the morning to exit in the evening.

2. Morning Assembly

2.1 The morning assembly is a daily programme in the university on all class days during which all members, i.e., students, faculty, staff and management meet together. The assembly starts at the prescribed time. During the assembly, important announcements are made and a thought or insight is shared. The assembly is concluded with an invocation to God to bless the activities of the day. Note that any announcement made at the morning assembly is considered as being equivalent to notifying the same in the notice boards. All students should reach the assembly venue before prescribed time. Immediately after assembly all should proceed to the classroom to start class. Any change in procedures will be notified by the concerned School at the beginning of the Semester.

2.2 One of the following prayers may be used to conclude the Morning Assembly:

The Our Father

Our Father, who art in heaven,

Hallowed be thy name, Thy kingdom come, Thy will be done on earth as it is in heaven.

Give us this day, our daily bread

And forgive us our trespasses

As we forgive those who trespass against us. And lead us not into temptation, But deliver us from all evil, Amen.

Or

Prayer for Peace

Lord, make me an instrument of your peace, where there is hatred, let me sow love; where there is injury, pardon; where there is doubt, faith; where there is despair, hope; where there is darkness, light; where there is sadness, joy;

O Divine Master, grant that I may not so much seek to be consoled as to console; to be understood as to understand; to be loved as to love.

For it is in giving that we receive; it is in pardoning that we are pardoned;

and it is in dying that we are born to eternal life. Amen

3. Punctuality in Attending Classes

3.1 All are expected to be at their respective assembly venues five minutes before assembly time.

3.2 Normally no student shall leave the University before all the classes are over. In case of an emergency, a student may leave with proper written permission from the HOD of the concerned department.

3.3 While all students are encouraged to have their lunch in the University Canteens, students are permitted to take lunch outside the University.

4. Make-up Classes, Leave of Absence and Earned Attendance

4.1 If any student misses any laboratory class due to illness or other grievous problems, he/she is required to meet the concerned teacher for completing the experiments as soon as possible. Such make-up attendance will be taken into consideration at the end of the semester if attendance is less than 75%. At most two make-up attendances may thus be earned by any student.

4.2 Any student who is required to be engaged in a University activity or a pre-planned training and placement activity during class hours, may apply for the grant of an 'earned attendance' from the concerned HODs in the prescribed form available at the Reception. Such applications must be forwarded by the Activity In-Charge. For club related activities, Faculty Advisor of the concerned club will be the Activity In-Charge. In all other cases, Faculty In-Charge or Assistant Faculty In-Charge of Student Affairs will be the Activity In-Charge. Filled up forms shall be submitted preferably before or in case of emergency, immediately after the activity for which earned attendance is to be granted.

4.3 Any student going to participate in any activity or competition outside the University must apply to the Faculty In-Charge of Student Affairs using the prescribed form which must be forwarded by the Assistant Faculty In-Charge of Student Affairs in consultation with respective Club Advisers. On return, these students must report back to the Assistant Faculty In-Charge of Student Affairs for recording the outcome.

4.4 Any student who is not able to attend classes due to medical or other grievous reasons are required to apply for leave in the prescribed form along with valid medical certificates and other requisite documents, to the Faculty In-Charge, students' affairs within seven days of joining back. Such applications must be signed by a parent of the student and forwarded by the mentor of the

concerned student and the HOD of the concerned department. Only these students will be considered for condonement of deficiency in attendance.

5. Discipline

5.1 Personal, academic and professional integrity, honesty and discipline, a sense of responsibility and a high degree of maturity is expected of all students inside and outside the campus. Integrity calls for being honest in examinations and assignments, avoiding plagiarism and misrepresentation of facts.

5.2 Indulging in acts of violence, riotous or disorderly behaviour directed towards fellow students, faculty members or other employees of the institution/hostel in the campus or outside is considered to be a serious breach of discipline and will attract penalty.

5.3 Respect for Common Facilities: Care and respect for common facilities and utilities are an essential component of social responsibility. Any willful damage to University property must be made good by the persons concerned. Further, maintaining cleanliness of the classrooms and the entire campus is everyone's responsibility.

5.4 Substance Abuse: Chewing of tobacco, betel nut and the likes, smoking and the use of other addictive substances and alcoholic drinks are strictly prohibited. These should not be brought into or used within the campus of the University. Violation of this norm will lead to stern action.

5.5 Use of Cell Phones: Cell phones may be used in the University lawns, canteens and other open areas. However, the use of cell phones in classrooms and labs are strictly prohibited except when used for teaching/learning purposes with the explicit permission of the teacher concerned. The cell phone of anyone found violating this rule shall be confiscated and his/ her SIM card shall be taken away and retained in the University office for 7 days. If a person violates the norm for a second time, his/her mobile will be confiscated and retained in the University office till the end of the semester.

5.6 Use of Internet: The entire campus is wi-fi enabled and the students may use the Internet freely for educational purposes. Students may also use the Computing Centre for browsing the Net. However, the use of Internet to access unauthorized and objectionable websites is strictly prohibited.

5.7 All cases of indiscipline will be brought before the Students' Disciplinary Committee and the decisions made by the Committee for dealing with such cases shall be final.

6. Class Tests and Examinations

6.1 The conduct of examinations will be governed by the norms of the University.

6.2 The Student Identity Card shall be the Admit Card for the class tests

6.3 During class tests, all students are expected to enter the venue of the class test 15 minutes before the scheduled time of commencement. However, no one will be permitted into the examination hall after 15 minutes of the commencement of the class test and No one will be allowed to leave the examination hall until an hour has elapsed from the commencement of the class test.

6.4 No one is to leave the hall during examination for any purpose, except in case of an emergency.

6.5 Malpractices during class tests and examinations will not be tolerated and will attract stern action.

7. Ragging

Ragging and eve-teasing are activities which violate the dignity of a person and they will be met with zero tolerance. Antiragging norms have been given to each student at the time of admission and all students and parents have signed the antiragging affidavit. Any case of ragging and eve-

teasing must be reported to the anti-ragging squad. All cases of violation of anti-ragging norms will be taken up by the anti-ragging Committee and punished according to the norms.

8. Grievance Redressal

The University has constituted a Grievance Redressal Cell to redress any genuine grievance students may have. Any student having a genuine grievance may make a representation to the Grievance Redressal Cell through his/her mentor. The representation should be accompanied by all relevant documents in support of the genuineness of the grievance.

9. School Association

9.1 The School Association is an association of the representatives of the various stake holders of the School – students, staff, faculty and management. It is the responsibility of the School Association to take charge of organizing most of the co- curricular activities such as the annual festivals, quizzes, debates, competitions and social events.

9.2 A male and a female student are elected by the students of each class as “class representatives” to represent them in the School Association. Class representatives are expected to be outstanding students who are academically competent and having qualities of leadership.

10. Participation in University Activities

10.1 In order to provide opportunities for the holistic development of the human person, a large number of co-curricular and extra-curricular activities are designed and implemented under the banner of the University Association and student clubs. Some of the most important activities are D'ERVE & BOSCOIADE (intra- University sports and cultural festival during University Week), PRAJYUKTTAM (the inter-University technical festival). All students are expected to take part actively in such activities to showcase their talents, to develop leadership qualities and to gain the experience of working in groups.

10.2 Training and Placement Activities: The training and Placement Cell of DBCET has been incorporated with the objective of minimizing the gap between industry and academia and giving the students training and exposure so that they can capitalize on every opportunity for placement. It is the prime responsibility of the cell to look after all matters concerning ‘Training to enhance employability’ and ‘guiding students for placement’. In the first two semesters, students are trained for communication skills development under the department of Humanities and Social Sciences, and personal development programmes under the department of campus ministry. From the third semester onwards, in every semester, students are given systematic training in aptitude tests, communication skills, group discussion, etc. They are also made to undergo mock HR and Technical Interviews. These activities of the training and placement cell find a place in the curriculum as Extra Academic Programmes (EAP) and all students are required to get a P grade for these activities by taking an active part in these activities regularly.

Other departments of the University offer customised services in training and placement of their students.

11. Free Time

Some hours without class may be available for some students during the day. Students are expected to use such ‘free time’ for visiting the library, meeting teachers and mentors, self- study, carrying out lab or project related activities, etc.

12. Faculty Performance Feedback

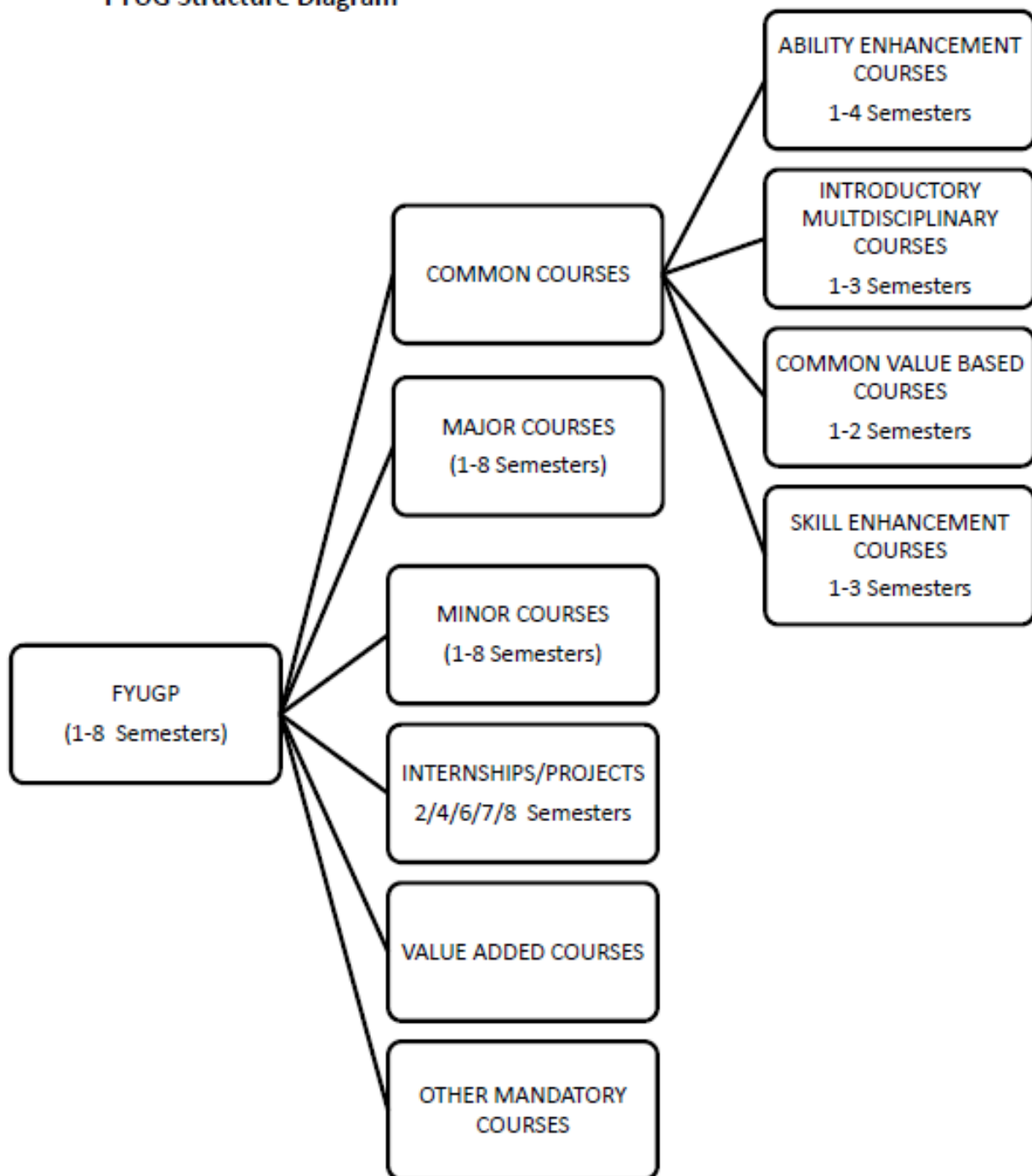
In order to improve the teaching and learning process in the University, students will be required to give feedback about the performance of their teachers from time-to-time. All students are expected to participate in the online feedback sessions concerning their teachers with sincerity and responsibility.

13. Mentoring

All students are assigned mentors from among the faculty members for their guidance. Directors of Schools in collaboration with the Heads of Departments will take care of assigning mentors. Mentors shall help the students to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them. Although students should meet their mentors on a regular basis to get timely help, specific days have been set aside in the calendar for meeting mentors to ensure proper documentation of achievements, activities, shortcomings and problems faced by the students. Every student must meet the mentor during these days.

14. Interaction Meet with Parents

The University organises interaction meetings with parents once a year in which the parents are invited to interact with teachers and management to appraise themselves about the performance of their ward and also to offer their suggestions for the betterment of the institution. It is the responsibility of the students too to invite their parents to come and participate in the event and make the event meaningful.

FYUG Structure Diagram**FYUG Structure Diagram**

THE FOUR YEAR UNDER GRADUATE PROGRAMME STRUCTURE

Year	Semester	Category		Description	Credit
I	Semester 1	Major Course 1, Introductory level		Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 1		Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	4
		Multi-disciplinary Course 1		Choose basic courses from the disciplines Commerce/Humanities/Science	3
		Ability Enhancement Compulsory Course 1		Language course - Communicative English -I /Communicative Hindi-I / Communicative Assamese-I	2
		Skill Enhancement Course 1		Hands-on training course	3
		Common Value Based Course 1		Understanding India/ Digital and Technological Solutions/ Health and Wellness, Yoga Education, and Sports and Fitness/ Environmental Studies	1
		Common Value Based Course 2		Understanding India/ Digital and Technological Solutions/ Health and Wellness, Yoga Education, and Sports and Fitness/ Environmental Studies	1
		Community Engagement Course 1		Service Learning Theory	2
		Total Credits			20
	Semester 2	Major Course 2, Introductory level	Disciplinary Major course (Theory + Lab/ Theory)		4
		Minor Course 2	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)		4
		Multi-disciplinary Course 2	Choose basic courses from the disciplines Commerce/Humanities/Science		3
		Ability Enhancement Compulsory Course 2	Language course - Communicative English –II /Communicative Hindi-II / Communicative Assamese-II		2

		Skill Enhancement Course 1	Hands-on training course	3
		Common Value Based Course 3	Understanding India/ Digital and Technological Solutions/ Health and Wellness, Yoga Education, and Sports and Fitness/ Environmental Studies	1
		Common Value Based Course 4	Understanding India/ Digital and Technological Solutions/ Health and Wellness, Yoga Education, and Sports and Fitness/ Environmental Studies	1
		Community Engagement Course 2	Service Learning Practice	2
	Total Credits			20
Exit option with UG Certificate (with the completion of courses and 4 credits in work based vocational courses offered during summer term or internship equal to a minimum of 44 credits)				
II	Semester 3	Major Course 3	Disciplinary Major course (Theory + Lab/ Theory)	4
		Major Course 4	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 3	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	4
		Multi-disciplinary Course 3	Choose basic courses from the disciplines Commerce/Humanities/Science	3
		Ability Enhancement Compulsory Course 3	Communicative English -I /Communicative Hindi-I / Communicative Assamese-I	2
		Skill Enhancement Course 2	Hands-on training course	3
		Total Credits		
	Semester 4	Major Course 5	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course 6	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course 7	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 4	Choose Minor course from either Disciplinary or Intra-disciplinary related (Theory + Lab/ Theory)	4

		Ability Enhancement Compulsory Course 4	Communicative English -II /Communicative Hindi-II / Communicative Assamese-II	2
		Total Credits		20

**Exit option with UG Diploma (with the completion of courses additional 4 credit in skill based vocational courses offered during first year or second year summer term equal to a minimum of 84 credits) Or
Completion of 2 credit Internship during Summer Term and evaluation during Semester 5**

III	Semester 5	Major Course 8	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course 9	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course 10	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 5	Choose Minor course from either Disciplinary or Intra- disciplinary related (Theory + Lab/ Theory)	4
		Internship	Internship	2
		Total Credits		20
	Semester 6	Major Course 11	Disciplinary Major course (Theory + Lab/ Theory)	4
		Major Course 12	Disciplinary Major course (Theory + Lab/ Theory)	4
		Major Course 13	Disciplinary Major course (Theory + Lab/ Theory)	4
		Minor Course 6	Choose Minor course from either Disciplinary or Intra- disciplinary related (Theory + Lab/ Theory)	4
		Major Course 14 Project Work	Minor Project	4
		Total Credits		20

Exit option with 3- year UG Degree (with the completion of courses equal to a minimum of 120 credits)

IV	Semester 7	Major Course 15	Disciplinary Major course (Theory + Lab/ Theory)	5

		Major Course 16	Disciplinary Major course (Theory + Lab/ Theory)	5
		Minor Course 7	Choose Minor course from either Disciplinary or Intra- disciplinary related (Theory + Lab/ Theory)	3
		Minor Course 8 Research Methodology	Research Methodology	2
		Research Project/ Dis- sertation	Dissertation Phase – I	6
		Total Credits		21
	Semester 8	Major Course 17	Disciplinary Major course (Theory + Lab/ Theory)	5
		Major Course18	Disciplinary Major course (Theory + Lab/ Theory)	5
		Minor Course 9	Choose Minor course from either Disciplinary or Intra- disciplinary related (Theory + Lab/ Theory)	3
		Research Project/ Dis- sertation	Dissertation Phase – II	6
		Total Credits		19
Exit option with UG Degree (Honours) (with the completion of courses equal to a minimum of 160 credits)				
IV	Semester 7	Research Methodology	Research Methodology	2
		Research Project/Disser- tation	Dissertation Phase – I	18
		Total Credits		20
	Semester 8	Research Project/Disser- tation	Dissertation Phase – II	20
		Total Credits		20
Students will be awarded UG Degree (Honours) with Research in the relevant Discipline (with the completion of courses equal to a minimum of 160 credits)				

ABILITY ENHANCEMENT COURSES

INTRODUCTORY MULTI DISCIPLINARY COURSES

COMMON VALUE BASED COURSES

COMMUNITY ENGAGEMENT COURSES

VALUE ADDED COURSES

MANDATORY COURSES

ABILITY ENHANCEMENT COURSES
(Compulsory for all Programmes)

Semester	Category	Course Code	Course Name	Credits	Page No
1/3	A E Course 1	AECE100T/AECE200T	Communicative English I	2	249
2/4	A E Course 2	AECE101T/ AECE201T	Communicative English II	2	255
1/3	A E Course 3	AECH100T/AECH200T	Communicative Hindi I	2	222
2/4	A E Course 4	AECH101T/ AECH201T	Communicative Hindi II	2	235
1/3	A E Course 5	AECA100T/AECA200T	Communicative Assamese I	2	223
2/4	A E Course 6	AECA101T/AECA201T	Communicative Assamese II	2	237
1/3	A E Course 7	AEFR100T/AEFR200T	French Beginner Level I	2	224
2/4	A E Course 8	AEFR101T/AEFR201T	French Beginner Level II	2	237
1/3	A E Course 9	AEGR100T/AEGR200T	Introduction to German Language – I	2	225
2/4	A E Course 10	AEGR101T/AEGR201T	Introduction to German Language – II	2	238

MULTI DISCIPLINARY COURSES

(Choose Multidisciplinary Courses from the stream other than the stream which he/she has studied in class 12)

AZARA CAMPUS						
For students who studied in Science stream in class 12						
Semester	Category	Course Code	Course Name	Offered by the Department	Credits	Page No
1	MD Course 1	CMBO108T	Business Organisation and Commercial Practices	Commerce	3	
1	MD Course 2	MTFB107T	Fundamentals of Business, Management & Economics	Management	3	

1	MD Course 3	CAOP108T	Office Productivity Tools	Computer Applications	3	
2	MD Course 1	CMAC109T	Accountancy	Commerce	3	
2	MD Course 2	MTIE108T	Indian Economy	Management	3	
3	MD Course 1	CMBI110T	Banking and Insurance	Commerce	3	
3	MD Course 2	MTEI109T	Emotional Intelligence	Management	3	739
For students who studied in Arts stream in class 12						
Semester	Category	Course Code	Course Name	Offered by the Department	Credits	Page No
1	MD Course 1	CMBO108T	Business Organisation and Commercial Practices	Commerce	3	
1	MD Course 2	MABM109T	Basic Mathematics	Basic Sciences	3	221
1	MD Course 3	CAOP108T	Office Productivity Tools	Computer Applications	3	
2	MD Course 1	CMAC109T	Accountancy	Commerce	3	
2	MD Course 2	BOBI111T	Biology	Basic Sciences	3	
2	MD Course 3	CAPY108T	Python For Business Analytics	Computer Applications	3	
3	MD Course 1	CMBI110T	Banking and Insurance	Commerce	3	
3	MD Course 2	PSNN106T	Nanoscience and Nanotechnology	Basic Sciences	3	
3	MD Course 3	CHFN115T	Food and Nutrition	Basic Sciences	3	293
For students who studied in Commerce stream in class 12						
Semester	Category	Course Code	Course Name	Offered by the Department	Credits	Page No
1	MD Course 1	MTFB107T	Fundamentals of Business, Management & Economics	Management	3	
1	MD Course 1	MABM109T	Basic Mathematics	Basic Sciences	3	221
1	MD Course 3	CAOP108T	Office Productivity Tools	Computer Applications	3	

Course Structure

2	MD Course 2	MTIE108T	Indian Economy	Management	3	
2	MD Course 2	BOBI111T	Biology	Basic Sciences	3	
2	MD Course 2	CAPY109T	Python For Business Analytics	Computer Applications	3	
3	MD Course 3	MTEI109T	Emotional Intelligence	Management	3	739
3	MD Course 3	PSNN106T	Nanoscience and Nanotechnology	Basic Sciences	3	
3	MD Course 2	CHFN115T	Food and Nutrition	Basic Sciences	3	293

TAPESIA CAMPUS						
For students who studied in Science stream in class 12						
Semester	Category	Course Code	Course Name	Offered by the Department	Credits	Page No
Humanities						
1	MD Course 1	PCCP108T	Community Psychology	Psychology	3	742
1	MD Course 2	ENMB107T	Money and Banking	Economics	3	556
1	MD Course 3	MCCJ108T	Basics of Communication and Journalism	Mass Com	3	
2	MD Course 1	EGDH107T	Digital Humanities	English	3	
2	MD Course 2	PCHW109T	Psychology of Health and Wellbeing	Psychology	3	743
2	MD Course 3	ENSM108T	Introduction to Stock Market	Economics	3	564
3	MD Course 1	MCFC109T	Fashion Communication	Mass Com	3	
3	MD Course 2	ENED110T	Entrepreneurship Development	Economics	3	572
3	MD Course 3	PCPM110T	Psychology and Media	Psychology	3	
For students who studied in Arts/ Commerce stream in class 12						
1	MD Course 1	CHFN115T	Food and Nutrition	Chemistry	3	293
1	MD Course 2	MABM111T	Basic Mathematics I	Mathematics	3	
1	MD Course 3	BOBC116T	Biodiversity Conservation	Botany	3	

1	MD Course 4	ZGNC110T	Nutrition for Community Health	Zoology	3	
2	MD Course 1	PSNN106T	Nanoscience and Nanotechnology	Physics	3	
2	MD Course 2	CHEE116T	Energy and Environment	Chemistry	3	294
2	MD Course 3	BOGN117T	Gardening and Nursery Management	Botany	3	
2	MD Course 4	ZGVB113T	Public Health and Vector Born Diseases	Zoology	3	
2	MD Course 5	MABM112T	Basic Mathematics II	Mathematics	3	
3	MD Course1	PSRS107T	Radiation and Safety Measurements	Physics	3	
3	MD Course 2	BOEB118T	Economic Botany	Botany	2	466
		BOEB119L	Economic Botany Lab		1	467
3	MD Course 3	ZGIB112T	Introduction to Biology of Insecta	Zoology	3	
3	MD Course 4	MABM212T	Basic Mathematics III	Mathematics	3	
3	MD Course 5	PSAA212T	Astrophysics and Astronomy	Physics	3	
BA Philosophy						
1	MD Course1	MDBM100T	Basics in Mathematics	Philosophy	3	
2	MD Course 2	MDBA101T	Basics in Accounting	Philosophy	3	
3	MD Course 3	MDGS200T	Introduction to General Science	Philosophy	3	

COMMON VALUE BASED COURSES**(Compulsory for all Programmes)**

Semester	Category	Course Code	Course Name	Credits	Page No
1	C V B Course 1	CBES101T	Environmental Studies	1	227
1	C V B Course 1	CBHY102T	Health and Wellness, Yoga Education, and Sports and Fitness	1	228
2	C V B Course 1	CBDT103T	Digital and Technological Solutions	1	240
2	C V B Course 1	CBUI104T	Understanding India	1	241

COMMUNITY ENGAGEMENT (SERVICE LEARNING)
(Compulsory for all Programmes)

Se- mester	Category	Department	Course Code	Course Name	Cred- its	Page No
Theory						
1	CE Course	Computer Appli- cations	CACE109T	Service Learning	2	102
1	CE Course	Commerce	CMCE111T	Service Learning	2	228
1	CE Course	Management	MTCE110T	Service Learning	2	
1	CE Course	Chemistry	CHCE117T	Elements of Service Learn- ing in Chemistry	2	
1	CE Course	Mathematics	MACE110T	Community Engagement and Service Learning	2	1832
1	CE Course	Physics	PSCE108T	Elements of Service Learn- ing in Physics	2	1861
1	CE Course	Education	EDCE106T	Service Learning (A Com- munity-University Engage- ment Programme)	2	2133
1	CE Course	English	EGCE108T	Service Learning- Language Communication	2	2171
1	CE Course	Mass Communication	MCCE110T	Community Media	2	2211
1	CE Course	Psychology	PCCE111T	Service Learning	2	
1	CE Course	Economics	ENCE111T	Service Learning	2	561
1	CE Course	Public Administration	PACE110T	Service Learning	2	2270
1	CE Course	Botany	BOCE112T	Service Learning on Ethno- botanical Practices	2	1979
1	CE Course	Zoology	ZGCE110T	Foundations of Service Learning	2	2038
1	CE Course	Hospitality and Hotel Administration	HACE110T	Introduction to Community Engagement	2	
1	CE Course	Philosophy	CESL100T	Service Learning: Theory	2	
Practice						
2	CE Course	ALL	CESL102P	Service Learning Practice	2	

VALUE ADDED COURSES

Course Name	Page no
DEPARTMENT OF COMPUTER APPLICATIONS	
CARP6051: Robotic Process Automation	1661
CABC6052: Blockchain	1662
CAAW6053: Advanced Web Application Development Techniques	1662
CADV6054: Data Visualisation	1665
DEPARTMENT OF COMMERCE	
CMII6011: Ideation to Innovation	1736
CMSS6012: Statistical Software Packages for Data Analysis	1741
CMAS6013: Accounting Software Package	1737
CMIT6014: Income Tax Return Filling	1739
CMCR6015: Customer Relationship Management	1738
DEPARTMENT OF MANAGEMENT	
MTII6011: Ideation to Innovation	
MTFS6012: Fundamental Selling Skills: Techniques and Applications	
DEPARTMENT OF CHEMISTRY	
CHPC6137: Petroleum Chemistry	1789
CHPA6138: Pharmaceutical Chemistry and its Applications	1790
DEPARTMENT OF MATHEMATICS	
MAFG0154: Fractal Geometry and Applications	1829
MAML0152: Essential Mathematics for Machine Learning	1831
MACS6005: Computational Mathematics with Sage Math	1835
MACM6004: Computational Skill Development: MATHEMATICA	1834
DEPARTMENT OF PHYSICS	
PSCP6120: Computational Physics using Python	1868
DEPARTMENT OF EDUCATION	
EDES6011: Education for Sustainable Development	2134
EDTT6012: Teacher and Teaching Skills	2135
EDHW6013: Education for Health and Wellness	2135
DEPARTMENT OF ENGLISH	
EGES0138: Effective Communication Skills	2173
EGML0028: Myth in Literature	2174
EGLA6005: Lyrical Analysis	2176

DEPARTMENT OF MASS COMMUNICATION	
MCCS6122: Communication Skills	2208
MCCW6123: Creative Writing	2209
MCEM6124: Event Management	2210
DEPARTMENT OF PSYCHOLOGY	
PDSP6117: School Psychology	2247
PDCM6118: Community Mental Health	2247
PCLS6119: Life Skills Education	2248
PCFA0120: Psychological First Aid	2238
DEPARTMENT OF ECONOMICS	
ENOS6002: Introduction to Stock Market	564
ENDA6005: Data Analysis with SPSS/STATA	
ENRC6008: Recent Developments in Monetary Policy in India	
ENCF6009: Consumer Decisions and Financial Literacy	
DEPARTMENT OF PUBLIC ADMINISTRATION	
PACS0022: Civil Service in India	793
PAIG0023: Innovation in Governance	2269
PAEP0021: Environmental Policy And Administration	2268
PADV0031: Data Management and Visualisation	2278
DEPARTMENT OF ZOOLOGY	
ZGPR6004: Project Management, Reporting and Documentation	2024
ZGWP6011: Introduction to Wildlife Photography	2026
ZGTM6010: Teaching Methodology and Classroom Management	2028
ZGSE6024: Soft Skill & Employability Skill Development	
ZGRS6025: Fundamentals of GIS and Remote Sensing	
DEPARTMENT OF HOSPITALITY AND HOTEL ADMINISTRATION	
HAEM6027: Basics of Event Management	

MANDATORY COURSES

Course code	Course name	Credits	Page no
USIP001	Student Induction Programme	P/NP	
	One Online SWAYAM/NPTEL Course	P/NP	

SCHOOL OF TECHNOLOGY

DEPARTMENT OF COMPUTER APPLICATIONS

PROGRAMME: BACHELOR OF COMPUTER APPLICATIONS (BCA) (Honours/Honours with Research)

VISION OF THE DEPARTMENT

Imparting knowledge of Computer Applications to mould individuals into IT professionals, researchers and entrepreneurs who are innovative, versatile and committed to society.

MISSION OF THE DEPARTMENT

1. To prepare students for professional career and higher studies by providing conducive teaching, learning and research environment.
2. To produce skilled individuals and entrepreneurs in emerging areas of technologies by academia-industry collaboration.
3. To instill in individuals a sense of commitment to work for the betterment of society using technology.

Program Outcomes (POs)

Upon successful completion of the BCA programme, graduates will be able to:

- PO1 – Computational Knowledge:** Apply knowledge of computing fundamentals, mathematics, and domain knowledge for the conceptualization of computing models.
- PO2 – Problem Analysis:** Identify, formulate, and analyze complex problems and reach substantiated conclusions using fundamental principles of mathematics and computer science.
- PO3 – Design/Development of Solutions:** Design, develop, and evaluate solutions for software-based systems to meet desired needs within realistic constraints.
- PO4 – Modern Tool Usage:** Use current techniques, skills, and modern computing tools to analyze problems and design appropriate solutions.
- PO5 – Social Interaction:** Elicit views of others, mediate disagreements, and help reach conclusions in group settings.
- PO6 – Ethics:** Understand and commit to Discipline Specific ethics and responsibilities, and apply ethical principles in societal and technological contexts.
- PO7 – Effective Communication:** Communicate effectively on complex activities with the computing community and society at large.
- PO8 – Self-Directed and Life-long Learning:** Recognize the need for, and have the ability to engage in independent learning for continual development.
- PO9 – Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
- PO10 – Innovation and Entrepreneurship:** Apply knowledge to identify, analyze, and create innovative computing solutions with entrepreneurial intent.

Program Specific Outcomes (PSOs)

- PSO1 – Software Development Expertise:** Graduates will be able to design and develop reliable software solutions for real-world problems using modern programming tools and techniques.
- PSO2 – Domain-Specific Proficiency:** Graduates will demonstrate skills in specialized areas such as Artificial Intelligence, Data Science, or Full Stack Development, enabling them to work effectively in specific technological domains.
- PSO3 – Industry and Research Readiness:** Graduates will be equipped with hands-on experience and practical exposure through internships, projects, and research components, preparing them for industry roles or higher education.

Course Category Definition and Code:

Course Category Code	Definitions
MC	Major Course
MDE	Multi-Disciplinary Elective course
SEC	Skill Enhancement courses

CVBC	Common Value Based Course
AEC	Ability Enhancement Course
DSE	Discipline Specific Elective
OE	Open Elective
CE	Community Engagement Course

Course Level/Duration/System:

Undergraduate / Three or Four years/6 or 8 Semesters with multiple entry and exit. The following option will be made available to the students joining BCA Research Program:

- 1. One year:** Under Graduate Certificate in Computer Applications
- 2. Two years:** Under Graduate Diploma in Computer Applications
- 3. Three years:** Bachelor in Computer Applications (BCA)
- 4. Four years:** Bachelor in Computer Applications with Honours: BCA (Honours) or Bachelor in Computer Application Honours with Research: BCA (Honours with Research)

Exit Criteria after First Year of BCA Programme:

Students will have the option to exit the Bachelor of Computer Application (BCA) program after successfully completing the first year. Upon exit, they will be awarded a **UG Certificate in Computer Applications**. To be eligible for this certificate, students must complete an **additional 04 credits** in one of the following areas:

- 1. Work-Based Vocational Course:** A vocational course offered during the summer term that emphasizes hands-on training and workplace readiness.
- 2. Internship/Apprenticeship:** A professional internship or apprenticeship program in a relevant field, with a minimum duration of 08 weeks, which will take place after the second semester.
- 3. Social Responsibility & Community Engagement:** Active engagement with an NGO or community organization for a minimum duration of 08 weeks, focusing on real-world problem-solving, social responsibility, and community service.

Exit Criteria after Second Year of BCA Programme:

Students will have the option to exit the Bachelor of Computer Application (BCA) program after successfully completing the second year. Upon exit, they will be awarded a **UG Diploma in Computer Applications**. To be eligible for this diploma, students must complete an additional 04 credits in one of the following areas:

Skill-Based Subject: A specialized course aimed at enhancing technical and practical expertise in computer applications.

- 1. Work-Based Vocational Course:** A vocational course offered during the summer term, focused on building practical, industry-relevant skills.
- 2. Internship/Apprenticeship:** A professional internship or apprenticeship with a minimum duration of 08 weeks, conducted after the fourth semester, offering hands-on experience in a relevant field.
- 3. Capstone Project:** Completion of a capstone project integrating the skills and knowledge gained during the first two years of the program, which can be an independent or group project.

BHARATIYA BHASHA INTEGRATION (NEP 2020):

In alignment with NEP 2020 recommendations promoting Bharatiya Bhashas, the laboratory courses support the use of **Assamese, Hindi, and/or English** for programming comments, documentation, interface labels, and student submissions wherever pedagogically appropriate.

.Course Category Definition and Code:

Course Category Code	Definitions
MC	Major Course
MDE	Multi-Disciplinary Elective course

SEC	Skill Enhancement courses
CVBC	Common Value Based Course
AEC	Ability Enhancement Course
DSE	Discipline Specific Elective
OE	Open Elective
CE	Community Engagement Course
VAC	Value Added Course

INTERNSHIPS

Semester	Category	COURSE CODE	Course Name	Credits
2	Internship	CAIN107I	Internship	4
4	Internship	CAIN213I	Internship	4
5	Internship	CAIN314I	Internship	2

SEMESTER-WISE COURSE STRUCTURE

Semester	Category	Course Code	Course Name	L	T	P	Credits	Page No
FIRST SEMESTER	THREE-WEEK COMPULSORY INDUCTION PROGRAMME							
	Major Course 1	CAMF101T	Mathematical Foundation of Computer Science I	3	0	0	3	59
	Major Course 2	CACA102T	Computer Architecture	3	0	0	3	60
	Major Course 2	CACA103P	Computer Architecture Lab	0	0	4	2	61
	Skill Enhancement Course 1	CAPS104T	Problem Solving Techniques	3	0	0	3	63
	Skill Enhancement Course 1	CAPS105P	Problem Solving Techniques Lab	0	0	4	2	64
	Multi-Disciplinary Elective 1	CAIK107T	Indian Knowledge System	2	0	0	2	67
	Common Value Based Course 1	CBES101T	Environmental Studies	1	0	0	1	70
	Ability Enhancement Course 1	CAGE106T	General English – I	1	1	2	2	68
	Ability Enhancement Course 2	AECH100T AECA100T AEFR100T AEGR100T	Communicative Hindi-I Communicative Assamese-I French Beginner Level I Introduction to German Language – I	1	1	0	2	71 72 73 74
	TOTAL CREDIT						20	
	Major Course 3	CAMF111T	Mathematical Foundation of Computer Science II	3	0	0	3	75
	Major Course 4	CADS112T	Data Structures	3	0	0	3	76
	Major Course 4	CADS113P	Data Structures Lab	0	0	2	1	78

	Major Course 5	CAOS114T	Operating Systems	3	0	0	3	79
	Major Course 5	CAOS115P	Operating Systems Lab	0	0	2	1	80
	Skill Enhancement Course 2	CAOP116T	Object-Oriented Programming using Java	2	0	0	2	81
	Skill Enhancement Course 2	CAOP117P	Object-Oriented Programming using Java Lab	0	0	2	1	82
	Skill Enhancement Course 3	CAWT118T	Web Technologies	2	0	0	2	83
	Skill Enhancement Course 3	CAWT119P	Web Technologies Lab	0	0	2	1	84
	Common Value Based Course 2	CBUI104T	Understanding India	1	0	0	1	85
	Ability Enhancement Course 3	AECH101T	Communicative Hindi-II	1	1	0	2	86
		AECA101T	Communicative Assamese-II					88
		AEFR101T	French Beginner Level II					89
AEGR101T		Introduction to German Language – II					90	
TOTAL CREDIT							20	
THIRD SEMESTER	Major Course 6		Probability and Statistics	3	0	0	3	92
	Major Course 7		Database Management System	3	0	0	3	94
	Major Course 7		Database Management System Lab	0	0	4	2	96
	Major Course 8		Software Engineering	3	0	0	3	97
	Skill Enhancement Course 4		Python Programming	1	0	0	1	98
	Skill Enhancement Course 4		Python Programming Lab	0	0	4	2	100
	Common Value Based Course 3	CBHY102T	Health and Wellness, Yoga Education, and Sports and Fitness	1	0	0	1	101
	Community Engagement Course 1	CACE109T	Service Learning Theory	2	0	0	2	102
	Specialization- I: Web and Applications Development							
	Discipline Specific Elective 1		UI/UX Designing and Prototyping	1	0	0	1	103
	Discipline Specific Elective 1		UI/UX Designing and Prototyping Lab	0	0	4	2	104
	Specialization- II: Data Science							
	Discipline Specific Elective 1		Basics of Data Analytics Using Spreadsheet	1	0	0	1	105
	Discipline Specific Elective 1		Basics of Data Analytics Using Spreadsheet Lab	0	0	4	2	106

	TOTAL CREDIT						20	
FOURTH SEMESTER	Major Course 9		Entrepreneurship and Startup Ecosystem	1	1	0	2	108
	Major Course 10		Computer Networks	3	0	0	3	109
	Major Course 10		Computer Networks Lab	0	0	4	2	110
	Major Course 11		Design and Analysis of Algorithm	3	0	0	3	112
	Major Course 12		Introduction to Artificial Intelligence	3	0	0	3	116
	Major Course 12		Introduction to Artificial Intelligence Lab	0	0	4	2	119
	Skill Enhancement Course 5		Design Thinking and Innovation	1	0	0	1	120
	Community Engagement Course 2	CESL102P	Service-Learning Practice	0	0	2	2	121
	Specialization- I: Web and Applications Development							
	Discipline Specific Elective 2		Web Programming using PHP and Laravel Framework	1	0	0	1	121
	Discipline Specific Elective 2		Web Programming using PHP and Laravel Framework Lab	0	0	4	2	123
	Specialization- II: Data Science							
	Discipline Specific Elective 2		Data Visualization	1	0	0	1	125
	Discipline Specific Elective 2		Data Visualization Lab	0	0	4	2	126
	TOTAL CREDIT						21	
FIFTH SEMESTER	Major Course 13		Quantitative Techniques	2	0	0	2	128
	Internship		Industry Internship	-	-	-	2	129
	Project		Mini Project	0	0	6	3	130
	Specialization- I: Web and Applications Development							
	Discipline Specific Elective 3		ReactJS Fundamentals	3	0	0	3	131
	Discipline Specific Elective 3		ReactJS Fundamentals Lab	0	0	4	2	132
	Discipline Specific Elective 4		API Integration and Development	3	0	0	3	134
	Discipline Specific Elective 4		API Integration and Development Lab	0	0	2	1	135
	Discipline Specific Elective 5		Introduction to NoSQL	3	0	0	3	136

	Discipline Specific Elective 5		Introduction to NoSQL Lab	0	0	2	1	137
	Specialization- II: Data Science							
	Discipline Specific Elective 3		Introduction to Data Science	3	0	0	3	139
	Discipline Specific Elective 3		Introduction to Data Science Lab	0	0	4	2	140
	Discipline Specific Elective 4		Machine Learning	3	0	0	3	141
	Discipline Specific Elective 4		Machine Learning Lab	0	0	2	1	143
	Discipline Specific Elective 5		Time Series Analysis	3	0	0	3	144
	Discipline Specific Elective 5		Time Series Analysis Lab	0	0	2	1	145
	TOTAL CREDIT						20	
SIXTH SEMESTER	Major Course 14		Generative AI	2	0	0	2	147
	Major Course 14		Generative AI Lab	0	0	4	2	
	Ability Enhancement Course 3		Soft Skills	1	1	0	2	149
	Project		Minor Project	0	0	8	4	150
	Specialization- I: Web and Applications Development							
	Discipline Specific Elective 6		Back-End Development using Node.js and Express.js	3	0	0	3	151
	Discipline Specific Elective 6		Back-End Development using Node.js and Express.js Lab	0	0	4	2	
	Discipline Specific Elective 7		Introduction to DevOps	2	0	0	2	152
	Discipline Specific Elective 7		Introduction to DevOps Lab	0	0	4	2	
	Specialization- II: Data Science							
	Discipline Specific Elective 6		Exploratory Data Analysis	3	0	0	3	154
	Discipline Specific Elective 6		Exploratory Data Analysis Lab	0	0	4	2	155
	Discipline Specific Elective 7		Big Data Analytics	3	0	0	3	156
	Discipline Specific Elective 7		Big Data Analytics Lab	0	0	2	1	157
	TOTAL CREDIT						19	

BCA (Honours) – Semester VII**Specialization – Web and Applications Development**

Category	Course Code	Course Name	L	T	P	Cred-its	Page No
Major Course 15		Python for Web Programming	2	0	0	2	
Major Course 15		Python for Web Programming Lab	0	0	4	2	
Multi-Disciplinary Elective 2		E-Commerce and Digital Marketing	3	0	0	3	
Discipline Specific Elective 8		Mobile Application Development	3	0	0	3	
Discipline Specific Elective 8		Mobile Application Development Lab	0	0	4	2	
Discipline Specific Elective 9		IoT and Web Connectivity	3	0	0	3	
Major Project		Major Project – Part I	-	-	10	5	
TOTAL CREDIT						20	

Specialization – Data Science

Category	Course Code	Course Name	L	T	P	Credits	Page No
Major Course 15		Python for Data Science	2	0	0	2	
Major Course 15		Python for Data Science Lab	0	0	4	2	
Multi-Disciplinary Elective 2		Advanced Statistical Methods for Data Science	3	0	0	3	
Discipline Specific Elective 8		Business Intelligence and Analytics	3	0	0	3	
Discipline Specific Elective 8		Business Intelligence and Analytics Lab	0	0	4	2	
Discipline Specific Elective 9		Data Warehousing and Data Mining	3	0	0	3	
Dissertation		Dissertation – Part I	-	-	10	5	
TOTAL CREDIT						20	

BCA (Honours with Research) – Semester VII**Specialization – Data Science**

Category	Course Code	Course Name	L	T	P	Cred-its	Page No
Major Course 15		Advanced Data Analysis Tools	0	2	4	4	
Major Course 16		Research Methodology	2	2	0	4	
Major Course 17		Research Internship	0	0	8	4	
Discipline Specific Elective 8		Business Intelligence and Analytics	3	0	0	3	

Discipline Specific Elective 8		Business Intelligence and Analytics Lab	0	0	4	2	
Discipline Specific Elective 9		Data Warehousing and Data Mining	3	0	0	3	
TOTAL CREDIT						20	

BCA (Honours) – Semester VIII**Specialization –Web and Applications Development**

Category	Course Code	Course Name	L	T	P	Credits	Page No
Discipline Specific Elective 10		Web Application Security	3	0	0	3	
Discipline Specific Elective 10		Web Application Security Lab	0	0	4	2	
Discipline Specific Elective 11		Blockchain for Web Application	3	0	0	3	
Discipline Specific Elective 11		Blockchain for Web Application Lab	0	0	2	2	
Discipline Specific Elective 12		Cloud Computing	2	0	0	2	
Major Project		Major Project – Part II	-	-	16	8	
TOTAL CREDIT						20	

Specialization – Data Science

Category	Course Code	Course Name	L	T	P	Credits	Page No
Discipline Specific Elective 10		Advanced Data Visualization	3	0	0	3	
Discipline Specific Elective 10		Advanced Data Visualization Lab	0	0	4	2	
Discipline Specific Elective 11		Cloud Computing for Data Analytics	3	0	0	3	
Discipline Specific Elective 11		Cloud Computing for Data Analytics Lab	0	0	4	2	
Discipline Specific Elective 12		Data Security and Privacy	2	0	0	2	
Dissertation		Dissertation – Part II	-	-	16	8	
TOTAL CREDIT						20	

BCA (Honours with Research) – Semester VIII**Specialization – Data Science**

Category	Course Code	Course Name	L	T	P	Credits	Page No
Dissertation		Dissertation	-	-	40	20	
TOTAL CREDIT						20	

LIST OF COURSES - BCA

1.1	Mathematical Foundation of Computer Science I
1.2	Computer Architecture
1.3	Computer Architecture Lab
1.4	Problem Solving Techniques
1.5	Problem Solving Techniques Lab
1.6	Indian Knowledge System
1.7	Environmental Studies
1.8	General English – I
1.9	Communicative Hindi-I / Communicative Assamese-I / French Beginner Level I / Introduction to German Language – I
2.1	Mathematical Foundation of Computer Science II
2.2	Data Structures
2.3	Data Structures Lab
2.4	Operating Systems
2.5	Operating Systems Lab
2.6	Object-Oriented Programming using Java
2.7	Object-Oriented Programming using Java Lab
2.8	Web Technologies
2.9	Web Technologies Lab
2.10	Understanding India
2.11	Communicative Hindi-II / Communicative Assamese-II / French Beginner Level II / Introduction to German Language – II
3.1	Probability and Statistics
3.2	Database Management System
3.3	Database Management System Lab
3.4	Software Engineering
3.5	Python Programming
3.6	Python Programming Lab
3.7	Health and Wellness, Yoga Education, and Sports and Fitness
3.8	Service Learning Theory
3.9A	UI/UX Designing and Prototyping
3.10A	UI/UX Designing and Prototyping Lab
3.9B	Basics of Data Analytics Using Spreadsheet
3.10B	Basics of Data Analytics Using Spreadsheet Lab
4.1	Entrepreneurship and Startup Ecosystem
4.2	Computer Networks
4.3	Computer Networks Lab
4.4	Design and Analysis of Algorithm
4.5	Introduction to Artificial Intelligence
4.6	Introduction to Artificial Intelligence Lab
4.7	Design Thinking and Innovation
4.8	Service Learning Practice

4.9A	Web Programming using PHP and Laravel Framework
4.10A	Web Programming using PHP and Laravel Framework Lab
4.9B	Data Visualization
4.10B	Data Visualization Lab
5.1	Quantitative Techniques
5.2	Industry Internship
5.3	Mini Project
5.4A	ReactJS Fundamentals
5.5A	ReactJS Fundamentals Lab
5.6A	API Integration and Development
5.7A	API Integration and Development Lab
5.8A	Introduction to NoSQL
5.9A	Introduction to NoSQL Lab
5.4B	Introduction to Data Science
5.5B	Introduction to Data Science Lab
5.6B	Machine Learning
5.7B	Machine Learning Lab
5.8B	Time Series Analysis
5.9B	Time Series Analysis Lab
6.1	Generative AI
6.2	Generative AI Lab
6.3	Soft Skills
6.4	Minor Project
6.5A	Back-End Development using Node.js and Express.js
6.6A	Back-End Development using Node.js and Express.js Lab
6.7A	Introduction to DevOps
6.8A	Introduction to DevOps Lab
6.5B	Exploratory Data Analysis
6.6B	Exploratory Data Analysis Lab
6.7B	Big Data Analytics
6.8B	Big Data Analytics Lab
7.1HA	Python for Web Programming
7.2HA	Python for Web Programming Lab
7.3HA	E-Commerce and Digital Marketing
7.4HA	Mobile Application Development
7.5HA	Mobile Application Development Lab
7.6HA	IoT and Web Connectivity
7.7HA	Major Project – Part I
7.1HB	Python for Data Science
7.2HB	Python for Data Science Lab
7.3HB	Advanced Statistical Methods for Data Science
7.4HB	Business Intelligence and Analytics
7.5HB	Business Intelligence and Analytics Lab
7.6HB	Data Warehousing and Data Mining

7.7HB	Dissertation – Part I
7.1HR	Advanced Data Analysis Tools
7.2HR	Research Methodology
7.3HR	Research Internship
7.4HR	Business Intelligence and Analytics
7.5HR	Business Intelligence and Analytics Lab
7.5HR	Data Warehousing and Data Mining
8.1HA	Web Application Security
8.2HA	Web Application Security Lab
8.3HA	Blockchain for Web Application
8.4HA	Blockchain for Web Application Lab
8.5HA	Cloud Computing
8.6HA	Major Project – Part II
8.1HB	Advanced Data Visualization
8.2HB	Advanced Data Visualization Lab
8.3HB	Cloud Computing for Data Analytics
8.4HB	Cloud Computing for Data Analytics Lab
8.5HB	Data Security and Privacy
8.6HB	Dissertation – Part II
8.1HR	Dissertation

A: Specialization-I, B: Specialization-II, HA: Hons (Specialization-I), HB: Hons (Specialization-II), HR: Hons with Research

POs and PSOs Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
1.1	H	H		M				M			M		
1.2	H	M		M				M			M		
1.3		M	H	H			M	M			M		
1.4	M	H	H					M		M	M		
1.5		M	H	H			M	M		M	M		
1.6					M	M	M		H				
1.7					M	M	M		H				
1.8						M	H						
1.9						M	H						
2.1	H	H		M				M			M		
2.2	H	H	H	M			M	M		M	H		
2.3		M	H	H			M	M		M	H		
2.4	H	H		M		M	M	M		M	M		
2.5		M	H	H		M	M	M		M	M		
2.6	H	M	H	H			M	M		M	H		
2.7		M	H	H			M	M		M	H		
2.8		M	H	H	M		M	M		H	H		
2.9		M	H	H	M		M	M		H	H		
2.10					M	M	M		H				

2.11						M	H						
3.1	H	H		M				M			M		
3.2	M	M	H	M			M	M		M	H		
3.3		M	H	H			M	M		M	H		
3.4	M	M	H	M	M	M	M	M		H	M		
3.5	M	M	H	H			M	M		M	H		
3.6		M	H	H			M	M		M	H		
3.7					M	M	M		H				
3.8					H	M	M	M	H	M			M
3.9A		M	H	M	M		M	M		H	M	M	
3.10A		M	H	H	M		M	M		H	M	M	
3.9B	M	M	H	M			M	M		M	M	M	
3.10B		M	H	H			M	M		M	M	M	
4.1					M	M	M	M		H			M
4.2	M	M	H	H			M	M		M	M		
4.3		M	H	H			M	M		M	M		
4.4	H	H	M	M				M		M	H		
4.5	M	H	M	M		M	M	M		M	M	M	
4.6		M	H	H		M	M	M		M	M	M	
4.7			M	M	H	M	M	M		H			M
4.8					H	M	M	M	H	M			M
4.9A		M	H	H	M		M	M		H	H	M	
4.10A		M	H	H	M		M	M		H	H	M	
4.9B		M	H	M			M	M		M	M	M	
4.10B		M	H	H			M	M		M	M	M	
5.1	M	M					M	M			M		
5.2			H	M	M	M	M	M		M			H
5.3		M	H	H	M	M	M	M		H	H		H
5.4A		M	H	H			M	M		M	H	M	
5.5A		M	H	H			M	M		M	H	M	
5.6A		M	H	H			M	M		H	H	M	
5.7A		M	H	H			M	M		H	H	M	
5.8A	M	M	H	M			M	M		M	M	M	
5.9A		M	H	H			M	M		M	M	M	
5.4B	M	M	H	M			M	M		M	M	H	
5.5B		M	H	H			M	M		M	M	H	
5.6B	M	H	H	M		M	M	M		M	M	H	
5.7B		M	H	H		M	M	M		M	M	H	
5.8B	M	M	M					M		M	M	H	
5.9B		M	M					M		M	M	H	
6.1	H	M	H	M		M	M	M		H	M	H	
6.2	M		H	H			M	M		M	M	H	
6.3					M		H	M					M
6.4	M	M	H	M			M	H		H	H		H
6.5A	M	M	H	H			M	M		M	H	M	
6.6A			H	H			M	M		M	H	M	
6.7A	M		M	H			M	M		M	M	M	
6.8A			H	H			M	M		M	M	M	

6.5B	H	H	M	M			M	M		M	M	H	
6.6B			H	H			M	M		M	M	H	
6.7B	H	H	M	M			M	M		M	M	H	
6.8B			H	H			M	M		M	M	H	
7.1HA	M		H	H			M	M		M	H	M	
7.2HA			H	H			M	M			H	M	
7.3HA	M	M	M	M			M	H		M	M	M	
7.4HA	M		H	H			M	M		M	H	M	
7.5HA			H	H			M	M			H	M	
7.6HA	M		H	H			M	M		M	H	M	
7.7HA	H	M	H	H			M	H		H	H	M	H
7.1HB	H	M	M	H			M	M		M	M	H	
7.2HB			H	H			M	M			M	H	
7.3HB	H	H	M	M			M	M		M	M	H	
7.4HB	H	M	M	M			M	M		M	M	H	
7.5HB			H	H			M	M			M	H	
7.6HB	H	M	H	M			M	M		M	M	H	
7.7HB	M		H	M			M	H		H	M	H	H
7.1HR	H	M	M	M			M	M		M	M	H	
7.2HR	H	H	M			M	M	M		M	M	H	
7.3HR	M		M	M			M	H		M			H
7.4HR	H	M	M	M			M	M		M	M	H	
7.5HR			H	H			M	M			M	H	
7.5HR	H	M	H	M			M	M		M	M	H	
8.1HA	M	M	H	H		M	M	M		M	H	M	
8.2HA			H	H		M	M	M			H	M	
8.3HA	M	M	M	H		M	M	M		M	M	M	
8.4HA			H	H		M	M	M			H	M	
8.5HA	H	M	H	H		M	M	H	M	M	H	M	
8.6HA	H	M	H	H		M	H	H		H	H	M	H
8.1HB	H	M	M	H			M	M		M	M	H	
8.2HB			H	H			M	M			M	H	
8.3HB	H	M	M	H			M	M		M	M	H	
8.4HB			H	H			M	M			M	H	
8.5HB	H	M	M	M		H	M	M			M	H	
8.6HB	H	H	M	M		M	M	H		M	M	H	H
8.1HR	H	H	M	M		M	M	H		M			H

DETAILED SYLLABUS

SEMESTER – I

CAMF101T: Mathematical Foundation of Computer Science – I (3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The objective of this course is to introduce students to the fundamental mathematical concepts, structures, and reasoning techniques that form the theoretical foundation of computer science. It aims to develop their ability to apply logic, set theory, relations, functions, combinatorics, and graph theory in solving computational problems. The course also seeks to strengthen students' analytical thinking and problem-solving skills, enabling them to model, analyze, and reason about algorithms, data structures, and various aspects of computer system design.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1:** Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics. (Understanding, Remembering)
- CO2:** Enable the students to use mathematical models and techniques to analyze and understand problems in computer science. (Applying, Analyzing)
- CO3:** Demonstrate how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze. (Analyzing, Creating)

Course Content:

MODULE I: Set, Relation and Function (12 Hours)

Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products. Relations on a Set, Properties of Relations, Representing Relations using matrices and digraphs, Types of Relations, Equivalence Relation, Equivalence relation and partition on set, Closures of Relations, Warshall's algorithm.

Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions.

Some useful functions for Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions.

MODULE II: Counting and Recurrence Relation (10 Hours)

Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem.

Recurrence relations, modelling recurrence relations with examples, like Fibonacci numbers, the tower of Hanoi problem. Solving linear recurrence relation with constant coefficients using characteristic equation roots method.

MODULE III: Elementary Graph Theory (11 Hours)

Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs, weighted graphs, Euler and Hamiltonian graphs.

Trees, properties of trees, concept of spanning tree. Planar graphs. Definitions and basic results on the topics mentioned.

MODULE IV: Matrix Algebra: (12 Hours)

Types of matrices, algebra of matrices—addition, subtraction, and multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations, Eigen values and Eigen vectors, Caley-Hamilton theorem.

Text Books

1. Garg, Reena, Engineering Mathematics, Khanna Book Publishing Company, 2024. (AICTE Recommended Text-book)
2. Garg, Reena, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2023.
3. Kolman, B., Busby, R. and Ross, S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
4. Vasishtha, A. R. and Vasishtha, A. K., Matrices, Krishna Prakashan, 2022.

Reference Books

1. Grimaldi Ralph P. and Ramana B. V., Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education, 2007.
2. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
3. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education, 2015

Web Resources

<https://nptel.ac.in/courses/106103205>

<https://nptel.ac.in/courses/111101115>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	H
CO2	M	H	H	H
CO3	M	H	H	M

CACA102T: Computer Architecture (3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The course aims to provide foundational understanding of digital electronics and number systems, enable students to design and analyze combinational and sequential circuits, Introduce the organization and functioning of basic computers and CPUs, and develop conceptual clarity on memory organization and parallel processing techniques.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Explain the basics of Digital Electronics and Binary Number System (*Understanding*)
 CO2: Learn the designing and implementation of combinational circuit. (*Applying, Creating*)
 CO3: Learn the designing and implementation of sequential circuit. (*Applying, Creating*)
 CO4: Describe the organization and functioning of basic computers. (*Understanding, Analyzing*)
 CO5: Explain the concept of parallel processing and memory organization (*Understanding, Applying*)

Course Content:

MODULE I: Digital Principles and Number Systems (12 Hours)

Digital Principles: Definition for Digital signals, Digital logic, Digital computers, Von Neumann Architecture, Boolean Laws and Theorems, K-Map: Truth Tables to K-Map, 2, 3 and 4 variable K Map, K-Map Simplifications, Don't Care Conditions, SOP and POS.

Number Systems: Decimal, Binary, Octal, Hexadecimal, Number System Conversions, Binary Arithmetic, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic, Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, Excess- 3 Code, The Gray Code.

MODULE II: Combinational and Sequential Circuits and Registers (11 Hours)

Combinational Circuits: Half Adder and Full Adder, Subtractor, Decoders, Encoder, Multiplexer, Demultiplexer

Sequential Circuits: Flip-Flops- SR Flip- Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop.

Register: 4-bit register with parallel load, Shift Registers- Bidirectional shift register with parallel load

Binary Counters-4 bit synchronous and Asynchronous binary counter.

MODULE III: Basic Computer Organization and Design and CPU (12 Hours)

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator logic. **Central Processing Unit:** Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC), RISC Vs CISC.

MODULE IV: Pipeline and Vector Processing and Memory Organization (10 Hours)

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor (IOP).

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Text Books:

1. Donald P Leach, Albert Paul Malvino, Goutam Saha - "Digital Principles & Applications", Tata McGraw Hill Education Private Limited, 2011 Edition.
2. M. Morris Mano - "Computer System Architecture", Pearson/Phi, Third Edition.

Reference Books:

1. William Stallings- "Computer Organization and Architecture", Pearson/PHI, Sixth Edition.
2. Andrew S. Tanenbaum- "Structured Computer Organization", PHI/Pearson 4th Edition,
3. M. V. Subramanyam, "Switching Theory and Logic Design", Laxmi Publications (P) Ltd.
4. Ikvinderpal Singh, Computer Organization Architecture, Khanna Book Publishing.

Web Resources

<https://nptel.ac.in/courses/106105163>

<https://nptel.ac.in/courses/108105113>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	
CO2	L	H	M	
CO3	L	M	H	
CO4		L	M	H
CO5			L	H

CACA103P: Computer Architecture Lab (2 Credits - 60 hours) (L-T-P: 0-0-2)

Course Objective:

The course aims to provide hands-on experience in digital logic circuit design, verification of fundamental logic gates and sequential circuits, as well as practical knowledge of computer hardware organization and troubleshooting. It helps students gain competency in both theoretical concepts of computer architecture and practical system-level skills including assembly, installation, and configuration.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Design, implement, and test combinational and sequential logic circuits using basic logic gates, flip-flops, counters, adders, decoders, and multiplexers. (Applying, Creating)
- CO2: Apply Boolean algebra and coding techniques (BCD, Gray, Excess-3) to realize digital functions and verify their truth tables. (Applying, Analyzing)
- CO3: Demonstrate knowledge of computer hardware components, perform system assembly, installation, configuration, and troubleshoot common hardware/software issues. (Applying, Evaluating)

MODULE I:

Verify logic behaviour of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates

To study and verify NAND as a Universal Gate

To verify De- Morgan's theorem for 2 variables

Design and test of an S-R flip-flop using NAND/NOR gate

Convert BCD to Excess-3 code using NAND gate

To Convert Binary to Grey Code

Verification of Truth Tables of J-K Flip-Flop using NAND/NOR gate

Realize Decoder and Encoder circuit using Basic Gates

Design and implement the 4:1 MUX using gates

Implementation of 4-Bit Parallel Adder Using 7483 IC

Design and verify operation of half adder and full adder

Design and verify operation of half subtractor

Design and implement a 4-bit shift register using Flip flops

Implement Boolean function using logic gates in both SOP and POS

Design and implement a 4-bit synchronous counter

Design and verify 4-bit asynchronous counter

MODULE II:

Familiarize the computer system layout: marking positions of SMPS, motherboard, FDD, HDD, CD, DVD and add on cards

Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit)

Identify and troubleshoot the problems of RAM, SMPS and motherboard

Configure BIOS settings- disable and enable USB and LAN

Adding additional RAM to the system. (Expanding RAM size)

To Study mother board layout of a system

Demonstrate the assembly of a PC

Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse), USB, LAN, Speaker, Audio

Install and configure windows OS

To study the installation of Printer and trouble shooting

Textbook

1. Morris Mano, *Digital Logic and Computer Design*, Prentice Hall of India
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, *Computer Organization*, McGraw Hill
3. B. Govindarajalu, *Computer Architecture and Organization: Design Principles and Applications*, Tata McGraw Hill
4. Thomas C. Bartee, *Digital Computer Fundamentals*, Tata McGraw Hill

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	
CO2	H	
CO3		H

CAPS104T: Problem Solving Techniques
(3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The objective of this course is to equip students with the skills and strategies required for effective problem analysis, algorithm design, and program development. It aims to introduce the fundamentals of computer systems, problem-solving methodologies, and programming language concepts, with a focus on structured programming using C. Students will learn to translate problem requirements into precise specifications, design solutions using structured constructs, implement algorithms in C, and apply debugging and testing techniques to ensure program correctness and efficiency.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Understand basic terminology of computers, problem solving, programming Languages and their evolution (Understanding)
- CO2: Create specification from problem requirements by asking questions to disambiguate the requirement statement. (Creating)
- CO3: Design the solution from specification of a problem and write pseudo code of the algorithm using basic building blocks or structured programming constructs (Sequence, Selection and Repetition statement). (Creating)
- CO4: Translate an algorithm into a C computer program (Creating)
- CO5: Testing and analysing programs using debugging tools. (Analyzing)

Course Content:

MODULE I: (11 Hours)

Problems And Problem Instances, Generalization and Special Cases, Types of Computational Problems, Classification of Problems, Analysis of Problems, Solution Approaches, Algorithm Development, Analysis of Algorithm, Efficiency, Correctness, Role of Data Structures in Problem Solving, Problem-Solving Steps (Understand the Problem, Plan, Execute, And Review), Breaking the Problem into Subproblems, Input/Output Specification, Input Validation, Pre and Post Conditions.

MODULE II: (12 Hours)

Structured Programming Concepts: Sequence (Input/Output/Assignment), Selection (If, If-Else) And Repetition (For, While, Do-While) Statements, Control Structure Stacking and Nesting.
Different Kinds of Repetitions: Entry Controlled, Exit Controlled, Counter Controlled, Definite, Indefinite and Sentinel-Controlled Repetitions.

Pseudocode and Flowcharts. Definition And Characteristics of Algorithms, Standard Algorithm Format. Problems Involving Iteration and Nesting: Displaying Different Patterns and Shapes Using Symbols and Numbers, Generating Arithmetic and Geometric Progression, Fibonacci and Other Sequences, Approximate Values For π , $\sin(x)$, $\cos(x)$, Etc. Using Taylor Series. Different Kinds of Data in The Real World and How They are Represented in The Computer Memory.

Representation of Integers: Signed Magnitude Form, 1's Complement And 2's Complement. Representation of Real Numbers: IEEE 754 Floating Point Representation. Representation of Characters: ASCII, UNICODE.

C Language: Introduction To Programming Languages, Different Generations of Programming Languages. Typed Vs Typeless Programming Languages, History of C Language, An Empty C Program. C Language Counterparts for Input (scanf()), Output (printf()) Statements, Assignment, Arithmetic, Relational and Logical Operators. If, If-Else Statements, For, While, Do-While Statements.

Data Types, Translating Pseudocode/Algorithm to C Program. Incremental Compilation and Testing of The C Program. Simple Problems Involving Input, Output, Assignment Statement, Selection and Repetition. Good Coding Practices.

MODULE III: (10 Hours)

Problems on Numbers: Extracting Digits of a Number (Left to Right and Right to Left), Palindrome, Prime Number, Prime Factors, Amicable Number, Perfect Number, Armstrong Number, Factorial, Converting Number from One

Base to Another. Statistics (Maximum, Minimum, Sum and Average) on a Sequence of Numbers which are Read using Sentinel- Controlled Repetition using only a few Variables.

C Language: else-if Ladder, switch Case, Increment/Decrement Operators, break and continue Statements.

MODULE IV: (12 Hours)

Modular Programming, Top-Down and Bottom-Up Approaches to Problem Solving. Recursion. Problems on Arrays: Reading and Writing of Array Elements, Maximum, Minimum, Sum, Average, Median and Mode. Sequential And Binary Search. Any one Sorting Algorithm. Matrix Operations.

C Language: Function Definition and Declaration (Prototype), Role of Return Statement, One Dimensional and Two-Dimensional Arrays. String Functions. Other Operators, Operator Precedence and Associativity. Debugging.

Text Books

1. Venkatesh, Nagaraju Y, Practical C Programming for Problem Solving, Khanna Book Publishing Company, 2024.
2. AICTE's Programming for Problem Solving (with Lab Manual), Khanna Book Publishing Company, 2024.
3. Harvey Deitel and Paul Deitel, C How to Program, 9th edition, Pearson India, 2015.
4. R G Dromey, How to Solve It by Computer.

Reference Books

1. Brian W. Kernighan and Dennis Ritchie, The C Programming Language, 2nd edition, Pearson, 2015.
2. Jeri Hanly and Elliot Koffman, Problem Solving and Program Design in C, 8th edition, Pearson, 2015.

Web Resource: <https://nptel.ac.in/courses/106105171>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	M	M
CO2	H	H	M	M
CO3	M	H	H	H
CO4		H	H	H
CO5		M	H	H

CAPS105P: Problem Solving Techniques Lab (2 credits – 60 Hours) (L-T-P: 0-0-2)

Course Objective:

The objective of this course is to provide students with practical experience in applying problem-solving strategies, algorithmic thinking, and structured programming concepts to develop efficient solutions using the C programming language. Through a variety of programming exercises, students will strengthen their skills in control structures, modular programming, recursion, and data manipulation, as well as in implementing mathematical, logical, and pattern-based problems. The lab also aims to enhance students' ability to test, debug, and optimize programs while fostering computational thinking and creativity in approaching real-world problems.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Develop algorithms for solving computational and mathematical problems using systematic problem-solving

strategies. (*Applying*)

CO2: Implement algorithms in C using appropriate programming constructs such as sequence, selection, repetition, and modularization. (*Creating*)

CO3: Apply recursion and modular programming techniques to design efficient and reusable solutions. (*Creating*)

CO4: Test, debug, and validate C programs to ensure correctness, reliability, and efficiency. (*Analyzing*)

CO5: Translate real-world problem statements into functional C programs with appropriate input/output handling and code documentation. (*Applying*)

Course Content:

MODULE I:

Converting degrees Celsius to Fahrenheit and vice versa

Display three input numbers in sorted (non-decreasing) order

Given a positive integer value n ($n \geq 0$) display number, square and cube of numbers from 1 to n in a tabular format?

Given an input positive integer number, display odd numbers from in the range $[1, n]$

Display the following patterns of n rows ($n > 0$), for the below examples $n = 5$

Hollow square pattern:	Triangle Patterns with numbers:	Square with diagonals:			Diamond Pattern
#####		* * *	*	*	
# #	1	* *	*	*	*
# #	121				***
# #	12321	* *		*	*****
#####	1234321	* *			
	123454321	* * *	*	*	***
			*	*	*

Display first mathematical tables, each table up to 10 rows? Generalise this to display first n ($n > 0$) mathematical tables up to m ($m > 0$) rows

Given the first term (a), difference/multiplier (d) and number of terms ($n > 0$), display the first n terms of the arithmetic/geometric progression

Display following patterns of n rows ($n > 0$), For the below examples $n = 5$? For each pattern write a separate algorithm/program

\$	\$	12345	12345
\$\$	\$\$	1234	1234
\$\$\$	\$\$\$	123	123
\$\$\$\$	\$\$\$\$	12	12
\$\$\$\$\$	\$\$\$\$\$	1	1

Display the first n ($n > 0$) terms of the fibonacci sequence

Display the first n ($n > 0$) terms of the Tribonacci sequence

Given two positive integer numbers n_1 and n_2 check if the numbers are consecutive numbers of the fibonacci sequence

Compute approximate value of π considering first n ($n > 0$) terms of the Taylor series for π

Compute approximate value of e^x considering first n ($n > 0$) terms of the Taylor series for e^x

Compute approximate value of $\sin(x)/\cos(x)$ considering first n ($n > 0$) terms of the Taylor series for $\sin(x)/\cos(x)$

MODULE II:

Extract digits of an integer number (left to right and right to left)

Given a sequence of digits form the number composed of the digits. Use sentinel-controlled repetition to read the digits followed by -1. For example, for the input 2 7 3 2 9 -1 the output number is 27329

Check if a given positive integer number is a palindrome or not

Compute character grade from the marks ($0 \leq \text{marks} \leq 100$) of a subject. Grading Scheme: 80-100: A, 60 - 79: B, 50 - 59: C, 40-49: D, 0-39: F. Solve this using both else-if ladder and switch case?

Compute the sum of a sequence of numbers entered using sentinel-controlled repetition

Extract digits of an integer number (left to right and right to left)

Check if a given positive integer number is a prime number or not

Compute prime factors of a positive integer number

Check if two positive integer numbers are amicable numbers or not

Check if a given positive integer number is a perfect number or not

Check if a given positive integer number Armstrong number or not

Converting a positive integer number ($n > 0$) from one base (inputBase) to another base (outputBase) ($2 \leq \text{input Base}, \text{outputBase} \leq 10$). Input number should be validated before converting to make sure the number uses only digits allowed in the input base

Write a program to display a number in text form. For example: If the number is 5432 the output should be "FIVE FOUR THREE TWO"

Using the grading scheme described in the question 4 (MODULE III), Compute how many students awarded each grade and display the frequency as a bar chart (horizontal) using single "*" for each student. Use sentinel-controlled repetition (-1 as sentinel value) in reading the students marks. Use else-if ladder/switch case to compute the grade and the corresponding frequency.

Compute Body mass index (BMI), where

$$\text{BMI} = \text{weight\_inKGs} / \text{Height\_inMeters} * \text{Height\_inMeters}$$

Both weight and height values are positive real numbers. Your program should display BMI value followed by whether the person is Underweight, Normal, Overweight or Obese using the below ranges:

BMI Values

Underweight: less than 18.5

Normal: ≥ 18.5 and < 25

Overweight: ≥ 25 and < 30

Obese: ≥ 30

MODULE III:

Design a modularized algorithm/program to check if a given positive integer number is a circular prime or not

Design a modularized algorithm/program to compute a maximum of 8 numbers

Design a modular algorithm/program which reads an array of n integer elements and outputs mean (average), range (max-min) and mode (most frequent elements)

Design a modular algorithm/program which reads an array of n integer elements and outputs median

Implement your own string length and string reversal functions

Design algorithm/program to perform matrix operations addition, subtraction and transpose

Write a recursive program to count the number of digits of a positive integer number

Recursive solutions for the following problems:

Factorial of a number

Display digits of a number from left to right (and right to left)

Compute x^y using only multiplication

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO1	H	M	H
CO2	H	H	H
CO3		M	H
CO4	M	H	H
CO5	M	H	H

(2 credit - 30 hours) (L-T-P: 2-0-0)

Course Objectives

- * To introduce fundamentals of Ancient Indian Educations to understand the pattern and purpose of studying vedas, vedangas, upangas, upveda, purana & Itihasa
- * To help students to trace, identify and develop the ancient knowledge systems.
- * To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing
- * To build in the learners a deep-rooted pride in Indian knowledge, committed to universal human right, well-being and sustainable development.

Course Outcomes

After completing the course, the students will be able to:

CO1: Identify the foundational elements of Bhāratiya civilization, including its knowledge systems, educational institutions, and philosophical traditions. (*Understanding*)

CO2: Apply traditional Indian approaches to language, logic, measurement systems, and physical reality to modern interdisciplinary contexts. (*Applying*)

CO3: Analyse the contributions of key scholars and literary figures in the development of Indian arts, sciences, and philosophy. (*Analysing*)

CO4: Evaluate the scientific principles and technological innovations from ancient India in the areas of mathematics, astronomy, medicine, and environmental studies. (*Evaluating*)

Course Content

Module-I: Foundations of Indian Knowledge Systems and Civilisational Heritage

Bhāratiya Civilization and Development of Knowledge System (4 hours)

Genesis of the land, Antiquity of civilization, On the Trail of the Lost River, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization, Traditional Knowledge System, The Vedas, Main Schools of Philosophy, Ancient Education System, the Takṣaśilā University, the Nālandā University, Alumni, Knowledge Export from Bhārata.

Arts, Literature, and Scholars (3 hours)

Art, Music, and Dance, Naṭarāja– A Masterpiece of Indian Art, Literature, Life and works of Agastya, Lopāmudrā, Vālmīki, Patañjali, Vedavyāsa, Yājñavalkya, Gārgī, Maitreyī, Bodhāyana, Caraka, Suśruta, Jīvaka, Nāgārjuna, Kaṇāda, Patañjali, Kauṭilya, Pāṇini, Āryabhaṭa, Varāhamihira, Ādi Śaṅkarācārya, Bhāskarācārya, Mādhavācārya.

Science, Astronomy, and Mathematics (5 hours)

Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, Bhāratiya Kāla-gaṇanā, Kerala School for Mathematics and Astronomy, History and Culture of Astronomy, Sun, Earth, Moon, and Eclipses, Earth is Spherical and Rotation of Earth, Archaeoastronomy; Concepts of Zero and Pi, Number System, Pythagoras Theorem, and Vedic Mathematics.

Life, Environment, and Health (3 hours)

Ethnic Studies, Life Science in Plants, Anatomy, Physiology, Agriculture, Ecology and Environment, Āyurveda, Integrated Approach to Healthcare, Medicine, Microbiology, Medicine, Surgery, and Yoga, etc.

Module-II: Scientific Traditions and Technological Innovations in Indian Knowledge Systems

Foundation concept for Science & Technology (7 hours)

Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeṣikan approach to physical reality, constituents of the physical reality, Pramāṇa, Saṃśaya.

Indian Science & Technology in IKS (8 hours)

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Engineering Science and Technology in the Vedic Age and Post-Vedic Records. Indian Science and Technology Heritage, sixty-four art forms and occupational skills (64 Kalas). Metals and Metalworking technology: Copper, Gold, Zinc, Mercury, Lead, Silver, Iron & Steel. Dyes and Painting Technology, Town & Planning Architecture in India, Temple Architecture, Vastu Sastra.

References:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
3. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
4. SK Das, The education system of Ancient hindus, Gyan publication house, India.
5. BL Gupta, Value and distribution system in india, Gyan publication house, India.
6. Reshmi ramdhoni, Ancient Indian Culture and Civilisation, Star publication, 2018.
7. Supriya Lakshmi Mishra, Culture and History of Ancient India (With Special Reference of Sudras), 2020.
8. Gambirananda, Swami, Tr. Upanishads with the Commentary of Sankarachrya. Kolkata: Advaita Ashrama publication Department, 2002.
9. Ranganathananda, Swami. The Massage of the Upanishads. Bombay: Bharathya Vidya Bhaven, 1985.
10. Om Prakash, Religion and Society in Ancient India, Bhariya Vidhya Prakashan, 1985.
11. J Auboyer, Daily Life in Ancient India from Approximately 200 BC to AD 700, Munshi ram Manoharlal publication, 1994.
12. DK Chakkrabarty, Makkhan Lal, History of Ancient India (Set of 5 Volumes), Aryan book Internation publication, 2014.
13. Dr. Girish Nath Jha, Dr. Umesh Kumar Singh and Diwakar Mishra, Science and Technology in Ancient Indian Texts, DK Print World limited.
14. Chatterjee, S.C. The Nyaya Theory of Knowledge. Calcutta: University of Calcutta Press, 1950.
15. Dasgupta, Surendra. A History of Indian Philosophy. Delhi: Motilal Banarsidass, 1991. Vols. III & IV.

CAGE106T: GENERAL ENGLISH - I (2 credit: 30 hours) (L-T-P: 1-1-0)

Course Objective:

The course aims to strengthen the foundational skills of English language learning by developing competence in listening, speaking, reading, and writing. It focuses on improving vocabulary, grammar, writing style, and oral communication through structured modules, practice sessions, and applied tasks, thereby enabling learners to enhance both academic and Discipline Specific communication skills.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Provide learning environment to practice listening, speaking, reading and writing skills. (*Applying, Analyzing*)
- CO2: Assist students to carry on the tasks and activities through guided instructions and materials. (*Understanding, Applying*)
- CO3: Effectively integrate English language learning with employability skills and training. (*Applying, Evaluating*)
- CO4: Provide hands-on experience through case-studies, mini-projects, group and individual presentations. (*Creating, Evaluating*)

Course Content:

Module I: Vocabulary Building (5 Hours)

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

Module II: Basic Writing Skills (6 Hours)

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

Module III: Identifying Common Errors in Writing (5 Hours)

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies

Module IV: Nature and Style of sensible Writing (6 Hours)

Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Module V: Writing Practices, Comprehension, Précis Writing, Essay Writing

Module V: Oral Communication (This Module involves interactive practice sessions in Language Lab) (8 Hours)

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

Text/Reference Books:

1. AICTE's Prescribed Textbook: Communication Skills in English, Anjana Tiwari, Khanna Book Publishing Co., 2023.
2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. Remedial English Grammar. F.T. Wood. Macmillan.2007
5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
7. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL/SWAYAM Course Name	Instructor	Host Institute
1	English language for competitive exams	Prof. Aysha Iqbal	IIT MADRAS
2	Technical English for engineers	Prof. Aysha Iqbal	IITM

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M	H		H	H
CO2		M	H	H	H
CO3	L		M	H	
CO4		M		H	H

CBES101T: ENVIRONMENTAL STUDIES

(1 credit: 15 hours) (L-T-P: 1:0:0)

Course Objective:

The course aims to create awareness and a holistic understanding of the environment by introducing students to its

multidisciplinary nature, natural resources, ecosystems, biodiversity, environmental pollution, and social issues. It seeks to instill ecological literacy, promote sustainable practices, and develop a sense of responsibility among learners to evaluate and address environmental challenges at both local and global scales.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Recall the multidisciplinary nature of environmental studies. (*Remembering*)
- CO2: Explain ecological processes of natural resources. (*Understanding*)
- CO3: Categorize different types of natural resources. (*Analysing*)
- CO4: Evaluate the global scale of environmental pollution. (*Evaluating*)

Module I: The Multidisciplinary Nature of Environmental Studies (1 Hour)

Definition, scope and importance, need for public awareness.

Module II: Natural Resources (2 Hours)

- a. Different types of natural resources and associated problems - forest resources, water resources, mineral resources, food resources, energy resources and land resources.
- b. Conservation of natural resources.

Module III: Ecosystems (2 Hours)

- a. Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, food chains, food webs.
- b. Structure of following ecosystems - forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems.

Module IV: Biodiversity and Its Conservation (2 Hours)

Types of biodiversity – genetic, species and ecosystem, value of biodiversity, global biodiversity, India as a mega-diversity nation, threats to biodiversity, conservation of biodiversity - in-situ and ex-situ conservation.

Module V: Environmental Pollution (3 Hours)

- a. Definition, causes, effects and control measures of - air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards and e-pollution.
- b. Solid waste management.
- c. Disaster management.

Module VI: Social Issues and the Environment (3 Hours)

- a. From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, climate change, global warming, acid rain, ozone layer depletion.
- b. Environment protection act.
- c. Introduction to environmental impact assessment.

Module VII: Human Population and the Environment (2 Hours)

Population growth and sex ratio; Population explosion - family welfare programme; Environment and human health; HIV/AIDS; Role of information technology in environment and human health.

Suggested Readings

1. Textbook for Environmental Studies, E. Bharucha, UGC, New Delhi.
2. Fundamentals of Environmental Studies, S. Somvanshi and R. Dhupper, S.K. Kataria and Sons Publisher.
3. Environmental Chemistry, A. K. De, New age publishers.
4. Environmental Studies, Third edition, J. P. Sharma, University Science Press.
5. Comprehensive Environmental Studies, K. G. Bhattacharyya and A. Sarma, Narosa Publishing House Pvt, Ltd.

Web Resources

<https://www.youtube.com/watch?v=zuSFs85kuJs&list=PLIC0i9IRboHb19v2dF0yuenG7xDOGJLeP>
<https://www.youtube.com/watch?v=tMwFNMfjFuU&list=PL8dPuuaLjXtOikZljhKAe28AkupJXnS2u>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H				H		H
CO2		M	H				
CO3				M		H	
CO4							H

AECH100T: COMMUNICATIVE HINDI - I**(2 credits – 30 hours) (L-T-P: 2-0-0)****Course Outcomes**

After successful completion of this course, students will be able to:

- CO1: Grasp the basic script of Devnagari for communicative usage (Remembering)
- CO2: Learn the vocabulary, grammar and sentence formation for day-to-day communication in Hindi (Understanding)
- CO3: Use the vocabulary, idiom and proverbs in communicative Hindi writing (Applying)
- CO4: Understand Hindi used in common public places & offices as National Language (Applying)

Course Content**Module I: Introduction to Hindi language and pronunciation**

Introduction to evolution of Hindi as National language of connectivity

Introduction to Hindi alphabet (Devanagari script) - vowels and consonants with their pronunciation

Basic greetings and expressions

- ✓ हिंदी भाषा का राष्ट्रीय भाषा के रूप में उत्थान: परिचयात्मक विश्लेषण
- ✓ हिंदी बारह बड़ी (देवनागरी लिपि) का ज्ञान – स्वर, व्यंजन एवं उनका उच्चारण
- ✓ सामान्य शब्दभंडार एवं उद्बोधन ज्ञान

Module II: Vocabulary building and basic sentence formation

Vocabulary building for daily use

Basic sentence formation using simple verbs and nouns

Introduction to daily inter personal communications / asking questions/ daily use conversations

- ✓ दैनिक प्रयोग की शब्दावली एवं शब्दकोष का ज्ञान
- ✓ संज्ञा एवं क्रिया के उपयोग से सामान्य वाक्यों की संरचना
- ✓ दैनिक उपयोगी सम्बोधन, स्व-सम्बोधन, प्रश्न इत्यादि पूछना एवं सामान्य बोलचाल सम्बन्धी ज्ञान

Module III: Basic level conversational practice and grammar

Introduction to Hindi grammar: noun, pronoun, adjective, verb, adverb

Sentence formation using different tenses: present, past, future

Use of prepositions and conjunctions in sentences

Role-play exercises for different situations: shopping, ordering food, asking for directions, etc.

Group discussion and conversation practice for grammar, sentence formation and effective communication in Hindi

- ✓ हिंदी व्याकरण – संज्ञा, सर्वनाम, विशेषण, क्रिया, क्रिया-विशेषण इत्यादि
- ✓ विभिन्न काल सम्बन्धी वाक्य संरचना – वर्तमान, भविष्य एवं भूत काल
- ✓ संबंध सूचक अव्यय / पूर्वसर्ग / शब्द एवं समुच्चयबोधक / संयोजक शब्द – वाक्य संरचना में उनका उपयोग

- ✓ अभिनय-नाटक / वार्तालाप गतिविधि / नाटक रचना के माध्यम से विभिन्न दैनिक परिस्थितियों के वार्तालाप का ज्ञान – दैनिक खान-पान सम्बन्धी, खरीददारी सम्बन्धी, पता-ठिकाना / दिशा सम्बन्धी इत्यादि
- ✓ सामूहिक परिचर्चा एवं वार्तालाप के माध्यम से व्याकरण के उपयोग, वाक्य संरचना एवं प्रभावी वार्तालाप का ज्ञान तथा अभ्यास

Module IV: Intermediate level vocabulary and grammar

- a. Vocabulary building for intermediate level topics: travel, health, environment, etc.
- b. Intermediate level sentence formation: complex sentences, conditional sentences, etc.
- c. Idioms & proverbs and their usage in communication
 - ✓ माध्यमिक स्तर के वार्तालाप हेतु शब्दावली निर्माण जैसे यात्रा, स्वास्थ्य, वातावरण इत्यादि क्षेत्रों में उपयोगी शब्दावली का ज्ञान
 - ✓ माध्यमिक स्तर के वार्तालाप हेतु वाक्य संरचना का ज्ञान: संयुक्त वाक्य, उपबंध वाची वाक्य इत्यादि
 - ✓ दैनिक वार्तालाप तथा उपयोग में आने वाली कहावतों एवं मुहावरों का ज्ञान

Module V: Advanced level conversation and writing practice

Advanced conversation practice on different Discipline Specific topics

Writing practice: Paragraph writing, message writing, letter writing, essay writing, etc.

- ✓ विभिन्न कार्यकारी क्षेत्रों से सम्बंधित उच्च स्तरीय वार्तालाप का ज्ञान एवं अभ्यास
- ✓ लेखन अभ्यास: पत्र लेखन, सन्देश, निबंध, अनुच्छेद / वाक्यखंड लेखन इत्यादि

Suggested Readings

1. Richard Delacy, Sudha Joshi (2009), Elementary Hindi: Learn to Communicate in Everyday Situations -Tuttle Publishing (a work book -e-book with MP4 video)
2. Sunita Narain Mathur, Madhumita Mehrotra (2017), Hindi for Beginners: A Guide to Conversational Hindi (Audio Disc Included), Tuttle Publishing
3. Surendra Kumar Gambhir (2003), Communicative Hindi for Beginners: Cultural Appropriateness, Vocabulary, Grammatical Accuracy Google book
4. DRISHTI IAS BLOG (2023), Hindi Language: Its Journey So Far, <https://www.drishtiiias.com/blog/hindi-language-its-journey-so-far>
5. Britannica blog(nd), Hindi language- history, variety, grammar and vocabulary, <https://www.britannica.com/topic/Hindilanguage>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2	L	M	H		
CO3				H	M
CO4			M	M	H

AECA100T: COMMUNICATIVE ASSAMESE I

(2 Credits: 30 hours) (L-T-P: 2-0-0)

Course Objectives

To give basic idea about the Assamese Language alphabets, wordings and also to make them learn about sentence formation, tense and writing skills of Assamese

Course Outcomes

After successful completion of this course, students will be able to:

- CO1: Understand the basic concept of Assamese language. (*Understanding*)
CO2: Remembering the conversational language. (*Remembering*)
CO3: Analyse the reading skills of Assamese. (*Analysing*)
CO4: Apply the writing skills in daily life activities. (*Applying*)

Module I: Introduction to Assamese language and pronunciation (8 Hours)

History and geography of Assam; Introduction to Assamese alphabet and pronunciation of vowels and consonants; Basic greetings and expressions

Module II: Vocabulary building and basic sentence formation (8 Hours)

Vocabulary building for daily use; Basic sentence formation using simple verbs and nouns; Introducing oneself and asking questions

Module III: Grammar Basics and Conversational Practice (6 Hours)

Introduction to Assamese grammar: noun, pronoun, adjective, verb, adverb; Sentence formation using different tenses: present, past, future; Use of prepositions and conjunctions
Role-play exercises for different situations: shopping, ordering food, asking for directions, etc.; Group discussion and conversation practice

Module IV: Intermediate level vocabulary and basic writing practice (8 Hours)

Vocabulary building for intermediate level topics: travel, health, environment, etc.; Intermediate level sentence formation: complex sentences, conditional sentences, etc.
Use of idioms and proverbs; Advanced conversation practice on different topics; Writing practice: letter writing, essay writing, etc.
Project Phase-I: Group discussion, project identification; Case study along with group discussion

Suggested Readings

- ১) অসমীয়া ভাষাৰ উত্তৰ আৰু অভিযান- ই-ৰিচাৰ্জ।
- ২) যোগাযোগমূলক অসমীয়া ভাষা – লেখক ডঃ হেমন্ত শৰ্মা।
- ৩) অসমীয়া বৰ্ণমালা আৰু যুক্তাক্ষৰ-
- ৪) অসমীয়া বাক্যৰ লেখক সতানাত্ৰ বৰা।
- ৫) অসমীয়া কুইজ পাঠ- কুৰ্বেৰ পৰিচালন।
- ৬) অকন হাইন- কুৰ্বেৰ পৰিচালন, শ্ৰী বাবুল শৰ্মা।

AEFR100T: FRENCH BEGINNER LEVEL I

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objective

French Beginner level I is a course of 30 learning hours designed to help learners to acquire basic speaking, listening, writing and reading skills in French. The course introduces pronunciation, common vocabulary and basic grammar to learners with no previous knowledge of French language. This knowledge prepares students to effectively communicate in French on topics related to everyday situations. Students practice listening and speaking in real-life situations, learn to read short and practical texts in French, and gain an insight into francophone cultures. By the end of the session, learners are expected to be able to engage in some general, everyday types of conversation.

Course Outcomes

After successful completion of this course, students will be able to:

- CO1: Recall, name and identify the vocabulary and phrases related to who, when, where and other key question words, explain and interpret their meanings and select appropriate response. (*Remembering, Analyzing, Evaluating*)
CO2: Use the vocabulary and sentence structures learned to converse and discuss on a range of topics related to

everyday situations. (*Understanding, Applying*)

CO3: Demonstrate a basic understanding of francophone countries' cultures, describe and summarize basic cultural values. (*Applying, Understanding, Evaluating*)

CO4: Analyse cultural differences and choose appropriate ways to interact with speakers from Francophone countries. (*Analysing, Evaluating*)

CO5: Design and compose meaningful situational dialogues and perform them; invent skits by using the language skills learned. (*Creating*)

Course Content:

Module I: Introduction to French phonetics and pronunciation drills (8 hours)

Phonetic alphabet; Vowels, semi-vowels and consonants; Silent letters; Pronunciation rules

Module II: Everyday common phrases and basic sentence structures (16 hours)

Greeting; Self-introduction (nationality, profession, age, family); Making requests

Talking about one's likes and dislikes; Making invitation; Describing personnel

Module III: Introduction to Francophone cultures (6 hours)

French and its speakers; Pop culture: music, movies, TV, dramas; Lifestyles

Suggested Readings

Amical A1, CLE International, Paris, 2011

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO1	M	H	
CO2		H	
CO3			H
CO4			H
CO5		H	

AEGR100T: Introduction to German Language I

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objective

The course aims at covering the basics of German language. It also covers a few basic grammar topics and an application of grammar in day-to-day life that is in reading, writing, listening, and speaking. On the completion of the first semester, one can understand and use familiar, everyday expressions and very simple sentences, can introduce him/her and others as well as ask others about themselves – e.g., where they live, who they know and what they own – and can respond to questions of this nature.

Course Outcomes

After successful completion of this course, students will be able to:

CO1: Demonstrate the ability to use basic German vocabulary and grammar (personal pronouns, articles, verbs, negation, and prepositions) for everyday communication. (*Understanding, Applying*)

CO2: Engage in simple conversations by introducing oneself, discussing family, occupations, hobbies, food, travel, and time-related contexts in German. (*Applying, Analysing*)

CO3: Interpret and construct short dialogues and written expressions using correct sentence structures (nominative/accusative, possessive articles, expressions of time) to communicate effectively in familiar situations. (*Applying, Creating*)

Course Content

Topic	Grammar
1 Greetings	Personal pronouns and verbs in the present tense
2 Introduce yourself/countries/occupations/Family	Artikel: der/die/das
3 The alphabet and the numbers	Verbs
4 Languages and countries	The negation
5 People and hobbies	Expression of time (am, um, von..bis)
6 In the city	Possessive Artikel
7 Food and drink and in the restaurant	Nominative and Accusative sentences, verbs and prepositions
8 Time and season	

Suggested Reading

Netzwerk Deutsch als Fremdsprache A1, Textbook + Workbook by Stephanie Dengler

SEMESTER -II

CAMF111T: Mathematical Foundation of Computer Science – II (3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The course aims to provide students with a strong mathematical foundation essential for advanced studies in computer science. It focuses on developing rigorous analytical and logical reasoning skills, enabling students to construct valid arguments and proofs. Through exposure to key topics such as logic, algebraic structures, numerical methods, and optimization techniques, the course builds the ability to apply mathematical concepts to computational and real-world problem-solving scenarios. By integrating theoretical understanding with practical applications, it prepares students to model, analyze, and optimize complex systems in the field of computer science.

Course Outcomes

After successful completion of this course, students will be able to:

- CO1: Construct valid arguments and proofs using appropriate logical and mathematical reasoning. (*Creating*)
- CO2: Apply fundamental mathematical techniques to understand and implement advanced computational methods, including numerical and optimization algorithms. (*Applying*)
- CO3: Employ effective problem-solving strategies to address both theoretical and practical challenges in computer science. (*Applying, Analyzing*)

Course Content:

Module I: Logic and Methods of Proofs (14 Hours)

Propositions, logical operations (basic connectives), compound statements, construction of truth table, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF).
Methods of proofs: Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Mathematical Induction.

Module II: Algebraic Structures: (8 Hours)

Semi-group, Monoid, Group, Subgroup, Cyclic group.

Module III: Numerical Methods: (12 Hours)

Concept and importance of errors in numerical methods.

Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson methods.
 Numerical Interpolation: Newton's Forward and Newton's Backward interpolation formula and Lagrange's formula.
 Numerical Integration: Trapezoidal rule and Simpson's 1/3 rule
 Only formula and problem solving for all the topics mentioned above.

Module IV: Optimization Techniques: (11 Hours)

Linear programming: Introduction, LP formulation, Graphical method for solving LPs with two variables, Special cases in graphical methods, Simplex method, Duality.

Transportation problem: Definition, Linear form, North-west corner method, least cost method, Vogel's approximation method for finding feasible solution, MODI method for finding optimum solution.

Text Books

1. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
2. Sastry S. S., Introductory Methods of Numerical Analysis, Fifth Edition, PHL, 2022.
3. Taha Hamdy A., Operations Research: An Introduction, Eighth Edition, Pearson Prentice Hall, 2003.
4. S.B. Singh, Discrete Structures, Khanna Book Publishing, 2023 (AICTE Recommended Textbook)

Reference Books

1. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
2. Chakravorty J. G. and Ghosh P. R., Linear Programming and Game Theory, Moulik Library, 2017.
3. Sharma J. K., Operations Research: Theory and Applications, Fourth Edition, Macmillan Publishers, 2007.

Web Resources

<https://nptel.ac.in/courses/111107127>

<https://www.math.iitb.ac.in/~siva/si50716/SI507lecturenotes.pdf>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2			H	H
CO3	H	M	H	H

CADS112T: Data Structures

(3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The objective of this course is to develop a strong foundation in the concepts, design, and implementation of fundamental data structures. Students will learn how various linear and nonlinear data structures operate, how they are stored and manipulated in memory, and how they support efficient algorithmic problem-solving. The course emphasizes analytical thinking, algorithmic efficiency, and hands-on implementation using the C programming language, enabling students to choose and apply appropriate data structures for solving computational problems effectively.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Understand the fundamental concepts, operations, and applications of various data structures. (*Understanding*)

CO2: Apply suitable data structures and algorithmic techniques to solve computational problems. (*Applying*)
CO3: Implement linear and nonlinear data structures using the C programming language. (*Applying*)

Prerequisite:

Programming Fundamentals: Understanding the basic syntax and semantics of C programming language.

Problem-Solving Skills: Ability to break down a problem into smaller steps and devise a step-by-step solution and familiarity with simple algorithms.

Course Content:

Module I: (12 Hours)

Introduction and Overview: Definition, Classification and Operations of Data Structures. Algorithms: Complexity, Time-Space Tradeoff

Arrays: Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Merging. Searching: Linear Search and Binary Search, Comparison of Methods. Sorting: Bubble Sort, Selection Sort, and Insertion Sort. Two-Dimensional Arrays, Representation of Two- Dimensional Arrays in Memory, Matrices and Sparse Matrices, Multi-Dimensional Arrays.

Module II: (10 Hours)

Linked Lists: Definition, Comparison with Arrays, Representation, Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List. Applications of Linked Lists: Addition of Polynomials.

Hashing and Collision: Hashing, Hash Tables, Types of Hash Functions, Collision, Collision Resolution with Open Addressing and Chaining

Module III: (12 Hours)

Stacks: Definition, Representation of Stacks using Arrays and Linked List, Operations on Stacks using Arrays and Linked List, Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Postfix Expression, Evaluation of Postfix Expression.

Recursion: Definition, Recursive Notation, Runtime Stack, Applications of Recursion: Factorial of Number, GCD, Fibonacci Series and Towers of Hanoi.

Queues: Definition, Representation of Queues using Array and Linked List, Types of Queue: Simple Queue, Circular Queue, Double-Ended queue, Priority Queue, Operations on Simple Queues and Circular Queues using Array and Linked List, Applications of Queues.

Module IV: (11 Hours)

Graphs: Definition, Terminology, Representation, Traversal.

Trees: Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree, Height Balanced Trees: AVL Trees, Insertion and Deletion in AVL Tree.

Text Books

1. R.B. Patel, "*Expert Data Structures with C*", Khanna Book Publishing Company, 2023 (AICTE Recommended Textbook)
2. Seymour Lipschutz, "*Data Structures with C*", Schaum's Outlines, Tata McGraw-Hill, 2011.
3. Yashavant Kanetkar, "*Data Structures Through C*", 4th Edition, BPB Publications, 2022.

Reference Books

1. Reema Thareja, "*Data Structures Using C*", Second Edition, Oxford University Press, 2014.
2. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, "*Fundamentals of Data Structures in C*", Second Edition, Universities Press, 2007.

Web Resources

GeeksforGeeks - Data Structures Tutorial

Khan Academy - [Algorithms Course](#)**Mapping of COs to Modules**

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2	H		H	H
CO3	H	M	H	H

CADS113P: Data Structures Lab
(1 credit - 30 hours) (L-T-P: 0-0-1)
Course Objective:

The objective of this lab course is to enable students to apply and implement fundamental data structures using the C programming language. Through hands-on exercises, students will develop practical skills in designing, coding, debugging, and analyzing data structure operations. The lab reinforces concepts learned in theory and prepares students to choose appropriate data structures for effective problem-solving in real-world applications.

Course Outcomes:

After successful completion of the lab course, students will be able to:

CO1: Implement basic and advanced operations on linear and nonlinear data structures using C. (Applying)

CO2: Analyze the behavior and performance of data structure operations through practical experimentation. (Analyzing)

CO3: Develop efficient solutions to computational problems by selecting and integrating appropriate data structures. (Applying/Creating)

List of Lab Programs:

Module I: Array and Matrix Operations: (10 Hours)

Insertion and deletion in arrays; Linear search and binary search; Bubble sort and selection; Merging of arrays; Addition, subtraction, and multiplication of matrices

Module II: Linked List Implementations (10 Hours)

Singly Linked List - Insertion: beginning, end, specific position; Deletion: beginning, end

Doubly Linked List – Create, Search

Circular Linked List – Create, Delete from end

Module III: Stacks and Queues (5 Hours)

Stacks - Implement stack using array; Implement stack using linked list

Queues - Simple queue using array; Circular queue using array

Module IV: Trees and Binary Search Trees (5 Hours)

Traversals: preorder, inorder, postorder

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2		M	H	H
CO3		H	H	H

CAOS114T: Operating Systems
(3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The primary objective of this course is to introduce students to the fundamental concepts, design principles, and functioning of modern operating systems. The course aims to build a strong understanding of process management, CPU scheduling, memory management, I/O handling, synchronization, and file systems, enabling students to analyze, compare, and apply operating system functionalities effectively.

Course Outcomes:

At the end of the course, students will be able to:

- CO1: Explain the fundamentals of the operating system. (*Understanding*)
- CO2: Comprehend multithreaded programming, CPU scheduling, process management, process synchronization, memory, deadlocks, and storage management. (*Understanding, Applying*)
- CO3: Compare the performance of CPU scheduling algorithms (*Analyzing, Evaluating*)
- CO4: Identify the features of I/O and File handling methods. (*Remembering / Understanding*)

Course Content:

Module I: (10 Hours)

Operating Systems Overview: Definition, Evaluation of O.S, Components & Services of OS, Structure, Architecture, types of Operating Systems, Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems.

Operating Systems Structures: Operating system services and systems calls, system programs, operating system structure, operating systems generations.

Module II: (12 Hours)

Process Management: Process Definition, Process states, Process State transitions, Process Scheduling, Process Control Block, Threads, Concept of multithreads, Benefits of threads, Types of threads.

Process Scheduling: Definition, Scheduling objectives, Scheduling algorithms, CPU scheduling Preemptive and Non-preemptive Scheduling algorithms (FCFS, SJF and RR), Performance evaluation of the scheduling Algorithms

Module III: (10 Hours)

Process Synchronization: Introduction, Inter-process Communication, Race Conditions, Critical Section Problem, Mutual Exclusion, Semaphores, Monitors.

Deadlocks: System model, deadlock characterization, deadlock prevention, avoidance, Banker's algorithm, Deadlock detection, and recovery from deadlocks.

Module IV: (13 Hours)

Memory Management: Logical and Physical address map, Swapping, Memory allocation, MFT, MVT, Internal and External fragmentation and Compaction, Paging, Segmentation.

Virtual Memory: Demand paging, Page Replacement algorithms, Allocation of frames, thrashing.

I/O Management: Principles of I/O Hardware: Disk structure, Disk scheduling algorithms.

Text Books:

1. Ekta Walia, Operating Systems Concepts, Khanna Publishing House, 2022 (AICTE Recommended Textbook)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition OR Later edition, Wiley India Private Limited, New Delhi.
3. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.

Reference Books:

1. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India.
2. Sumitabha Das, UNIX Concepts and Applications, 4th Edition, Tata McGraw-Hill.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	L
CO2	M	H	H	H
CO3	L	H		
CO4	L	H		

CAOS115P: Operating Systems Lab
(1 credit - 30 hours) (L-T-P: 0-0-1)

Course Objective:

The objective of this laboratory course is to provide hands-on experience with operating system concepts such as CPU scheduling, process synchronization, inter-process communication, deadlock avoidance, memory management, file allocation, and page replacement. Students will learn to implement core OS algorithms using C programming, enhancing their understanding of internal OS mechanisms.

Course Outcomes (COs):

At the end of the course, students will be able to:

- CO1: Implement CPU scheduling algorithms. *(Applying)*
- CO2: Understand and demonstrate solutions for critical section problems. *(Understanding, Applying)*
- CO3: Apply concepts of memory and file allocation techniques. *(Applying)*
- CO4: Implement and compare page replacement algorithms. *(Applying, Analyzing)*

Course Content:**Module I: Process Scheduling, Synchronization & IPC (15 Hours)**

- Write a C program to simulate the FCFS CPU Scheduling algorithm.
- Write a C program to simulate the SJF CPU Scheduling algorithm.
- Write a C program to simulate the Round Robin (RR) CPU Scheduling algorithm.
- Write a C program to simulate Banker's Algorithm for deadlock avoidance.
- Write a C program to implement the Producer–Consumer problem using semaphores.
- Write a C program to illustrate IPC mechanism using Pipes.
- Write a C program to illustrate IPC mechanism using FIFOs.
- Write a C program to simulate the Dining Philosophers problem.

Module II: Memory Management, Page Replacement & File Allocation (15 Hours)

- Write a C program to simulate Paging memory management technique.
- Write a C program to simulate Segmentation memory management technique.
- Write a C program to simulate the Best Fit memory allocation technique.
- Write a C program to simulate the First Fit memory allocation technique.
- Write a C program to implement FIFO page replacement technique.
- Write a C program to implement Sequential file allocation method.

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	L
CO2	H	M
CO3	L	H
CO4	L	H

CAOP116T: Object Oriented Programming using Java
(2 credits - 30 hours) (L-T-P: 3-0-0)

Course Objective:

The objective of this course is to introduce students to the foundational principles of object-oriented programming, Java syntax and semantics, modular program development, and the use of JDK for creating, debugging, and executing Java applications.

Course Outcomes:

At the end of the course, students will be able to:

- CO1: Describe the fundamental concepts of Object-Oriented Programming. (*Remembering, Understanding*)
- CO2: Apply basic Java syntax to write simple programs. (*Applying*)
- CO3: Use classes, objects, methods, and arrays to develop small modular Java programs. (*Applying*)
- CO4: Set up and use the JDK environment to compile and run Java programs. (*Applying*)

Prerequisite: Knowledge of Problem Solving Techniques using C programming language

Course Content:

Module I: OOP Basics and Java Fundamentals (15 Hours)

Fundamentals of Object-Oriented Programming: Basic Concepts of Object-Oriented Programming (OOP) - objects, classes, abstraction, encapsulation, inheritance, polymorphism (overview only); Benefits and applications of OOP.

Java Basics: Java Features, Difference between Java, C and C++, Java Environment, structure of a simple Java Program, compiling & executing using command line; Java tokens - identifiers, keywords, literals, operators, separators; Variables, constants, data types, typecasting

Control Structures: Decision Making with Control Statements, Looping statements, Jump in loops, Labelled loops.

Module II: Classes, Methods, Arrays & Basic Packages (15 Hours)

Classes and Objects: Defining classes, creating objects, member methods, constructors, method overloading (only)

Arrays and Strings: 1D and 2D arrays, simple String operations

Inheritance: Simple Single Inheritance

Packages: Basics of packages, Creating user defined packages

Text Books

- Balaguruswamy E. (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education
- Schildt, H. (2022). Java: The Complete Reference. 12th edition. McGraw-Hill Education.

Reference Books

1. Arunesh Goyal, The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.
2. Tanweer Alam, Core JAVA, Khanna Book Publishing Company Private Limited, 2015.
3. Y. Daniel Liang, Introduction to Java Programming, 7th Edition, Pearson, 2008.
4. S. Malhotra and S. Choudhary, Programming in Java, 2nd Edition, Oxford University Press, 2014.

Web Resources

<https://www.w3schools.com/java/>
<http://www.java2s.com/>
https://onlinecourses.nptel.ac.in/noc22_cs47/preview

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	M
CO2	H	H
CO3	M	H
CO4	H	L

CAOP117P: Object Oriented Programming using Java Lab
(1 credit - 30 hours) (L-T-P: 0-0-1)

Course Objective:

The objective of this lab course is to provide hands-on experience in writing, compiling, and executing Java programs while applying basic object-oriented concepts and handling simple program structures.

Course Outcomes:

At the end of the course, students will be able to:

- CO1: Apply basic Java syntax to develop simple programs. (Applying)
- CO2: Implement classes, objects, and basic OOP concepts in Java. (Applying)
- CO3: Use arrays, strings, and methods to write modular Java programs. (Applying)
- CO4: Handle simple exceptions during program execution. (Applying)

Module I: Basic Java & OOP Foundations (15 hours)

- Write a program to read two numbers and print their product.
- Write a program to print the square of a number using command-line arguments.
- Write a program to find the largest number among n numbers.
- Write a program to generate Fibonacci series and factorial (recursive & non-recursive).
- Write a program to check whether a given string is a palindrome.
- Write a program to sort a list of names in ascending order.
- Write a program to multiply two matrices.
- Write a program to read n values in an array and display them in reverse.

Module II: Classes, Inheritance & Exception Handling (15 hours)

- Program with classes AddSub (add, subtract) and derived class MulDiv (multiply, divide).
- Create a *Student* class (USN, Name, Branch, Phone, Percentage) and create n objects.
- Program with class Shape and subclass Circle overriding getArea() and getPerimeter().
- Program with Employee as base class and subclasses Manager and Programmer overriding calculateSalary().
- Program using an interface Bank with implementations SBI and PNB printing rates of interest.
- Program demonstrating divide-by-zero exception handling.
- Program that throws an UnderAge exception if age < 18 and handles it in main().

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	M
CO2	M	H
CO3	H	M
CO4	L	H

CAWT118T: Web Technologies
(2 credits - 30 hours) (L-T-P: 2-0-0)
Course Objective:

The objective of this course is to introduce students to fundamental web technologies, including HTML, CSS, JavaScript, and XML, enabling them to design and develop responsive, interactive, and modern web applications.

Course Outcomes:

At the end of the course, students will be able to:

- CO1: Understand the concepts and architecture of the WWW, markup languages, and CSS. (*Understanding*)
- CO2: Apply event handling and data validation techniques using JavaScript. (*Applying*)
- CO3: Understand client-side dynamic scripting and basic full-stack concepts. (*Understanding*)
- CO4: Develop simple, responsive, and interactive web applications. (*Applying / Creating*)

Course Content:**Module I: Basics of HTML and CSS (15 Hours)**

Basics of HTML: Introduction to Web browsers, WWW, protocols and HTML, history of HTML, basic Structures of HTML, Header Tags, body tags, Paragraph Tags; Tags for TABLE, FORM, TEXTAREA, SELECT, IMG, IFRAME FIELDSET, ANCHOR; Lists in HTML, Introduction to DIV tag, NAVBAR Design, Introduction to XHTML

Introduction to CSS: Types of CSS, Selectors, and Responsiveness of a web page; Background, text and font properties; table and list properties; Introduction to Bootstrap

Module II: JavaScript Basics and XML (15 Hours)

Introduction to JavaScript: Functions and Events, Document Object model traversing using JavaScript. Output System in JavaScript i.e. Alert, throughput, Input box, Console. Variables and Arrays in JavaScript. Date and String handling in JavaScript.

Manipulating CSS through JavaScript: Form Validation like Required validator, length validator, Pattern validator. Advanced JavaScript, Combining HTML, CSS and JavaScript events and buttons, controlling your browser

Introduction to XML: Uses, Key concepts, DTD & schemas, XSL, XSLT, and XSL Elements and transforming with XSLT.

Text Books

1. Laura Lemay, Mastering HTML, CSS & Java Script Web Publishing, BPB Publications, 2016
2. Thomas A. Powell, The Complete Reference HTML & CSS, Fifth Edition, 2017

Reference Books

1. Silvio Moreto, Bootstrap 4 By Example, ebook, 2016.
2. Tanweer Alam, Web Technologies, Khanna Book Publishing, 2011.

Web Resources

www.javatpoint.com
www.w3schools.com

<https://www.geeksforgeeks.org/web-technology/>

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	M
CO2	L	H
CO3	M	H
CO4	M	H

CAWT119P: Web Technologies Lab (1 credit - 30 hours) (L-T-P: 0-0-1)

Course Objective:

The objective of this course is to provide hands-on experience in creating static and interactive web pages using HTML, CSS, JavaScript, XML, and related web technologies. Students will learn to design responsive layouts, validate input data, work with client-side scripting, and utilize structured data formats.

Course Outcomes (COs)

At the end of the course, students will be able to:

CO1: Design web pages using HTML and CSS. *(Applying)*

CO2: Implement interactivity and input validation using JavaScript. *(Applying)*

CO3: Use XML, DTD, XSD, and XSLT for structured data handling. *(Understanding / Applying)*

CO4: Develop small web applications integrating HTML, CSS, JavaScript, and XML/JSON. *(Applying / Creating)*

LIST OF PROGRAMS:

Module I: HTML & CSS BASICS (15 Hours)

Create your class timetable using the HTML table tag.

Design a descriptive webpage for your college (courses, departments, library, etc.) using lists, links, and anchor tags.

Create a webpage layout using frames with rows and columns (header, left menu, right content, status bar).

Create your personal Resume using HTML text formatting, links, colours, and lists.

Design a Supermarket homepage using internal CSS.

Apply external CSS to format your timetable.

Use all CSS types (inline, internal, external) to format the college webpage designed earlier.

Create a mobile-friendly webpage for your college (responsive basic layout).

Module II: JavaScript and XML (15 Hours)

Create an HTML/JavaScript Login Page with basic validations.

Develop a Simple Calculator using JavaScript (add, subtract, multiply, divide).

Apply Regular Expressions for login form validation.

Retrieve data from a text file and display it using AJAX.

Create an XML file to store student information (Register No, Name, Mobile, DOB, Email).

Create a DTD for the XML file.

Create an XML Schema (XSD) for the XML file.

Create an XSL file to convert XML to XHTML.

Write a JavaScript program using switch case.

Write a JavaScript program using built-in objects (Date, Math, String, Array).

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	L
CO2	L	H
CO3	L	H
CO4	M	H

CBUI104T: Understanding India
(1 credit - 15 hours) (L-T-P: 1-0-0)
Course Outcomes:

At the end of this course, students will be able to:

CO1: Explain the social, cultural and religious diversity of India and its impact on Indian psyche.

CO2: At the end of this course, students will be able to evaluate the political and economic system of India.

Module 1: India and its Diversity (8 hours)

Overview of India's geography, diversity, demographics and development indicators

A brief survey of India's history, highlighting key events, personalities and movements that shaped its identity and destiny

An exploration of India's rich and varied cultural heritage, including its languages, religions, arts, literature and philosophy

An overview of India's social structure, institutions, norms and values, with a focus on issues such as caste, gender, class and ethnicity

Module 2: Indian Political System (7 hours)

A study of India's political system, institutions, parties and ideologies

India's role in regional and global affairs

A review of India's economic performance; the challenges and opportunities for growth;

An overview of sectors such as agriculture, industry, services, and trade.

A discussion of India's environmental problems & the solutions for sustainable development

A discussion on India's journey towards a developed nation.

Suggested Readings

1. Thapar, R. (2015). The Penguin History of Early India: From the Origins to AD 1300. India: Penguin Books Limited.
2. Kosambi, D. D. (2022). The Culture and Civilization of Ancient India in Historical Outline. United Kingdom: Taylor & Francis.
3. Zimmer, H. R. (2020). Philosophies of India. United States: Princeton University Press.
4. Mohanty, M. (2004). Class, Caste, Gender. India: SAGE Publications.
5. Mitra, S. K. (2017). Politics in India: Structure, Process and Policy. United Kingdom: Taylor & Francis.
6. Kothari, R. (1970). Politics in India. India: Orient Longman.
7. Balasubramanyam, V. N. (2019). The Economy of India. United Kingdom: Taylor & Francis.
8. Fisher, M. H. (2018). An Environmental History of India: From Earliest Times to the Twenty-First Century. United Kingdom: Cambridge University Press.

Suggested Software/Learning Websites:

<https://www.constitution.org/cons/india/const.html>
<http://www.legislative.gov.in/constitution-of-india>
<https://www.sci.gov.in/constitution>

<https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

AECH101T: COMMUNICATIVE HINDI II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Outcomes

On completion of this course successfully, students will be able to:

CO1: Conceptualize vocabulary used in professional sectors (remembering)

CO2: Apply advance level grammatical concepts in communicative usage (applying)

CO3: Understand the cultural and regional influences on communicative Hindi (understanding)

CO4: Effectively use Hindi in public, professional and social platforms

Module I: Advanced vocabulary building

Review of concepts: Review of basic level Hindi vocabulary, pronunciation and sentence formation

Review of intermediate level vocabulary, conversation and grammar

Vocabulary building for advanced topics: politics, economics, technology, etc.

Understanding and usage of synonyms, antonyms, and homonyms words

सामान्य हिंदी ज्ञान एवं अवधारणाओं की समीक्षा: शब्द कोष, उच्चारण, वाक्य संरचना इत्यादि

माध्यमिक स्तर के वार्तालाप हेतु शब्दावली, वार्तालाप व्याकरण एवं इत्यादि की समीक्षा

उच्च स्तरीय वार्तालाप हेतु शब्दकोष निर्माण जैसे राजनीति, अर्थशास्त्र, विज्ञान व तकनीकी आदि क्षेत्रों में उपयोगी शब्दावली

समानार्थी, विरुद्धार्थी एवं सामान्य शब्दों का ज्ञान एवं उपयोग

Module II: Advanced grammar concepts

Advanced sentence formation: passive voice, direct and indirect speech, etc.

Use of conjunctions, interjections, and transitional words

Figures of speech (Alankar) and their effective usage in communicative Hindi

उच्च स्तरीय वाक्य संरचना: कर्तृवाच्य और कर्मवाच्य, प्रत्यक्ष कथन और अप्रत्यक्ष कथन इत्यादि

संज्ञोक्त, विस्मयादिबोधक, सकर्मक-अकर्मक शब्दों का उपयोग

अलंकारों का ज्ञान एवं प्रभावशाली वार्तालाप में उनका प्रयोग

Module III: Conversational practice and Writing practice

Role-play exercises for advanced situations: negotiating, debating, expressing opinions, etc. Group discussion and conversation practice

Writing practice for advanced topics: newspaper articles, book/magazine articles, reports, etc.; rhetorical usage in Hindi writing

अभिनय-नाटक / वाद-विवाद / वार्तालाप गतिविधि / नाट्य-रचना के माध्यम से उच्च स्तरीय परिस्थितियों के वार्तालाप का ज्ञान: वाद-विवाद, सामूहिक परिचर्चा, व्यक्तित्व अभिव्यक्ति एवं वार्तालाप अभ्यास

लेखन अभ्यास: आलेख, पत्र, समाचार, पुस्तकीय आलेख, प्रतिवेदन इत्यादि; उच्च स्तरीय लेखन कार्य में आलंकारिक / शब्दाडंबरपूर्ण भाषा का उपयोग

Module IV: Cultural and social influences on communication

Analytical understanding of Cultural and social aspects of communication in Hindi-speaking regions

Major communication styles: across generations, cultures and regions

Major Hindi Dialects of different regions of India

विभिन्न हिंदी भाषी क्षेत्र एवं वार्तालाप सम्बद्ध सामाजिक एवं सांस्कृतिक दृष्टिकोण एवं विवेचन

विभिन्न वार्तालाप पद्धतियाँ: सांस्कृतिक, क्षेत्रीय एवं पीढ़ी दर पीढ़ी परिवर्तन के सन्दर्भ में

विभिन्न भारतीय क्षेत्रों की प्रमुख हिंदी उपभाषाएँ एवं बोलियाँ

Module V: Professional communication and specialized communication

Communication in professional contexts: Vocabulary building for professional use, Writing emails, letters and memos in Hindi

Communication used in core business sectors for specific purposes: tourism, healthcare, education, etc.

Vocabulary building and sentence formation for specialized professional communication

Role-play exercises for specialized communication scenarios viz. institutional, administrative, professional, legal, corporate and business communications etc.

व्यावसायिक वार्तालाप सन्दर्भ: व्यावसायिक वार्तालाप हेतु शब्दकोश का ज्ञान, ई-मेल/पत्र, व्यावसायिक पत्र, ज्ञापन आदि

प्रमुख व्यावसायिक क्षेत्रों जैसे भ्रमण, स्वास्थ्य, शिक्षा इत्यादि क्षेत्रों में उपयोग में आने वाली शब्दावली का ज्ञान

व्यावसायिक वार्तालाप/सूचनाओं के आदान-प्रदान में उपयोगी शब्दावली, वाक्य संरचना एवं शब्दकोश का ज्ञान

अभिनय-नाटक/वार्तालाप गतिविधि/ नाटक रचना के माध्यम से विभिन्न/विशेषीकृत परिस्थितियों के वार्तालाप का ज्ञान — जैसे व्यावसायिक, प्रबंधकीय, संस्थागत, व्यावहारिक, संगठित/नियमित व्यापार सम्बन्धी एवं कानूनी वार्तालाप

Module VI: Use of Hindi in digital communication

Opportunities and Usage of Hindi language in social media and digital communication

Writing online content, public contents and professional contents in Hindi through in class activities.

सामाजिक संचार माध्यम/सोशल मीडिया, अंकीय माध्यम/डिजिटल मीडिया में हिंदी भाषा का प्रयोग एवं संभावनाएं

सीधा संचार संपर्क/ आन लाइन के सन्दर्भ में प्रारूप लेखन/कंटेंट राइटिंग , सार्वजनिक लेखन, व्यावसायिक लेखन इत्यादि का ज्ञान एवं अभ्यास

Suggested Readings

Soorya prasad Dixit (2012) ,Sanchar Bhasha –Hindi, Lokbharti Prakashan

Hindi-B- Rachna Sagar(2019), Rachna Sagar publication

Omkar N.Koul (2008),Modern Hindi Grammar, Donwoody Press

Richard Delacy, Sudha Joshi (2009), Elementary Hindi: Learn to Communicate in Everyday Situations -Tuttle Publishing (a work book -e-book with MP4 video)

Sunita Narain Mathur, Madhumita Mehrotra (2017) ,Hindi for Beginners: A Guide to Conversational Hindi (Audio Disc Included), Tuttle Publishing

Surendra Kumar Gambhir (2003), Communicative Hindi for Beginners: Cultural Appropriateness, Vocabulary, Grammatical Accuracy Google book

DRISHTI IAS BLOG (2023), Hindi Language: Its Journey So Far, <https://www.drishtiias.com/blog/hindi-language-its-journey-so-far>

Britannica blog, Hindi language- history, variety, grammar and vocabulary, <https://www.britannica.com/topic/Hindilanguage>

Mapping of Course Outcomes with Modules:

Course Out-comes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	L	M	H			
CO 2	L	M	H			
CO 3				H	L	
CO 4			M		H	H

AECA101T/AECA201T: COMMUNICATIVE ASSAMESE II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objectives

The objective of this course is to provide Advance Writing Skill in Assamese Language, knowledge of Assamese grammar, Conversational practice, Cultural and Social Communication, Advance Grammar Concepts and finally to provide professional communication in Assamese.

Course Outcomes

CO 1: Understand the Advanced vocabulary buildings.

CO 2: Explain the Advance sentence formation in Assamese language.

CO 3: Evaluate the importance of Assamese culture professional communication.

Module I: Advanced vocabulary building (6 Hours)

- a. Review of basic Assamese pronunciation and sentence formation
- b. Review of intermediate level vocabulary and grammar
- c. Vocabulary building for advanced topics: politics, economics, technology. etc.
- d. Use of synonyms, antonyms, and homonyms

Module II: Advanced grammar concepts (8 hours)

- a. Advanced sentence formation: passive voice, direct and indirect speech, etc.
- b. Use of conjunctions, interjections, and transitional words

Module III: Conversational practice and Writing practice (8 Hours)

- a. Role-play exercises for advanced situations: negotiating, debating, expressing opinions, etc.
- b. Group discussion and conversation practice
- c. Writing practice for advanced topics: newspaper articles, reports, etc.
- d. Use of rhetorical devices in writing

Module IV: Cultural and social communication (8 hours)

- a. Cultural and social aspects of communication in Assam
- b. Differences in communication styles across generations and regions

- c. Professional communication and specialized communication
- d. Communication in professional contexts
- e. Vocabulary building for professional use
- f. Writing emails and memos in Assamese
- g. Communication for specific purposes: tourism, healthcare, education, etc.
- h. Vocabulary building and sentence formation for specialized communication Role-play exercises for specialized communication scenarios

Suggested Readings

- ১) নতুন আৰ্জ-অসমীয়া বাক্যৰ আৰ্হি বচন। ৫ ম, ৬ ঠ আৰু ৭ ম শ্ৰেণী, - দীনেশ্বৰ নাথ, ক্ৰিয়েটিভ পাব্লিকেশন
- ২) পাঠশালাৰ- বাক্যৰ আৰ্হি বচন। তৃতীয় আৰু চতুৰ্থ শ্ৰেণীৰ বাবে অসম বুক- দিপেন

AEFR101T: FRENCH BEGINNER LEVEL II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course objective

French Beginner level II is a course of 30 learning hours designed to help learners having completed French Beginner Level 1 to acquire more advanced language skills in French language. These skills prepare students to effectively communicate in French on topics related to various daily situations. Students enhance listening and speaking abilities in real-life situations, learn to read and write practical texts in French, and gain deeper understanding of francophone cultures. By the end of the session, learners are expected to be able to engage in a variety of simple daily conversations, read and write short paragraphs in French.

Course Outcomes

On completion of this course, students will be able to:

- CO1: Recall, name and identify the vocabulary and phrases related to who, when, where and other key question words, explain and interpret their meanings and select appropriate response. (Remembering, analyzing, evaluating)
- CO2: Use the vocabulary and sentence structures learned to converse and discuss on a range of topics related to everyday situations. (Understanding, applying)
- CO3: Demonstrate a deeper understanding of francophone countries' cultures, describe and summarize basic cultural values. (Applying, understanding, evaluating)
- CO4: Analyse cultural differences and choose appropriate ways to interact with speakers from Francophone countries. (Analysing, evaluating)
- CO5: Design and compose meaningful situational dialogues and perform them; invent skits by using the language skills learned. (Creating)

Module I: Pronunciation drills (8 hours)

Liaison and enchainment; Sound discrimination; Distinction of grammatical gender; Elision

Module II: Daily conversation and grammatical structures (16 hours)

- a) Shopping
- Expressing wishes and needs
- Asking and giving direction
- Telling time
- Describing intention in near-future tense
- Making an appointment

Module III: Introduction to Francophone cultures (6 hours)

Tourism, Arts and literature, Lifestyles

Suggested Readings1. *Amical A1*, CLE International, Paris, 2011**Mapping of COs to Syllabus**

Course Outcome	Module 1	Module 2	Module 3
CO1	M	H	
CO2	M	H	
CO3			H
CO4			H
CO5	M	H	

AEGR101T/AEGR201T: INTRODUCTION TO GERMAN LANGUAGE II**(2 credits – 30 hours) (L-T-P: 2-0-0)****Course Objectives**

The course aims at covering the basics of German language. It also covers a few basic grammar topics and an application of grammar in day-to-day life that is in reading, writing, listening, and speaking. On the completion of the first semester, one can understand and use familiar, everyday expressions and very simple sentences, can introduce him/her and others as well as ask others about themselves – e.g., where they live, who they know and what they own – and can respond to questions of this nature.

Course Outcomes

Students will be able to acquire a working knowledge in basic German

Course Contents

	Topic	Grammar
1	Daily schedule and arranging appointments	Dative sentences, verbs, prepositions
2	In the office, different jobs, and leisure activity	Sentence connectives: conjunctions (und, oder, aber)
3	On the computer and emails	The group of nouns
4	Living and the home furnishings	Pronouns
5	Clothes and the shopping	Adjectives
6	Health and body parts	Modal Verbs
7	Holiday, travel, and city tour	Past Tense

Suggested Reading

Netzwerk Deutsch als Fremdsprache A1, Textbook + Workbook by Stephanie Dengler

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	CAIN107I	Internship	4

4	Internship	CAIN213I	Internship	4
5	Internship	CAIN314I	Internship	2

CAIN107I/ CAIN108I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 hours)

CAIN314I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)**(2 Credits-60 Hours)****Objectives**

The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in classroom courses to real-life industry work situations. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills.

COURSE/ LEARNING OUTCOMES

At the end of the internship, students will be able to:

CO 1: Relate theory and practical with real life examples. (Remembering)

CO 2: Explain the technical processes involved in the industry. (Understanding)

CO 3: Identify the importance of learning the computer technology. (Applying)

CO 4: Analyse application of computer technology into the practical field. (Analysing)

CO 5: Discuss the actual technological advancements in the industry. (Creating)

GUIDELINES:

The students should follow the following instruction and guidelines during the course of the internship:

The internship should be for a minimum duration of 80 hours which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively. The students have to undergo the internship during the Summer/Winter Break.

The students can undergo an internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to computer technology.

After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department.

There would be a Seminar Presentation (PPT) and Viva-Voce Examination based on which the students would be evaluated for the internship. The Internship report would also be a part of the evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise the following:

Recommendation Letter from the Department.

Completion Certificate from the Organisation where the student has worked as an intern.

Internship Diary as per the prescribed format.

Organisation details (Address, E-mail, Contact Number)

The Contents of the Report must include:

a. Introduction

b. Objectives of the Internship

c. About the Organisation (Sector, Activities, Operations)

d. Description of the work

Learning Outcomes

The Assessment for the internship must have the following components:

Internship Report: 15 Marks

Internship Diary: 15 Marks
Seminar Content and Presentation: 30 Marks
Work Undertaken/Project Output: 15 Marks
Learning Outcome and Reflection: 15 Mark
Viva-Voce Examination: 10 Mark

SEMESTER – III

COURSE CODE: PROBABILITY AND STATISTICS

(3 credits – 45 hours) (L-T-P: 3-0-0)

COURSE OBJECTIVE:

The objective of this course is to develop a strong foundation in probability theory and statistical methods so that students can understand, model, and analyze uncertainty in real-world systems. The course aims to help learners acquire the ability to organize and describe data effectively, compute and interpret various statistical measures, understand randomness through classical and modern probability concepts, and apply probabilistic and inferential techniques to practical decision-making scenarios across science, engineering, and business domains.

COURSE / LEARNING OUTCOMES:

After learning this course, the students will be able to:

CO1: Handle randomness scientifically using theory of probability. (Understanding, Applying)

CO2: Represent the statistical data in a systematic way and analyze it to draw meaningful information from them. (Analyzing) CO3: Apply probabilistic and statistical techniques to deal with the real-life problems. (Applying, Evaluating)

COURSE CONTENT:

Module I: Descriptive Statistics (12 Hours)

Basic concepts of Statistics: Kinds of Statistics, qualitative and quantitative data, classification of data, construction of frequency distribution, diagrammatic representation of data.

Descriptive Statistics: Measures of Central Tendency: mean, median and mode; Measures of Dispersion: range, standard deviation, variance; Measures of position: interquartile range and percentile rank.

Module II: Correlation and Regression (10 Hours)

Correlation: Definition, scatter diagram, types of correlation, measures—Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient.

Regression: Linear regression-fitting by least square method and interpretation.

Module III: Probability and Probability Distributions (13 Hours)

Concepts of probability: Experiment and sample space, events and operations with events, probability of an event, basic probability rules, applications of probability rules, conditional probability, Bayes theorem

Random Variables: Discrete and continuous random variable, probability distribution of a random variable, probability mass function, probability density function, expectation and variance of a random variable.

Standard Probability Distributions: Binomial probability distribution, Poisson probability distribution, Normal probability distribution.

Module IV: Sampling Distribution and Inference (10 Hours)

Sampling Distribution: Concept of Population and Sample, parameter and statistic, sampling distribution

of sample mean and sample proportion.

Statistical Inference: Estimation and Hypothesis Testing (only concept).

Hypothesis Testing for a Single Population: Concept of a hypothesis testing, tests involving a population mean and population proportion (z test and t test).

Chi square test for independence of attributes and goodness of fit.

Text Books

1. Manish Sharma, Amit Gupta, The Practice of Business Statistics, Khanna Book Publishing Company, 2010 (AICTE Recommended Textbook)
2. Das N. G., Statistical Methods, Combined Edition, Tata McGraw Hill, 2010.
3. Ross Sheldon M., Introduction to Probability and Statistics for Engineers and Scientists, 6th Edition, Elsevier, 2021.
4. Miller Irwin and Miller Marylees, Mathematical Statistics with Applications, Seventh Edition, Pearson Education, 2005

Reference Books

1. Pal Nabendu and Sarkar Sahadeb, Statistics: Concepts and Applications, Second Edition, PHI, 2013
2. Montgomery Douglas and Runger George C., Applied Statistics and Probability for Engineers, Wiley, 2016.
3. Reena Garg, Engineering Mathematics, Khanna Publishing House, 2024.

Web Resources

<https://nptel.ac.in/courses/111106112>

<https://nptel.ac.in/courses/111105041>

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III	Module IV
CO1			H	M
CO2	H	H		
CO3	M	M	H	H

COURSE CODE: DATABASE MANAGEMENT SYSTEM
(3 credits – 45 hours) (L-T-P: 3-0-0)

COURSE OBJECTIVE:

The objective of this course is to provide a comprehensive foundation in database concepts, data modelling, SQL programming, and modern database technologies. Students will learn to design robust relational databases, formulate efficient queries, understand the internal mechanisms of database management systems, and explore advanced data storage and processing paradigms, including NoSQL and Big Data systems. The course aims to equip learners with both conceptual knowledge and practical skills required for implementing and managing data-driven applications in real-world environments.

COURSE / LEARNING OUTCOMES:

After learning this course, the students will be able to:

- CO1: Explain the fundamental concepts, architecture, and data models of DBMS. (Understanding)
- CO2: Design relational databases using ER modelling and apply normalization techniques for efficient schema design. (Applying, Analyzing)
- CO3: Construct SQL queries including advanced SQL features for data manipulation, retrieval, and control. (Applying)
- CO4: Demonstrate understanding of transaction management, concurrency control, and indexing mechanisms in DBMS (Understanding, Analyzing)
- CO5: Compare relational databases with NoSQL systems and evaluate modern data management technologies (Evaluating)

COURSE CONTENT:

Module I: Database Concepts and ER Modelling (12 Hours)

Introduction to Databases: Definition of Data, Database, and DBMS, Overview of Database Applications, Advantages and Disadvantages of DBMS, Roles of Database Users and Administrators

Data Models: Introduction to Data Models, Types of Data Models (Hierarchical, Network, Relational, Object-oriented), Importance of Data Models in DBMS

Database Design: Keys - Primary Key, Candidate Key, Super Key, Foreign Key, Composite Key, Alternate Key, Unique Key, Surrogate Key, Constraints in a table: Primary Key, Foreign Key, NOT NULL, UNIQUE, CHECK

Entity-Relationship (ER) Model: Entities and Entity Sets, Attributes and Relationships, ER Diagrams, Key Constraints and Weak Entity Sets, Extended ER Features, Introduction to the Relational Model and Relational Schema

Module II: Relational Algebra, SQL, and Normalization (13 Hours)

Relational Algebra and Calculus: Introduction to Relational Algebra, Operations: Selection, Projection, Set Operations, Join Operations, Division, Tuple and Domain Relational Calculus

Structured Query Language (SQL): SQL Basics: DDL and DML, Aggregate Functions (Min(), Max(), Sum(), Avg(), Count()), Logical operators (AND, OR, NOT), Predicates (Like, Between, Alias, Distinct), Clauses (Group By, Having, Order by, top/limit), Inner Join, Natural Join, Full Outer Join, Left Outer Join, Right outer Join, Equi Join

Advanced SQL: Analytical queries, Hierarchical queries, Views, Cursors, Stored Procedures and Functions, Packages, Triggers **Normalization and Database Design:** Functional Dependencies: Armstrong's Axioms, Definition, Properties (Reflexivity, Augmentation, Transitivity), Types (Trivial, Non-Trivial, Partial and Full Functional Dependency), Normal Forms (1NF, 2NF, 3NF, BCNF), Denormalization

Module III: Transaction Management, Recovery, and Indexing (10 Hours)

Transaction Management: ACID Properties, Transactions and Schedules, Concurrent Execution of Transactions, Lock-Based Concurrency Control, Performance of Locking, Transaction Support in SQL, Introduction to Crash Recovery, 2PL, Serializability, and Recoverability, Introduction to Lock Management, Dealing with Deadlock

Database Storage and Indexing: Data on External Storage, File Organizations and Indexing, Index Data Structures, Comparison of File Organizations, Indexes and Performance Tuning, Guidelines for Index Selection

Module IV: NoSQL, Big Data, and Security (10 Hours)

NoSQL Databases and Big Data: Introduction to NoSQL, Data Models: Document, Key value, Column family, Graph. Uses and Features of NO/SQL document databases. CAP theorem, BASE vs ACID, CRUD operations

Database Security and Advanced Topics: Introduction to Database Security, Access Control, Discretionary Access Control, Introduction to Data Warehousing, OLAP, Data Mining

Text Books

1. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", third edition, McGraw – Hill, 2018
2. Benjamin Rosenzweig, Elena Rakhimov, "Oracle PL/SQL by Example", fifth edition, Prentice Hall, 2015
3. Brad Dayley, "NoSQL with MongoDB in 24 Hours", 1st edition, Sams Publishing, 2024

Reference Books

1. Korth, Silbertz, Sudarshan, "Database System Concepts", Seventh Edition, McGraw – Hill (2019)
2. R.P. Mahapatra, Govind Verma, "Database Management Systems", Khanna Publishing House, 2025.

Web Resources

<https://oracle-base.com/articles>
https://forums.oracle.com/ords/apexds/domain/dev-community/category/sql_and_pl_sql <https://asktom.oracle.com/ords/f?p=100:1:0>

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III	Module IV
CO1	H			
CO2	H	H		
CO3		H	M	
CO4			H	M
CO5				H

COURSE CODE: DATABASE MANAGEMENT SYSTEM LAB
(2 credits – 60 hours) (L-T-P: 0-0-2)

COURSE OBJECTIVE:

The objective of this laboratory course is to equip students with hands-on skills in SQL and PL/SQL programming. Students will learn to implement database schemas, perform data manipulation and retrieval, and develop procedural database components such as functions, procedures, cursors, and triggers. The course enables students to translate real-world problems into database solutions using structured and procedural extensions of SQL.

COURSE / LEARNING OUTCOMES:

After learning this course, the students will be able to:

CO1: Apply SQL commands to create, manipulate, and retrieve data from relational databases. (Applying)

CO2: Develop PL/SQL blocks including procedures, functions, cursors, and triggers for database programming. (Applying, Creating)

CO3: Analyse SQL and PL/SQL programs to optimize and validate database operations. (Analyzing)

COURSE CONTENT:

Module I – SQL Programming (30 Hours)

Introduction to DBMS interface and creation of databases DDL Commands: CREATE, ALTER, DROP, TRUNCATE

DML Commands: INSERT, UPDATE, DELETE

Basic SELECT queries with WHERE, GROUP BY, HAVING and ORDER BY clauses Aggregate functions: MIN(), MAX(), AVG(), SUM(), COUNT()

SQL Operators: LIKE, BETWEEN, IN, NOT, GROUP BY, HAVING, ORDER BY clauses

Join operations: Inner Join, Natural Join, Left Outer Join, Right Outer Join, Full Outer Join, Equi Join

Subqueries (single-row, multi-row, correlated) Views: Creation, modification, and deletion

Module II – PL/SQL Programming (30 Hours)

Introduction to PL/SQL structure: DECLARE, BEGIN, EXCEPTION, END Variables, constants, and control structures (IF, CASE, LOOP, WHILE, FOR) Cursors (implicit and explicit), %TYPE, %NOTFOUND, %FOUND, %ROWCOUNT Stored Procedures and Functions

Exception handling in PL/SQL.

Triggers: BEFORE and AFTER triggers for INSERT, UPDATE, DELETE. Packages (optional, based on tool availability).

Simple analytical or business-rule-based PL/SQL programs.

Mapping of COs to Modules

Course Outcome	Module I	Module II
CO1	H	
CO2		H
CO3	M	M

COURSE CODE: SOFTWARE ENGINEERING
(3 credits – 45 hours) (L-T-P: 3-0-0)

COURSE OBJECTIVE:

The objective of this course is to provide students with a strong foundation in the principles, methodologies, and practices of modern software engineering. It aims to develop an understanding of the complete software development lifecycle—from requirements analysis to design, implementation, testing, deployment, and maintenance. The course emphasizes project management, quality assurance, agile and traditional development approaches, and equips learners with the ability to plan, design, and deliver reliable, scalable, and maintainable software systems.

COURSE / LEARNING OUTCOMES:

After learning this course, the students will be able to:

- CO1:** Demonstrate an understanding of the software development lifecycle, engineering principles, and evolving software processes. (*Understanding*)
- CO2:** Apply project management strategies including planning, estimation, scheduling, and risk management for effective software project execution. (*Applying*)
- CO3:** Develop structured software designs, apply modelling techniques, and perform effective testing to ensure software quality and reliability. (*Applying / Analyzing*)
- CO4:** Evaluate software quality assurance practices, release processes, and maintenance strategies in real-world software projects. (*Evaluating*)

Prerequisites: Basic understand of Software, Applications, Programming fundamentals.

COURSE CONTENT:

Module I: Software Processes & Agile Development (10 Hours)

The evolving role of software, changing nature of software, layered technology, a process framework, Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

Agile software development: Agility Principles, Agile methods, Plan-driven and agile development, Extreme programming, Scrum, A Tool Set for the Agile Process.

Module II: Requirements Engineering, Risk & Project Planning (12 Hours)

Software Requirements Engineering: Functional and non-functional requirements, the software requirements document, Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM, RMMM plan.

Project planning- Software pricing, Plan-driven development, Project scheduling, Agile planning, Estimation techniques.

Module III: Design, Testing & Metrics (13 Hours)

Design: Design process and design quality, design concepts, the design model, software architecture, data design, architectural design, Basic structural modeling, class diagrams, sequence diagrams, collaboration diagrams, use case diagrams, component diagrams.

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.

Product metrics: Software quality, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance.

Module IV: Quality, Release & Product Sustainance (10 Hours)

Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability.

Release Management: Release planning, development and build plans, release strategies, risk management, and post- deployment monitoring.

Product sustainance: Maintenance, updates, End of life, migration strategies.

Text Books

1. Software Engineering, N.S. Gill, Khanna Publishing House, 2023 (AICTE Recommended Textbook)
2. Software Engineering, Ian Somerville, 9th edition, Pearson education.
3. Software Engineering: A Practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

Reference Books

1. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007
2. Software Engineering: Principles and Practice Hans van Vliet

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2		H	M	
CO3			H	M
CO4		M		

COURSE CODE: PYTHON PROGRAMMING
(1 credit – 15 hours) (L-T-P: 1-0-0)

COURSE OBJECTIVE:

This course aims to provide learners with a foundational understanding of Python programming by introducing essential programming constructs, data structures, file handling, and visualization techniques. The objective is to enable students to develop modular programs, apply appropriate Python libraries for solving computational problems, and gain familiarity with basic data processing and visualization tasks.

COURSE / LEARNING OUTCOMES:

After learning this course, the students will be able to:
CO1: Develop modular Python programs. (Applying)

CO2: Apply suitable Python programming constructs and built-in data structures using Python libraries to solve a problem. (Applying, Analyzing)

CO3: Understand basic data visualization and file handling in Python. (Understanding, Applying)

Prerequisites:

Understanding of problem-solving techniques using a programming language and basic data structures.

COURSE CONTENT:

Module I: Basics of Python (6 Hours)

Introduction: History and Application areas of Python; Structure of Python Program; Identifiers and Keywords; Operators and Precedence; Basic Data Types and type conversion; Statements and expressions; Input/Output statements.

Strings: Creating and Storing Strings, Built-in functions for strings; string operators, String slicing and joining; Formatting Strings.

Control Flow Statements: Conditional Flow statements; Loop Control Statements; Nested control Flow; continue and break statements, continue, Pass and exit.

Module II: Functions and Data Structures (5 Hours)

Functions: Built-In Functions, Function Definition and call; Scope and Lifetime of Variables, Default Parameters, Command Line Arguments; Lambda Functions; Assert statement; Importing User defined module;

Mutable and Immutable objects: Lists, Tuples and Dictionaries; Commonly used Functions on Lists, Tuples and Dictionaries. Passing Lists, tuples and Dictionaries as arguments to functions. Using Math and Numpy module for list of integers and arrays.

Module III: File Handling, Exception Handling and Visualization (4 Hours)

Files: Types of Files; Creating, Reading and writing on Text and Binary Files; The Pickle Module, Reading and Writing CSV Files. Reading and writing of csv and JSON files.

Exception Handling: Try-except-else-finally block, raise statement, hierarchy of exceptions, adding exceptions.

Data visualization: Plotting various 2D and 3D graphics; Histogram; Pi charts; Sine and cosine curves.

Text Books:

1. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press, ISBN:9789367257654
2. Eric Matthes, Python Crash Course: A Hands-On, Project-Based Introduction to Programming, No Starch Press, ISBN:978- 1593276034
3. S. Sridhar, J. Indumathi & V. M. Hariharan, Python Programming, Pearson Education, ISBN: 978-9356069336

Reference Books:

1. Think Python, by Allen Downey, 2nd edition, 2015, O'Reilly, https://drive.google.com/file/d/1p9Pul6d5UvnQrO9-Q-LE2_p4YvMk5clg/view
2. An introduction to Python for absolute beginners, by Bob Dowling, Cambridge University
3. Introduction to Computation and Programming using Python, by John Guttag, 2nd edition, 2016, PHI India.

Web Resources:

<https://www.learnpython.org/>
<https://www.w3schools.com/python/default.asp>

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III
CO1	H	H	
CO2	M	H	M
CO3			H

COURSE CODE: PYTHON PROGRAMMING LAB
(2 credit – 60 hours) (L-T-P: 0-0-4)

COURSE OBJECTIVE:

The objective of the course is to provide learners with a solid foundation in the practical knowledge of Python programming language. The course aims to equip students with the knowledge and skills necessary to write simple Python programs and understand the core concepts and principles of Python programming.

COURSE / LEARNING OUTCOMES

At the end of the lab experiments, students will be able to learn-

- CO1: Apply basic Python programming constructs, data types, control structures, and functions to develop simple computational solutions.
- CO2: Analyse program logic involving file handling, modular programming, and object-oriented principles to implement structured and reusable code.
- CO3: Evaluate the efficiency, readability, and error handling of Python programs to ensure correctness and robustness in implementation.

Lists of experiments:

Module I: Introduction to Python and Data Handling (18 Hours)

Programs using variables, input/output, and type conversion, Demonstration of arithmetic, relational, logical, identity, and membership operators, Implementation and operations on Strings, Lists, Tuples, Ranges, Sets, and Dictionaries.

Module II: Control Structures and Functions (18 Hours)

Programs using if, if-else, if-elif-else statements, Looping constructs using while, for, break, continue, pass, and return, Programs to demonstrate the use of functions — with and without parameters, return values, default arguments, Programs using lambda functions and Python built-in functions, Programs illustrating the use of Python modules and packages.

Module III: Files and Exception Handling (12 Hours)

Programs for reading and writing text files and appending data, Programs for writing and reading binary files and using the pickle module, Programs demonstrating exception handling using try, except, finally blocks.

Module IV: Object-Oriented Programming in Python (12 Hours)

Programs to define classes and objects, use of the `__init__()` constructor and self parameter, Demonstration of namespaces, instance variables, and methods, Programs illustrating inheritance, encapsulation, and polymorphism.

Suggested Readings

1. Reema Theresa, "Python Programming using Problem Solving Approach", Oxford University press, ISBN-13: 978- 0199480173
2. Charles R. Severance, "Python for Everybody: Exploring Data Using Python", 1st Edition, Shroff Publishers, 2017. ISBN: 978- 9352136278.
3. Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014.
4. Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978- 9332555365.

Suggested Web Links

NPTEL course on "The Joy of Computing Using Python", Link:
<https://nptel.ac.in/courses/106106182> NPTEL course on "Programming in Python".
 Link: https://onlinecourses.swayam2.ac.in/cec22_cs20

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III	Module IV
CO1	H	M	L	L
CO2	L	M	H	H
CO3	L	L	H	M

CBHY102T: HEALTH AND WELLNESS, YOGA EDUCATION, AND SPORTS AND FITNESS

(1 Credit: 15 hours)

Course Outcomes

After learning this course, the students will be able to:

CO 1: Explain the importance of healthy lifestyle (Understanding)

CO 2: Make use of Yoga, sports for health and fitness (Applying)

Module I: Health and Wellness (4 hours)

Meaning and importance of health and Wellness, components/dimensions of health and Wellness; Nutrition for health and wellness

Module II: Yoga (6 hours)

Introduction to Yoga, Asanas and Pranyamas

Module III: Sports and Fitness (5 hours)

Concept of Sports and fitness; Fitness activities for strength, Flexibility and Endurance; Indoor and Outdoor sports

Suggested Readings

1. Claude Bouchard, Steven N. Blair, William L. Haskell, 'Physical Activity and Health', Human Kinetics, 2007

2. Emily Oddo, 'Yoga: For Beginners', White Flower Publishing, 2018
3. Marzia Fernandez, Emily Attached, Gino Mackesy, 'Mental Health Workbook', 2020.
4. Dr. A. K. Uppal, Dr. P. P. Ranganathan, 'Fitness, Wellness and Nutrition', Friends Publications India. 2020
5. Fred Coalter, 'Sports for Development: What game are we playing?', Routledge. 2013

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III
CO1	H		M
CO2		H	M

CACE109T: SERVICE LEARNING

(Credit: 2 Hours: 30)

Objective: *Service Learning will aim to support the development of basic skills among the students namely, critical and creative thinking, reflection, communication, collaboration, information literacy, and social skills. The emphasis will be on active civic participation. As the students will actively involve in a wide range of experiences, which will benefit both the community at large and the students in particular and in the process the goals of the curriculum shall be achieved*

Course Outcomes

After learning this course, the students will be able to:

CO1: Define and explain the foundational concepts, framework, and purpose of Service Learning. (Remembering, Understanding) CO2: Describe and analyse various types of community engagement, partnerships, and design-thinking approaches relevant to service-oriented projects. (Understanding & Analysing)

CO3: Apply service-learning principles and computing skills to identify community needs and develop appropriate solutions in the field of Computer Applications. (Applying)

Module I: Concept of Service Learning (12 Hours)

Service Learning – Introduction, Conceptual Framework of Service Learning, History of Service-Learning, Service Learning vs other types of Experiential Learning, Service Learning Model, Types of Service Learning projects, Service Learning vs Traditional Education, Benefits of Service-Learning, Service Learning: Student Perspective, Purpose of Service Learning, Elements of Service-Learning, Community Service vs Service Learning vs Internship, Diversity and Cultural Responsive Teamwork
Service Learning Within University Context, Ethical Aspects of Community Partnerships, Historical Context of University Community Partnerships, Understanding of Society and Social Issues

Module II: Community Partnerships and Design Thinking (8 Hours)

Understanding Community Partnerships: Dimensions of Partnership, potential linkage, community justice, Arnstein's model of social participation, community capacity, partnerships – dimension and capacity,
Design Thinking Pedagogy and Practice: Definition, benefits, possible risks
Cultural and Power Dynamics: Definition and Understanding

Module III: Service Learning in the Field of Computer Applications (10 Hours)

Relevance of service-oriented projects for Computer Applications students; understanding the societal impact of software solutions; ethics in computing for social good, Use of ICT tools for addressing community challenges; digital literacy initiatives; assisting local schools or NGOs with basic computing support; promoting responsible and ethical use of technology among community members.

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III
CO1	H	M	L
CO2	M	H	M
CO3	L	M	H

COURSE CODE: UI/UX DESIGNING AND PROTOTYPING (1 Credit -15 Hours) (L-T-P:1-0-0)

Learning Objectives: *The primary objective of this course is to enable students to understand the fundamental principles of UI and UX design and their importance in creating effective digital experiences. It aims to help learners explore the stages of design thinking and the user-centered design process.*

Course Outcomes

After learning this course, the students will be able to:

- CO1: Explain the concepts and importance of UI/UX design. (Understanding)
- CO2: Apply design thinking for developing user-centric interfaces. (Applying)
- CO3: Create wireframes and prototypes using open-source tools. (Creating)
- CO4: Evaluate the usability and accessibility of interfaces. (Evaluating)

Module I: (3 Hours)

Introduction to UI/UX Design: Concept of User Interface (UI) and User Experience (UX), Importance of UI/UX in modern applications, Design thinking and user-centered design process, Understanding user personas and scenarios, Usability and accessibility principles.

Module II: (4 Hours)

UI Design Fundamentals: Visual design principles: layout, color theory, typography, iconography; Grid systems and responsive design; UI components and design patterns; Style guides and design systems.

Module III: (4 Hours)

UX Process and Wireframing: UX research methods: surveys, interviews, and empathy mapping; Information architecture and user flows; Wireframing: low-fidelity and high-fidelity; Heuristic evaluation and usability testing basics.

Module IV: (4 Hours)

Prototyping and Testing: Introduction to interactive prototyping; Creating clickable prototypes; Usability testing and feedback collection; Iterative design and improvement.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	
CO2	M	H	M	
CO3		M	H	H
CO4	M		M	H

Recommended Books

1. Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability; Steve Krug Publisher: Pearson Education Imprint
2. The Design of Everyday Things; Don Norman; Publisher: Perseus Books Group
3. About Face: The Essentials of Interaction Design; Alan Cooper, Robert Reimann, David Cronin, and Christopher Noessel; Publisher: Wiley India Pvt. Ltd.
4. Lean UX: Applying Lean Principles to Improve User Experience; Jeff Gothelf and Josh Seiden; Publisher: O'Reilly Media, Inc.
5. Designing Interfaces: Patterns for Effective Interaction Design; Jenifer Tidwell; Publisher: O'Reilly Media, Inc.

Suggested Web Links

[Penpot \(Open-source UI/UX tool\)](#)
[Pencil Project \(Open-source wireframing tool\)](#) [Google Material Design Guidelines](#)
[Interaction Design Foundation – Free UX Courses](#)
[Figma for Education \(Free Plan\)](#)

COURSE CODE: UI/UX DESIGNING AND PROTOTYPING LAB (2 Credit - 60 Hours) (L-T-P:0-0-4)

Learning Objectives: *The objective of this course is to enable students to gain hands-on experience in designing user interfaces and developing interactive prototypes using free and open-source tools available for Linux. The course aims to help learners understand the complete design process—from user research, wireframing, and interface layout to prototyping and usability testing. Students will develop practical skills in creating aesthetically pleasing and functional user experiences for web and mobile applications while adhering to design principles and usability standards.*

Course Outcomes

After learning this course, the students will be able to:

- CO1: Identify and analyze user needs and requirements for a given digital interface. (Analyzing)
- CO2: Create low-fidelity wireframes and interactive prototypes using open-source design tools. (Applying)
- CO3: Apply UI design principles such as layout, color theory, typography, and alignment in design projects. (Applying)
- CO4: Develop interactive, high-fidelity prototypes and evaluate their usability through user feedback. (Evaluating)
- CO5: Work collaboratively in a design workflow using version control and design documentation tools. (Applying)

Module I: (4 Hours)

Understanding UI vs UX, stages of design, personas, empathy maps, task flows.

Module II: (5 Hours)

Creating low-fidelity sketches and digital wireframes using Pencil Project / Draw.io.

Module III: (5 Hours)

Applying color theory, typography, and grid systems using Inkscape or Krita.

Module IV: (6 Hours)

Developing clickable prototypes using Penpot (open-source Figma alternative).

Module V: (4 Hours)

Conducting usability evaluation, heuristic analysis, and making design improvements.

Module 6: (6 Hours)

End-to-end design of a simple app or website UI/UX prototype demonstrating all stages.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module 6
CO1	H	L				
CO2		H	M			
CO3		M	H			
CO4				H	M	
CO5					M	H

Recommended Books

1. The Elements of User Experience – Jesse James Garrett, Pearson Education.
2. Don't Make Me Think: A Common-Sense Approach to Web Usability – Steve Krug, New Riders Press.
3. About Face: The Essentials of Interaction Design, Alan Cooper, Robert Reimann, David Cronin, and Christopher Noessel, Wiley
4. A Project Guide to UX Design" – Russ Unger and Carolyn Chandler, New Riders.
5. Designing Interfaces: Patterns for Effective Interaction Design" – Jenifer Tidwell, O'Reilly Media.

Suggested Web Links

<https://pencil.evolus.vn> – Open-source GUI prototyping tool.
<https://inkscape.org> – Free vector graphics editor for UI design.
<https://krita.org> – Open-source digital painting software
<https://draw.io> – Diagramming and wireframing tool for Linux.
<https://uxdesign.cc> – Online UX community and design resources.

COURSE CODE: BASICS OF DATA ANALYTICS USING SPREADSHEET (1 Credit -15 Hours) (L-T-P:1-0-0)**COURSE OBJECTIVE:**

The objective of this course is to provide students with a foundational understanding of data analytics and its practical application using spreadsheet tools. It aims to equip learners with the ability to import, clean, and organize datasets efficiently within spreadsheet environments, apply essential statistical and visualization techniques for basic data analysis, and develop simple yet effective dashboards and reports to support informed decision-making.

COURSE / LEARNING OUTCOMES:

After learning this course, the students will be able to:

- CO1: Explain key data analytics concepts and spreadsheet features used for data handling. (*Understanding*)
 CO2: Use spreadsheet functions to clean, manipulate, and summarize datasets. (*Applying*)
 CO3: Apply descriptive statistics and visualization tools for analyzing data trends. (*Applying*)
 CO4: Develop analytical reports and dashboards using spreadsheets. (*Analyzing*)

Module I (3 Hours)

Introduction to Data Analytics: Overview of data analytics; applications in business and data science; introduction to spreadsheet tools (MS Excel, Google Sheets); spreadsheet interface, formulas, and functions; scope of spreadsheet analytics.

Module II (3 Hours)

Data Handling and Cleaning: Data import (CSV, text files); sorting, filtering, and removing duplicates; data validation and conditional formatting; lookup functions (VLOOKUP, HLOOKUP, XLOOKUP); handling missing values.

Module III (3 Hours)

Descriptive Statistics and Data Summarization: Functions — AVERAGE, COUNT, MIN, MAX, MEDIAN, STDEV, VAR, CORREL; using Data Analysis ToolPak; summary statistics and correlation interpretation.

Module IV (3 Hours)

Data Visualization: Creating and formatting charts (bar, pie, line, scatter); using PivotTables and PivotCharts; visual design principles and dashboard fundamentals.

Module V (3 Hours)

Basic Analytical Techniques: Trendlines, forecasting, and regression using spreadsheet tools; scenario and what-if analysis; preparing and interpreting reports.

Suggested Readings

1. Microsoft Excel Data Analysis and Business Modeling, Seventh Edition, Wayne L. Winston, 2024, PHI Learning Pvt. Ltd.
2. Mastering Advanced Excel, Ritu Arora, 2023, BPB Publications.
3. Microsoft Excel Data Analysis for Dummies, Third Edition, Stephen L. Nelson, Elizabeth C. Nelson, 2018, Wiley.

Suggested Web Links

1. Analyze Data in Excel, <https://support.microsoft.com/en-us/office/analyze-data-in-excel-3223aab8-f543-4fda-85ed-76bb0295ffc4>
2. Excel Basics for Data Analysis, <https://www.coursera.org/browse/data-science>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	L			
CO2		H	M		
CO3	L		H	H	
CO4				M	H

COURSE CODE: BASICS OF DATA ANALYTICS USING SPREADSHEET LAB (2 Credit - 60 Hours) (L-T-P:0-0-4)

COURSE OBJECTIVE:

The objective of this course is to provide students with hands-on experience in spreadsheet-based data analysis, enabling them to clean, summarize, and visualize data while performing basic statistical analysis. It aims to develop the learner's ability to work with real-world datasets using spreadsheet tools and to create analytical dashboards that support interpretation of insights and informed decision-making.

COURSE / LEARNING OUTCOMES:

After learning this course, the students will be able to:

- CO1: Demonstrate data handling, cleaning, and transformation using spreadsheet tools. *(Applying)*
- CO2: Perform descriptive statistical analysis using built-in functions and add-ins. *(Applying)*
- CO3: Create effective data visualizations using charts and PivotTables. *(Applying)*
- CO4: Design dashboards and analytical reports. *(Analyzing)*
- CO5: Perform basic forecasting and what-if analysis using spreadsheet tools. *(Applying)*

LIST OF EXPERIMENTS

Lab No.	Task
1.	Introduction to spreadsheet interface, formulas, and functions.
2.	Importing and formatting data from CSV and text files.
3.	Perform data cleaning using sorting, filtering, and validation tools.
4.	Applying lookup and logical functions (IF, VLOOKUP, HLOOKUP, INDEX-MATCH).
5.	Descriptive statistics using spreadsheet functions and Data Analysis ToolPak.
6.	Data visualization using charts and conditional formatting.
7.	Summarizing data using PivotTables and PivotCharts.
8.	Dashboard design using combined visualizations.
9.	Perform the task of trend analysis, forecasting, and what-if scenario analysis.
10.	Mini Project: Complete data analytics process on real-world dataset (import → clean → analyze → visualize → report).

Suggested Readings

- Microsoft Excel Data Analysis and Business Modeling, Seventh Edition, Wayne L. Winston, 2024, PHI Learning Pvt. Ltd.
- Mastering Advanced Excel, Ritu Arora, 2023, BPB Publications.
- Microsoft Excel Data Analysis for Dummies, Third Edition, Stephen L. Nelson, Elizabeth C. Nelson, 2018, Wiley.

Mapping of COs

Course Outcomes	Lab 1–2	Lab 3–4	Lab 5–6	Lab 7–8	Lab 9–10
CO1	H				
CO2		H	M		
CO3			H	H	
CO4				H	
CO5					H

SEMESTER – IV

COURSE CODE: ENTREPRENEURSHIP AND STARTUP ECOSYSTEM (2 Credit - 30 Hours) (L-T-P:1-1-0)

COURSE OBJECTIVE:

The objective of this course is to help students understand the fundamentals of entrepreneurship, evaluate business ideas, and assess their market potential. It also aims to equip learners with basic skills in business planning, financing options, low-cost marketing, team building, and operational management. Additionally, the course introduces the start-up ecosystem, including incubators, accelerators, funding sources, and government schemes, along with the basics of family business.

COURSE / LEARNING OUTCOMES:

After learning this course, the students will be able to:

CO1: Understand the concepts, types, and role of entrepreneurship and family business. (*Understanding*)

CO2: Evaluate business ideas through market potential, feasibility analysis, and industry assessment. (*Evaluating*)

CO3: Apply entrepreneurial tools such as low-cost marketing, team building, funding options, and operational planning. (*Applying*)

CO4: Analyze the components of the start-up ecosystem, including support systems and government schemes. (*Analyzing*)

COURSE CONTENT:

Module I: Introduction to Entrepreneurship & Family Business

Definition and Concept of entrepreneurship, Entrepreneur Characteristics, Classification of Entrepreneurs Role of Entrepreneurship in Economic Development –Start-ups
Knowing the characteristics of Family business with discussion on few Indian cases of Family Business like Murugappa, Dabur, Wadia, Godrej, Kirloskar etc.

Module II: Evaluating Business opportunity

Sources of business ideas and opportunity recognition, Guesstimating the market potential of a business idea, Feasibility analysis of the idea, Industry, competition and environment analysis

Module III: Building Blocks of starting ventures

Low-cost Marketing using digital technologies, Team building from scratch, Venture Funding, Establishing the value-chain and managing operations, Legal aspects like IPR and compliances

Module IV: Start-up Ecosystem

Know the components of the start-up ecosystem including Incubators, Accelerators, Venture Capital Funds, Angel Investors etc.; Know various govt. schemes like Start-up India, Digital India, MSME etc.; Sources of Venture Funding available in India Source of Technology, Intellectual Property management

Text Books:

1. *Startup India Leaning Program* by Start Up India available at www.startupindia.gov.in
2. *Entrepreneurship*, Rajeev Roy, Oxford University Press
3. *Entrepreneurship: Successfully Launching New Ventures* by R. Duane Ireland Bruce R. Barringer, Pearson Publishing
4. *Family Business Management* by Rajiv Agarwal, Sage Publishing

5. Anish Tiwari (2003), "Mapping the Startup Ecosystem in India", *Economic & Political Weekly*

COURSE CODE: COMPUTER NETWORKS

(3 Credits - 45 Hours) (L-T-P:3-0-0)

COURSE OBJECTIVE:

The objective of this course is to make the students understand basic terminologies of computer networks along with their types, mode of communication, models, transmission media, connecting devices. It also emphasizes to make the students aware about network security and basic conception of the World Wide Web.

COURSE / LEARNING OUTCOMES:

At the end of this course students will be able to:

- CO1: Define the basic concepts of Computer Networks, its goals and network related terminologies. (Remembering)
- CO2: Explain the concepts of Analog and Digital signals, Electromagnetic spectrum and related concepts on various architecture used in computer networks. (Understanding)
- CO3: Experiment with various Networks concepts such as Types of networks, Topologies, Transmission media. (Applying)
- CO4: Comprehend Network Security Devices, Digital Signature and Internet Basics for designing the network with a suitable topology and network types. (Creating)

Module I (15 Hours)

Computer Network: Definition, Goals, Applications, Structure, Components, Topology, Types of Topology, Types of Networks (LAN, MAN, WAN, Internet), Broadcast and Point-To-Point Networks, Communications Types (Synchronous, Asynchronous), Modes of Communication, Topology, Client/Server architecture, Network Models, Design issues of the layer, Protocol Hierarchy, ISO-OSI Reference Model (Functions of each layer), Terminology, SAP, Connection Oriented and connectionless services, Peer Entities, TCP/IP model, Layers, Ports, Protocol Stack, Comparison of ISO-OSI and TCP/IP Model

Module II (15 Hours)

Transmission Media, Classes of Transmission Media, Guided Media: Coaxial Cable, Twisted Pair, Fiber Optics Cable, Connectors, Unguided Media (Wireless), Electromagnetic Spectrum for Wireless Communication, Propagation Methods (Ground, Sky, Line-of-Sight), Wireless Transmission, Radio Waves, Infrared, Microwave, Wireless LANs Architecture, MAC Sublayer, Frame Format, Frame Types, Bluetooth Architecture.

Module III (15 Hours)

Analog and Digital Signals, Data Encoding, Parallel and Serial Transmission, Network Connectivity Devices, Categories of Connectivity Devices, Passive and Active Hubs, Repeaters, Bridges, Switches (2-Layer Switch, 3-Layer Switch (Router)), Gateways, Network Interface Cards (NIC), Internetworking Principles, Network Security : Definition, Network Security Requirements and Attacks, Network Security Devices (firewalls, Proxy Server), Encryption and Digital Signatures, Internet Basics, Concept of Intranet and Extranet, Web Server, World Wide Web (WWW) Architecture, Web Documents, Search Engines, Internet Service Providers (ISP).

Suggested Readings

1. Andrew S. Tannenbaum, "Computer Networks", Tata McGraw-Hill Publishing Company Limited New Delhi.
2. Behrouz A. Forouzan, "Data Communications and Networking", Tata McGraw-Hill Publishing Company Limited New Delhi.
3. William Stallings, "Data and Computer Communications", Pearson Education Asia.

Mapping of CO to Modules

Course Outcomes	Module I	Module II	Module III
CO1	L	M	M
CO2		M	M
CO3	L	L	L
CO4	H		H

COURSE CODE: COMPUTER NETWORKS LAB

(2 credits – 60 hours) (L-T-P: 0-0-4)

Course Objectives

The objective of this lab is to enable students to practically understand the fundamental concepts of computer networks by configuring network devices, implementing network protocols, analyzing data communication, and troubleshooting real-world networking scenarios.

COURSE / LEARNING OUTCOMES:

At the end of this course, students will be able to:

- CO1: Implement various commands and evaluate the significance of socket programming used in networking. (Understanding)
- CO2: Make client-server communication with optimum algorithm and topology. (Creating)
- CO3: Make a distinctive comparison of various routing algorithms to select the optimum network path for data transfer. (Analysing)

List of Experiments/Modules

1. Basic Networking Commands and troubleshooting.
2. Introduction and implementation of LAN for various topologies and protocols simulation.
3. Programs using TCP Sockets (like date and time server and client, echo server and client, file transfer, etc.)
4. Programs using UDP Sockets (like simple DNS, file transfer, etc.)
5. Program to implement Remote Command Execution.
6. Create HTTP socket for web page upload and download.
7. Perform a case study on the following routing algorithms to select the optimum network path for data transfer.
 - a. Shortest path routing
 - b. Flooding
 - c. Distance vector

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	L	H	L	L	M	M	L
CO2	L	H	M	M	H	M	L
CO3			M	M			H

COURSE CODE: COMPUTER NETWORKS LAB

(2 credits – 60 hours) (L-T-P: 0-0-4)

Course Objectives

The objective of this lab is to enable students to practically understand the fundamental concepts of computer networks by configuring network devices, implementing network protocols, analyzing data communication, and troubleshooting real-world networking scenarios.

COURSE / LEARNING OUTCOMES:

At the end of this course, students will be able to:

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CO2: Make client-server communication with optimum algorithm and topology. (Creating)

CO3: Make a distinctive comparison of various routing algorithms to select the optimum network path for data transfer. (Analysing)

List of Experiments/Modules

1. Basic Networking Commands and troubleshooting.
2. Introduction and implementation of LAN for various topologies and protocols simulation.
3. Programs using TCP Sockets (like date and time server and client, echo server and client, file transfer, etc.)
4. Programs using UDP Sockets (like simple DNS, file transfer, etc.)
5. Program to implement Remote Command Execution.
6. Create HTTP socket for web page upload and download.
7. Perform a case study on the following routing algorithms to select the optimum network path for data transfer.
 - a. Shortest path routing
 - b. Flooding
 - c. Distance vector

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	L	H	L	L	M	M	L
CO2	L	H	M	M	H	M	L
CO3			M	M			H

COURSE CODE: DESIGN AND ANALYSIS OF ALGORITHMS
(3 credits – 45 hours) (L-T-P: 3-0-0)

Course Objectives

This course aims to provide students with a strong foundation in the principles of algorithm design and analysis, enabling them to understand key algorithmic paradigms such as divide and conquer, greedy methods, dynamic programming, and backtracking. It further develops the ability to evaluate algorithm performance using asymptotic notations and complexity measures, while strengthening problem-solving skills through the design of efficient algorithms for a variety of computational and real-world scenarios. The course also introduces students to the inherent limitations of algorithms and the concepts of computational intractability, preparing them for advanced study in theoretical and applied computing.

Course Outcomes

- CO1: Demonstrate an understanding of basic algorithm design paradigms and performance measures. (Understanding)
- CO2: Analyze algorithms using asymptotic notations to determine their time and space complexities. (Analyzing)
- CO3: Design and synthesize efficient algorithms for common computational tasks and real-life problem scenarios. (Creating/Applying)

Prerequisite: Knowledge of Data Structures

COURSE CONTENT:

Module I: Foundations of Algorithms (12 Hours)

What is an algorithm? Design and performance analysis of algorithms, time complexity, space complexity. Asymptotic notations (O , Ω , Θ) to measure growth of a function and application to measure complexity of algorithms. Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication. Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem.

Module II: Divide & Conquer and Greedy Methods (12 Hours)

The Divide & Conquer Design Technique: The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication.

Lower bound for comparison-based sorting.

The Greedy Design Technique: The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem.

Module III: Dynamic Programming & Graph Algorithms (11 Hours)

The Dynamic Programming Design Technique: The general concept. Computation of Fibonacci series and Binomial coefficients, all pair shortest paths problem (Floyd-Warshall's algorithm), 0/1 Knapsack problem.

Algorithms on Graphs: Breadth First Search, Depth First Search, finding connected components, depth first search of a directed graph, topological sorting.

Module IV: Backtracking and Computational Intractability (10 Hours)

Limitations of Algorithmic Power: Backtracking Method: n-Queen problem; sum of subsets problem/Hamiltonian circuit problem/vertex cover problem.

Computational Intractability: Overview of non-deterministic algorithms, P, NP, NP-Complete and NP-hard problems.

Text Books

1. Gajendra Sharma, Design and Analysis of Algorithms, Khanna Publishing House (AICTE Recommended Textbook)
2. Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford, Introduction to Algorithms, PHI publication, 3rd Edition, 2009.
3. Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar, Fundamentals of Computer Algorithms, University Press (I) Pvt. Ltd., 2012.
4. Levitin Anany, Introduction to Design and Analysis of Algorithms, 3rd Edition, Pearson, 2012

Reference Books

1. Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., The Design & Analysis of Computer Algorithms, Addison Wesley Publications, Boston, 1983.
2. Kleinberg Jon & Tardos Eva, Algorithm Design, Pearson Education, 2006.

Web Resources

<https://nptel.ac.in/courses/106101060>
<https://www.cs.umd.edu/~mount/451/Lects/451lects.pdf>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	
CO2	M	H	H	M
CO3	L	H	H	M

COURSE CODE: DESIGN AND ANALYSIS OF ALGORITHMS

(3 credits – 45 hours) (L-T-P: 3-0-0)

Course Objectives

This course aims to provide students with a strong foundation in the principles of algorithm design and analysis, enabling them to understand key algorithmic paradigms such as divide and conquer, greedy methods, dynamic programming, and backtracking. It further develops the ability to evaluate algorithm performance using asymptotic notations and complexity measures, while strengthening problem-solving skills through the design of efficient algorithms for a variety of computational and real-world scenarios. The course also introduces students to the inherent limitations of algorithms and the concepts of computational intractability, preparing them for advanced study in theoretical and applied computing.

Course Outcomes

CO1: Demonstrate an understanding of basic algorithm design paradigms and performance measures. (Understanding)

CO2: Analyze algorithms using asymptotic notations to determine their time and space complexities. (Analyzing)

CO3: Design and synthesize efficient algorithms for common computational tasks and real-life problem scenarios. (Creating/Applying)

Prerequisite: Knowledge of Data Structures

COURSE CONTENT:**Module I: Foundations of Algorithms (12 Hours)**

What is an algorithm? Design and performance analysis of algorithms, time complexity, space complexity. Asymptotic notations (O , Ω , Θ) to measure growth of a function and application to measure complexity of algorithms. Analysis of sequential search, bubble sort, selection sort, insertion sort, matrix multiplication. Recursion: Basic concept. Analysis of recursive algorithms, Master's theorem.

Module II: Divide & Conquer and Greedy Methods (12 Hours)

The Divide & Conquer Design Technique: The general concept. Binary search, finding the maximum and minimum, merge sort, quick sort. Best and worst case analysis for the mentioned algorithms. Strassen's matrix multiplication, Lower bound for comparison-based sorting.

The Greedy Design Technique: The general concept. Applications to general Knapsack problem, finding minimum weight spanning trees: Prim's and Kruskal's algorithms, Dijkstra's algorithm for finding single source shortest paths problem.

Module III: Dynamic Programming & Graph Algorithms (11 Hours)

The Dynamic Programming Design Technique: The general concept. Computation of Fibonacci series and Binomial coefficients, all pair shortest paths problem (Floyd-Warshall's algorithm), 0/1 Knapsack problem.

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Module IV: Backtracking and Computational Intractability (10 Hours)

Limitations of Algorithmic Power: Backtracking Method: n-Queen problem; sum of subsets problem/Hamiltonian circuit problem/vertex cover problem.

Computational Intractability: Overview of non-deterministic algorithms, P, NP, NP-Complete and NP-hard problems.

Text Books

1. Gajendra Sharma, Design and Analysis of Algorithms, Khanna Publishing House (AICTE Recommended Textbook)
2. Cormen Thomas H., Leiserson Charles E., Rivest Ronald L. and Stein Clifford, Introduction to Algorithms, PHI publication, 3rd Edition, 2009.
3. Horowitz Ellis, Sahni Sartaj and Rajasekaran Sanguthevar, Fundamentals of Computer Algorithms, University Press (I) Pvt. Ltd., 2012.
4. Levitin Anany, Introduction to Design and Analysis of Algorithms, 3rd Edition, Pearson, 2012

Reference Books

1. Aho Alfred V., Hopcroft John E. & Ullman Jeffrey D., The Design & Analysis of Computer Algorithms, Addison Wesley Publications, Boston, 1983.
2. Kleinberg Jon & Tardos Eva, Algorithm Design, Pearson Education, 2006.

Web Resources

<https://nptel.ac.in/courses/106101060>
<https://www.cs.umd.edu/~mount/451/Lects/451lects.pdf>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	
CO2	M	H	H	M
CO3	L	H	H	M

COURSE CODE: INTRODUCTION TO ARTIFICIAL INTELLIGENCE

(Credits: Theory-03)

COURSE OBJECTIVE:

The objective of this course is to introduce students to the fundamental concepts, history, and scope of Artificial Intelligence (AI), while helping them understand the role of intelligent agents, search techniques, and knowledge-based reasoning. The course further explores various problem-solving approaches, methods for handling uncertainty, and provides exposure to real-world domains and applications of AI, including discussions on ethics and the societal impact of intelligent systems.

COURSE / LEARNING OUTCOMES:

- CO1: Understand the characteristics of rational agents and problem-solving agents. *(Understanding)*
- CO2: Apply uninformed, informed, and evolutionary search techniques for problem solving. *(Applying)*
- CO3: Demonstrate knowledge representation using propositional and predicate logic and apply inference mechanisms. *(Applying)*
- CO4: Analyze planning and uncertainty handling through probabilistic reasoning and fuzzy sets. *(Analyzing)*
- CO5: Examine the domains, applications, and ethical aspects of AI. *(Evaluating)*

Module I (10 Hours)

Introduction to AI: What is AI? Intelligent Agents: Agents and environment, concept of rationality, environment types (PEAS), nature of environment, structure of agents, agent types.

Knowledge-Based Agents: Introduction, the Wumpus World example, knowledge-based reasoning, problem-solving agents.

Module II (12 Hours)

Advanced Search Techniques: Uninformed Search – DFS, BFS, Iterative Deepening Search; Informed Search – Best First Search, A*, AO*;

Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning;

Constraint Satisfaction Problems (CSPs): Constraints, backtracking search;

Evolutionary Search: Genetic algorithms and their applications in AI.

Module III (12 Hours)

Logical Reasoning and Uncertainty: Logic: Propositional logic, First-order predicate logic, propositional vs. first-order inference, unification and lifting;

Inference: Forward and backward chaining, resolution, truth maintenance systems;

Planning: Blocks World, STRIPS;

Uncertainty Handling: Non-monotonic reasoning, probabilistic reasoning, fuzzy set theory.

Module IV (11 Hours)

Domains and Applications of AI: Domains in AI – Introduction to Machine Learning, Computer Vision, Robotics, Natural Language Processing, Deep Neural Networks;

Expert Systems: Architecture, inference engine, case studies;

Legal and Ethical Issues: AI bias, transparency, accountability, and societal implications.

Suggested Readings

1. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
2. Nilsson Nils J., Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers Inc.
3. Dan W. Patterson, Introduction to Artificial Intelligence & Expert Systems, PHI Learning, 2010.
4. Rajiv Chopra, Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024.

Suggested Web Links

Artificial Intelligence Course, <https://pll.harvard.edu/subject/artificial-intelligence> Fundamentals of Artificial Intelligence, https://onlinecourses.nptel.ac.in/noc25_ge55/preview

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	L	H		
CO3		L	H	
CO4			H	M
CO5				H

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The objective of this course is to introduce students to the fundamental concepts, history, and scope of Artificial Intelligence (AI), while helping them understand the role of intelligent agents, search techniques, and knowledge-based reasoning. The course further explores various problem-solving approaches, methods for handling uncertainty, and provides exposure to real-world domains and applications of AI, including discussions on ethics and the societal impact of intelligent systems.

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- CO1: Understand the characteristics of rational agents and problem-solving agents. (*Understanding*)
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 CO3: Demonstrate knowledge representation using propositional and predicate logic and apply inference mechanisms. (*Applying*)
 CO4: Analyze planning and uncertainty handling through probabilistic reasoning and fuzzy sets. (*Analyzing*)
 CO5: Examine the domains, applications, and ethical aspects of AI. (*Evaluating*)

Module I (10 Hours)

Introduction to AI: What is AI? Intelligent Agents: Agents and environment, concept of rationality, environment types (PEAS), nature of environment, structure of agents, agent types.

Knowledge-Based Agents: Introduction, the Wumpus World example, knowledge-based reasoning, problem-solving agents.

Module II (12 Hours)

Advanced Search Techniques: Uninformed Search – DFS, BFS, Iterative Deepening Search; Informed Search – Best First Search, A*, AO*;

Adversarial Search & Games: Two-player zero-sum games, Minimax Search, Alpha-Beta pruning;

Constraint Satisfaction Problems (CSPs): Constraints, backtracking search;
Evolutionary Search: Genetic algorithms and their applications in AI.

Module III (12 Hours)

Logical Reasoning and Uncertainty: Logic: Propositional logic, First-order predicate logic, propositional vs. first-order inference, unification and lifting;

Inference: Forward and backward chaining, resolution, truth maintenance systems;

Planning: Blocks World, STRIPS;

Uncertainty Handling: Non-monotonic reasoning, probabilistic reasoning, fuzzy set theory.

Module IV (11 Hours)

Domains and Applications of AI: Domains in AI – Introduction to Machine Learning, Computer Vision, Robotics, Natural Language Processing, Deep Neural Networks;

Expert Systems: Architecture, inference engine, case studies;

Legal and Ethical Issues: AI bias, transparency, accountability, and societal implications

Suggested Readings

1. M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
2. Nilsson Nils J., Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers Inc.
3. Dan W. Patterson, Introduction to Artificial Intelligence & Expert Systems, PHI Learning, 2010.
4. Rajiv Chopra, Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024.

Suggested Web Links

Artificial Intelligence Course, <https://pll.harvard.edu/subject/artificial-intelligence>
 Fundamentals of Artificial Intelligence, https://onlinecourses.nptel.ac.in/noc25_ge55/preview

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	L	H		
CO3		L	H	
CO4			H	M
CO5				H

COURSE CODE: INTRODUCTION TO ARTIFICIAL INTELLIGENCE LAB**(2 Credits: 60 Hours) (L-T-P: 0-0-4)****COURSE OBJECTIVE:**

The objective of this lab course is to provide hands-on experience in implementing core Artificial Intelligence algorithms, enabling students to understand and apply various search, optimization, and reasoning techniques. Through practical exercises, the course guides learners in designing and developing intelligent systems using Python and widely used AI libraries, while also exploring applications of AI in domains such as natural language processing and computer vision.

COURSE / LEARNING OUTCOMES:

- CO1: Apply uninformed and heuristic search algorithms to solve AI problems. (Applying)
- CO2: Analyze and solve Constraint Satisfaction Problems. (Applying)
- CO3: Develop and implement simple rule-based expert systems. (Applying)
- CO4: Implement and evaluate optimization techniques for problem solving. (Analyzing)
- CO5: Apply Natural Language Processing and image classification techniques using Python. (Applying)

LIST OF EXPERIMENTS

Lab No.	Task
1.	Demonstrate basic problem-solving using Breadth-First Search (BFS) on a simple grid.
2.	Implement Depth-First Search (DFS) on a small graph.
3.	Solve the Water Jug Problem using BFS.
4.	Implement a Hill Climbing search to find the peak in a numeric dataset.
5.	Apply the A* Search algorithm to find the shortest path in a 4×4 grid.
6.	Implement the Minimax algorithm for a two-player game (3-ply game tree).
7.	Solve the 4-Queens Problem using backtracking as a CSP.
8.	Use constraint propagation to solve a Magic Square puzzle.
9.	Apply optimization techniques to find the maximum value in a list
10.	Represent and evaluate propositional logic expressions.
11.	Implement a simple rule-based expert system for weather classification.
12.	Implement a basic AI agent with decision-making rules.
13.	Develop a simple rule-based chatbot in Python
14.	Perform NLP tasks using NLTK: Tokenizing, Stop-word Filtering, Stemming, POS Tagging, Chunking, and Named Entity Recognition.
15.	Perform Image Classification using CNN with TensorFlow/Keras

Suggested Readings

- M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing Company, 2024 (AICTE Recommended Textbook).
- Nilsson Nils J., Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publishers Inc.
- Dan W. Patterson, Introduction to Artificial Intelligence & Expert Systems, PHI Learning, 2010.
- Rajiv Chopra, Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024.

Mapping of COs to Modules

Course Outcomes	Lab 1–3	Lab 4–6	Lab 7–9	Lab 10–12	Lab 13–15
CO1	H				
CO2		H			

CO3			H		
CO4			H	H	
CO5					H

COURSE CODE: DESIGN THINKING AND INNOVATION (1 Credit – 15 Hours) (L–T–P: 1–0–0)

COURSE OBJECTIVE:

This course aims to introduce students to the foundational concepts of design thinking and innovation, enabling them to approach problems creatively and empathetically. Through a learning-by-doing orientation, students will learn to observe user needs, frame meaningful problem statements, ideate using structured templates, develop simple prototypes, and understand iterative improvement through feedback. The course encourages application of design thinking tools to real-world challenges, fostering an innovative mindset essential for modern technological and business environments.

COURSE / LEARNING OUTCOMES:

After completing this course, students will be able to:

CO1: Explain the principles of design thinking, innovation, empathy, and user-centric problem solving. (Understanding) **CO2:** Apply design thinking stages to identify, frame, and ideate solutions for simple real-world or classroom problems. (Applying)

CO3: Evaluate user feedback and refine prototypes to improve solution feasibility and user experience. (Analyzing)

COURSE CONTENT:

Module I: Fundamentals of Design Thinking (4 Hours)

Concept of innovation and its relevance; Creative thinking and problem-solving approaches; Introduction to the design thinking process: Empathize, Define, Ideate, Prototype, Implement; Customer-centric thinking with short examples (AirBnB, IDEO, Apple, Netflix)

Module II: Empathy and Problem Definition (4 Hours)

Importance of empathy; observing user behaviour and gathering insights; Understanding unstructured information and forming problem statements; Wicked problems: meaning, examples, and societal relevance; Short activities to understand individual differences and user uniqueness

Module III: Ideation, Prototyping, and Implementation (4 Hours)

Templates for ideation: brainstorming, mind-mapping, systems thinking; Reaching consensus on problem framing; Mapping customer experience; Methods and purpose of rapid prototyping; simple prototype creation; Basics of implementing an idea.

Module IV: Feedback and Iteration (3 Hours)

Feedback loop and user experience improvement; Ergonomic considerations and user-focused design; Re-design and refinement of prototype; Final presentation of a mini-innovation concept

Text Books (Latest Editions)

1. E. Balaguruswamy (2023), *Developing Thinking Skills*, Khanna Publishing.
2. Tim Brown (2008), *Change by Design*, Harvard Business Review Press.
3. R. T. Krishnan & V. Dabholkar, *8 Steps to Innovation*, Collins.

Reference Book

Nigel Cross, *Design Thinking*, Bloomsbury.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	
CO2		M	H	M
CO3		L	M	H

COURSE CODE: SERVICE-LEARNING PRACTICE**(2 Credits - 60 Hours) (L-T-P: 0-0-4)****COURSE OBJECTIVE:**

The objective of this course is to equip students with opportunities to apply their academic knowledge to address real-world challenges faced by communities, particularly in the area of digital literacy. Through hands-on community engagement, students will develop a sense of social responsibility and ethical awareness while enhancing their skills in problem-solving, communication, and teamwork. The course encourages critical thinking by fostering connections between academic learning and societal challenges, empowering students to design and implement sustainable and impactful service initiatives that address specific community needs.

COURSE / LEARNING OUTCOMES:

After successful completion of this course, students will be able to:

- CO1: Analyze the digital literacy needs of rural communities or children unfamiliar with technology and design practical training modules to address these needs. (Analyzing)
- CO2: Apply advanced tools and technologies to create and deliver IT-based solutions that enhance digital literacy in underserved communities. (Applying)
- CO3: Evaluate the impact of service-learning projects on community empowerment and reflect on their role in fostering digital inclusion. (Evaluating)

Field work

The group of students preferably should be able to contribute to the community and should be able to link their concrete experiences in the community to the theoretical concepts learnt. The activities that can be carried out during field work are:

1. Organizing digital literacy training for rural communities or children unfamiliar with technology, focusing on practical use of devices, basic internet skills, and digital safety.
2. Developing interactive, user-friendly e-learning modules or tutorials to teach fundamental IT skills, such as word processing, spreadsheets, and online communication tools.
3. Conducting hands-on training sessions on using latest tools and technologies, such as mobile apps for education, digital payments, and government services.
4. Designing and implementing coding basics or robotics awareness programs for children to spark interest in technology.
5. Creating simple digital solutions, such as websites or resource platforms, to aid community centres or schools in enhancing digital education.

COURSE CODE: WEB PROGRAMMING USING PHP AND**LARAVEL FRAMEWORK (1 Credit - 15 Hours) (L-T-P: 1-0-0)****COURSE OBJECTIVE:**

The objective of this course is to enable students to understand the fundamentals of PHP for server-side development while gaining familiarity with the MVC architecture and its advantages in building structured web applications. Students will learn the core components of the Laravel framework, including routing, controllers, and views, and will develop the ability to perform essential database operations using Eloquent

ORM. By the end of the course, learners will be equipped with the skills required to design and develop small-scale dynamic web applications using PHP and the Laravel framework.

COURSE / LEARNING OUTCOMES:

After successful completion of this course, students will be able to:

CO1: Explain server-side scripting concepts and PHP fundamentals.

CO2: Demonstrate understanding of Laravel framework architecture and components. CO3: Apply routing, controllers, and views to design structured web applications.

CO4: Perform CRUD operations using Laravel's Eloquent ORM. CO5: Build basic dynamic web applications using Laravel.

Course Content

Module I: Introduction to PHP and Server-Side Scripting (3 Hours)

Client–Server Architecture Overview; Difference between Client-side & Server-side Scripting; Introduction to PHP; PHP Syntax; Variables; Data Types; Operators and Expressions; PHP Configuration (XAMPP/WAMP/MAMP); Handling Forms (GET, POST, REQUEST); Basic Input Validation; Introduction to Sessions & Cookies (Conceptual)

Module II: MVC Architecture & Introduction to Laravel (3 Hours)

Introduction to MVC; Benefits of MVC in Web Development; Introduction to Laravel Framework; Installing Laravel using Composer; Laravel Directory Structure; Understanding .env file; Laravel Request Lifecycle; Basics of Artisan CLI

Module III: Laravel Routing, Controllers, and Views (4 Hours)

A. Routing: Basic Routing, Route Methods (GET, POST), Route Parameters, Named Routes, Route Groups (conceptual)

B. Controllers: Creating Controllers using Artisan, Controller Methods, Passing Data to Views, RESTful Controller Basics

C. Views: Blade Template Engine, Template Inheritance (Layouts), Displaying Variables, Loops & Conditionals in Blade

Module IV: Laravel Database & Eloquent ORM (3 Hours)

Database Configuration (.env); Migrations – Creating & Modifying Tables; Eloquent Models; Query Builder Basics; CRUD Operations using Eloquent; Form Handling with Eloquent; Simple Validation Rules (required, email, numeric)

Module V: Building a Mini Laravel Application (2 Hours)

Setting up Project Structure; Creating Routes, Controller, Model, and Views; Database Connectivity; Implementing CRUD example (Students/Products/Tasks); Testing with Artisan Server; Final Integration & Demo.

Recommended Books

1. PHP & MySQL Web Development – Luke Welling & Laura Thomson, Addison Wesley.
2. Learning PHP, MySQL & JavaScript – Robin Nixon, O'Reilly.
3. Laravel: Up & Running – Matt Stauffer, O'Reilly.
4. Beginning Laravel – Sanjib Sinha, Apress

Suggested Web Links

Official PHP Documentation – <https://www.php.net>
W3Schools PHP Tutorial – <https://www.w3schools.com/php/>
Laravel Documentation – <https://laravel.com/docs>

Laracasts – <https://laracasts.com>
 Laravel News – <https://laravel-news.com>
 PHP The Right Way – <https://phptherightway.com>

Suggested MOOCs (SWAYAM / NPTEL)

NPTEL – Web Application Development (IIT Kharagpur)
 NPTEL – Programming in JavaScript, HTML & PHP (IIT Madras)
 SWAYAM – Introduction to PHP & MySQL
 SWAYAM – Full Stack Development (includes PHP modules)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	L				
CO2		M	H		
CO3			L	L	H
CO4				H	H
CO5			L	H	H

COURSE CODE: WEB PROGRAMMING USING PHP AND LARAVEL FRAMEWORK LAB **(2 Credits - 60 Hours) (L-T-P: 0-0-4)**

COURSE OBJECTIVE:

The objective of this lab course is to equip students with practical skills in server-side web development using PHP and the Laravel framework. Through hands-on exercises, students will learn the fundamentals of PHP scripting, form handling, and validation while gaining exposure to the MVC architecture that underpins modern web applications. The course further focuses on developing proficiency in Laravel's routing, controllers, views, and database interactions using Eloquent ORM. By the end of the lab, learners will be capable of designing, implementing, and integrating dynamic, database-driven web applications using Laravel.

COURSE / LEARNING OUTCOMES:

After successful completion of this course, students will be able to:

CO1: Write PHP programs to handle forms, sessions, and basic validations. *(Applying)*

CO2: Configure the Laravel environment and create MVC components. *(Applying)*

CO3: Implement routing, controllers, and Blade views in Laravel. *(Applying)*

CO4: Design and implement CRUD functionality using Eloquent ORM. *(Applying, Analyzing)*

CO5: Build a functional mini-project using Laravel with database integration. *(Creating)*

Course Content

Module I: PHP Basic Programming & Form Handling (12 Hours)

Installation of XAMPP/WAMP & folder structure (htdocs), Writing basic PHP scripts, Using variables, operators, loops, and arrays Simple form handling using GET & POST, Form validation (required fields, email validation), Sessions and Cookies basics, File upload handling using PHP, Storing form data in text/JSON files (introduction)

Module II: Laravel Installation, Environment Setup & MVC Basics (12 Hours)

Installing Composer, Installing Laravel and running the project, Exploring Laravel folder structure, Configuring .env file for app name, timezone, Using Artisan commands, Creating a simple route and returning text/view, Creating simple controllers and views, Understanding MVC workflow through examples

Module III: Laravel Routing, Controllers & Views (12 Hours)

Creating routes (GET, POST), Passing parameters to routes, Named routes, Creating controllers with Artisan, Passing data from controller to view, Creating views with Blade templating, Blade loops, conditionals, layouts, Building a small app (listing static data)

Module IV: Laravel Forms, Validation & Database Operations (12 Hours)

Creating migration files, Running migrations to create DB tables, Creating Models using Artisan, Eloquent CRUD operations (Create, Read, Update, Delete), Form creation with Blade, Form validation rules, Saving data to database, Displaying records in view (table format), Editing and deleting records, Pagination (basic)

Module V: Mini Project Development & Evaluation (12 Hours) Students will build one mini-project such as:

Student Management System

Product Inventory
System Task/To-Do
Manager Simple Blog
Post Manager Em-
ployee Directory

Project Requirements

At least **5 database fields**
Proper routing & MVC
structure CRUD with vali-
dation
Blade template with layout
Display tables with pagi-
nation User-friendly UI
Final demonstration

Recommended Books

1. PHP & MySQL Web Development – Luke Welling & Laura Thomson, Addison Wesley
2. Laravel: Up & Running – Matt Stauffer, O'Reilly
3. Beginning Laravel – Sanjib Sinha, Apress
4. Learning PHP, MySQL, JavaScript & CSS – Robin Nixon, O'Reilly

Suggested Web Links

Official Laravel Docs – <https://laravel.com/docs>
Laracasts (Hands-on tutorials) – <https://laracasts.com>
PHP Manual – <https://www.php.net>
W3Schools PHP – <https://www.w3schools.com/php>
GitHub Laravel Projects – <https://github.com/topics/laravel-project>

Suggested SWAYAM / NPTEL MOOCs

NPTEL – Web Application Development
 SWAYAM – PHP & MySQL Web Development
 NPTEL – Introduction to Modern Application Development
 SWAYAM – Full Stack Development (with PHP modules)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		M	M		
CO3			H	M	M
CO4				H	H
CO5				H	H

COURSE CODE: DATA VISUALIZATION (1 Credit - 15 Hours) (L-T-P: 1-0-0)

COURSE OBJECTIVE:

The objectives of this course are to develop skills in designing and creating visualizations, to understand visualization techniques for correlation analysis, distribution analysis, and multivariate analysis, to comprehend the components involved in visualization design, and to recognize how the type of data influences the choice of visualization.

COURSE / LEARNING OUTCOMES:

On successful completion of the course students will be able to:

CO1: Develop familiarity with the design process to develop visualization methods and visualization systems. (Remembering) CO2: Understand the fundamental design principles and different types of data visualization. (Understanding)
 CO3: Apply existing visualization tools and techniques to analyze basic datasets. (Applying) CO4: Design and develop various data visualization methods for a given problem. (Creating)

Module I: (7 hours)

Tufte's Principles, Data visualization: Introduction, Types of data visualization, Data for visualization, Aesthetics and Types of data, Applications of Data Science technologies for visualization. Basic Plotting - Line plot, Bar plot, Pie Chart, Scatter Plot, Histogram, Stacked Bar Charts, Sub Plots, Matplotlib, Seaborn, Plotly, Seaborn Styles. Applied Visualizations - Box plot, Density Plot, Area Chart, Heat map, Tree map, Graph Networks. Interactive Visualizations and Animation - Dynamic charts, Dynamic maps, Animation types- 2D, 3D, Motion Animation, Animation Principles, Statistical Visualizations.

Module II: (8 hours)

Distribution analysis, describing distributions, distribution patterns, distribution displays, distribution analysis best practices, correlation analysis, describing correlations, correlation patterns, correlation displays, correlation analysis techniques and best practices, multivariate analysis, multivariate patterns, multivariate displays, multivariate analysis techniques and best practices. Information dashboard, Introduction, Types of Dashboard, Case Study: Creating a dashboard using Excel. Time Series Data Visualization

Suggested Readings

1. Cole Nussbaumer Knaflitz, *Storytelling with Data: A Data Visualization Guide for Business Professionals*, Wiley, 2015
2. Claus O. Wilke, *Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures*, O'Reilly, 2019
3. Edward R. Tufte, *The Visual Display of Quantitative Information*, Graphics Press, 2001.
4. D. Kusleika, *Data Visualization with Excel Dashboards*, Wiley 2021.

E Resources

1. Udemy Course on Mastering Data Visualization: Theory and Foundations
2. Coursera Course on Data Visualization with Python

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	M
CO2	H	M
CO3	M	H
CO4	M	H

COURSE CODE: DATA VISUALIZATION LAB
(2 Credits - 60 Hours) (L-T-P: 0-0-4)
COURSE OBJECTIVE:

The objective of the course is to develop practical skills in designing and implementing effective data visualizations using Python tools; to understand fundamental visualization principles, types, and aesthetics; to apply libraries such as Matplotlib, Seaborn, Plotly, and Altair for creating static, interactive, and animated visualizations; to analyze distributions, correlations, and multivariate data through visual techniques; and to design dashboards and visualization reports for real-world data analysis and decision-making.

COURSE / LEARNING OUTCOMES:

- CO1:** Create basic and advanced data visualizations using Python libraries such as Matplotlib, Seaborn, Plotly, and Altair.
(Applying)
- CO2:** Analyze and interpret data distributions, correlations, and multivariate patterns using appropriate visual techniques.
(Analyzing)
- CO3:** Design aesthetically effective and meaningful visualizations by applying visualization principles, styles, and layouts.
(Creating, Applying)
- CO4:** Develop interactive and dynamic visualizations, including dashboards, using tools such as Plotly Dash and Excel. (Creating)
- CO5:** Build a complete visualization-based mini-project or analytical dashboard for real-world data analysis and decision-making. (Creating, Evaluating)

Course Content

Module I (30 Hours)

Introduction to Python visualization libraries - Matplotlib, Seaborn, Plotly; Basic plotting - Line, Bar, Pie, Scatter, Histogram, Box, and Area charts; Subplots and combined charts; Visualization aesthetics - color, style, and layout; Advanced visualizations - Heat map, Tree map, Density plot; Interactive and animated charts - Plotly Express, Altair; Understanding visualization principles and effective data representation.

Module II (30 Hours)

Distribution analysis - histograms, density plots; Correlation analysis - heat maps, pair plots; Multivariate visualization - multidimensional data representation; Time series visualization - trend analysis, smoothing, decomposition; Dashboard design - Plotly Dash, Excel; Interactive and dynamic visualizations; Mini project - visualization report or dashboard using real-world dataset.

Suggested Readings

1. Kyran Dale, *Data Visualization with Python and JavaScript*, O'Reilly Media, 2016.
2. Cole Nussbaumer Knaflic, *Storytelling with Data: A Data Visualization Guide for Business Professionals*, Wiley, 2015
3. Claus O. Wilke, *Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures*, O'Reilly, 2019
4. Edward R. Tufte, *The Visual Display of Quantitative Information*, Graphics Press, 2001.
5. D. Kusleika, *Data Visualization with Excel Dashboards*, Wiley 2021.

Mapping of CO to Modules

Course Outcomes	Module I	Module II
CO1	H	M
CO2	M	H
CO3	H	M
CO4	M	H
CO5	M	H

SEMESTER – V

COURSE CODE: QUANTITATIVE TECHNIQUES

(2 Credits - 30 Hours) (L-T-P: 2-0-0)

COURSE OBJECTIVE:

The primary objecti

ve of this course is to equip students with the fundamental quantitative and analytical skills necessary for effective decision-making in computer applications, business, and management contexts. The course aims to develop logical reasoning and problem-solving abilities through the application of mathematical and statistical concepts.

COURSE / LEARNING OUTCOMES:

On successful completion of the course students will be able to:

CO1: Explain the fundamental concepts and importance of quantitative techniques in business and computing applications. (Understanding)

CO2: Apply mathematical tools such as matrices, linear equations, and inequalities to real-world computational and business problems. (Applying)

CO3: Analyse and interpret data using measures of central tendency and dispersion for decision-making. (Analyzing)

CO4: Solve optimization problems using linear programming methods and understand their applications in computing and operations. (Applying)

CO5: Use probability and correlation techniques to support forecasting and data-driven decisions. (Evaluating)

COURSE CONTENT

Module I: (4 Hours)

Introduction to Quantitative Techniques: Meaning, definition, and scope; role in decision-making; applications in business and computer science; steps in quantitative analysis.

Module II: (6 Hours)

Mathematical Tools: Sets, functions, matrices, determinants, linear equations, and inequalities; applications in computing and data processing.

Module III: (6 Hours)

Measures of Central Tendency and Dispersion: Mean, median, mode; range, variance, standard deviation; coefficient of variation; interpretation in data analysis.

Module IV: (8 Hours)

Linear Programming: Introduction to optimization; formulation of LPP; graphical and simplex methods; applications in resource allocation and scheduling.

Module V: (6 Hours)

Probability and Correlation: Basic probability concepts; addition and multiplication theorems; correlation and regression analysis; interpretation for forecasting.

Recommended Books

1. Quantitative Techniques in Management – N.D. Vohra, McGraw Hill Education, 5th Edition.
2. Business Mathematics and Statistics – R.Q. Hazra & S.K. Mondal, Himalaya Publishing House.
3. Quantitative Techniques for Decision Making – M. Raghavachari, Tata McGraw Hill.

4. Operations Research: An Introduction – Hamdy A. Taha, Pearson Education.

Suggested Web Links

<https://www.khanacademy.org/math/statistics-probability>
<https://www.coursera.org/specializations/operations-research>

Mapping of CO to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	L			
CO2		H		M	
CO3			H		
CO4		M		H	
CO5				M	H

CAIN314I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester) (2 Credits-60 Hours)

Learning Objective:

The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in classroom courses to real-life industry work situations. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills.

COURSE/LEARNING OUTCOMES

At the end of the internship, students will be able to:

- CO1: Relate theory and practical with real life examples. (Remembering)
- CO2: Explain the technical processes involved in the industry. (Understanding)
- CO3: Identify the importance of learning the computer technology. (Applying)
- CO4: Analyse application of computer technology into the practical field. (Analysing)
- CO5: Discuss the actual technological advancements in the industry. (Creating)

GUIDELINES:

The students should follow the following instruction and guidelines during the course of the internship:

- The internship should be for a minimum duration of 80 hours which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively. The students have to undergo the internship during the Summer/Winter Break.
- The students can undergo an internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to computer technology.
- After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department.
- There would be a Seminar Presentation (PPT) and Viva-Voce Examination based on which the students would be evaluated for the internship. The Internship report would also be a part of the evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise the following:

- a. Recommendation Letter from the Department.
- b. Completion Certificate from the Organisation where the student has worked as an intern.
- c. Internship Diary as per the prescribed format.
- d. Organisation details (Address, E-mail, Contact Number)

The Contents of the Report must include:

- Introduction
- Objectives of the Internship
- About the Organisation (Sector, Activities, Operations)
- Description of the work
- Learning Outcomes

The Assessment for the internship must have the following components:

- Internship Report: 15 Marks
- Internship Diary: 15 Marks
- Seminar Content and Presentation: 30 Marks
- Work Undertaken/Project Output: 15 Marks
- Learning Outcome and Reflection: 15 Mark
- Viva-Voce Examination: 10 Mark

COURSE CODE: MINI PROJECT

(3 Credits - 90 Hours) (L-T-P: 0-0-6)

Learning Objective:

The objective of the Mini Project is to provide students with an opportunity to apply the knowledge and skills acquired in previous semesters to a practical, problem-based task. This course aims to foster hands-on learning by engaging students in real-world project execution—individually or in groups—under faculty guidance. Through activities such as problem identification, requirement analysis, system design, implementation, testing, and documentation, students develop technical competence, teamwork, creativity, and problem-solving abilities. The Mini Project strengthens students' ability to plan and manage tasks, analyze user requirements, build functional solutions, and communicate their results effectively through structured reports, presentations, and demonstrations.

COURSE / LEARNING OUTCOMES:

After completing this Mini Project course, students will be able to:

- CO1:** Identify, define, and analyze a real-world problem suitable for a mini project, and prepare a clear project proposal or synopsis. (Applying)
- CO2:** Design the system architecture, workflow, or methodology using appropriate tools, techniques, or models. (Applying)
- CO3:** Implement the proposed solution using relevant technologies, frameworks, or programming environments. (Creating)
- CO4:** Demonstrate the project outcome through presentations, demonstrations, and justification of design and implementation decisions. (Evaluating)
- CO5:** Prepare a well-structured project report documenting requirements, methodology, results, and conclusions. (Creating)

EVALUATION OF PROJECTS

The guidelines for the conduct and evaluation of Mini Projects shall be laid down by the Department. The components of evaluation and allotment of marks may be as follows:

In Semester Evaluation (weightage 60)	Marks	End Semester Evaluation (Weightage 40)	Marks
Synopsis	10	Project Implementation	20
Progress Seminar presentation I (Analysis and Design)	20	Presentation	5
Progress Seminar presentation II (Implementation)	20	Report	10
Attendance	10	Viva Voce	5
TOTAL	60	TOTAL	40
GRAND TOTAL			100

COURSE CODE: REACTJS FUNDAMENTALS

(3 Credits - 45 Hours) (L-T-P: 3-0-0)

COURSE OBJECTIVE:

The objective of this course is to provide students with a comprehensive understanding of modern React development by covering essential ES6 JavaScript concepts, the fundamentals of React components, state, and props, as well as React Hooks, forms, and event handling. Students will also learn how to integrate APIs using fetch or axios, develop single-page applications with React Router, and manage application-level state using the Context API, along with an introductory exposure to Redux.

COURSE / LEARNING OUTCOMES:

After completing this Mini Project course, students will be able to:

- CO1:** Demonstrate understanding of ES6 and functional programming concepts. (Understanding)
- CO2:** Build reusable React components. (Creating, Applying)
- CO3:** Use state, props, and hooks for dynamic UI. (Analyzing, Applying)
- CO4:** Integrate REST APIs into React applications. (Analyzing, Applying)
- CO5:** Implement routing and state management in React. (Analyzing, Evaluating)

COURSE CONTENT

Module 1: Introduction to React & Modern JavaScript (6 hours)

React features, JSX, Node.js & npm basics, ES6 Syntax: let/const, Arrow functions, Spread/rest, operators, Template literals, Array functions (map/filter/reduce), Virtual DOM

Module 2: Components, Props, State & Events (6 hours)

Functional components, Props – passing data between components, State – useState hook, Event handling, Conditional rendering, Lists and keys, Component communication

Module 3: Hooks & Form Handling (6 hours)

useState, useEffect, Custom hooks (concept), Controlled & uncontrolled components, Form validation basics, Refs, Lifecycle with hooks

Module 4: API Integration & React Router (6 hours)

Fetch API & Axios, Handling API responses, Error handling, React Router v6, Navigation, Routes, Params, Protected routes (concept)

Module 5: State Management & App Structure (6 hours)

Context API, Reducer pattern, Introduction to Redux, Folder structure for large apps, Environment variables, Performance optimization basics

Recommended Books

1. Learning React – Alex Banks, Eve Porcello (O'Reilly)
2. Fullstack React – Accomazzo et al.
3. React Up & Running – Stoyan Stefanov

Suggested Web Links

<https://react.dev>
<https://reactrouter.com>
<https://javascript.info>
<https://beta.reactjs.org/learn>

Suggested MOOCs (SWAYAM / NPTEL)

NPTEL – Joy of Computing with Modern JavaScript
 SWAYAM – Full Stack Development using MERN
 NPTEL – Introduction to React (IIT Roorkee)

Mapping of CO to Modules

Course Outcomes	M1	M2	M3	M4	M5
CO1	L	M			
CO2		L	M		
CO3		L	M	H	
CO4			L	H	
CO5				M	H

COURSE CODE: REACTJS FUNDAMENTALS LAB

(2 Credits - 60 Hours) (L-T-P: 0-0-4)

COURSE OBJECTIVE:

The objective of this course is to enable students to perform hands-on React component development, work effectively with state, props, hooks, and forms, build API-driven user interfaces, and construct as well as test small React applications with practical proficiency.

COURSE / LEARNING OUTCOMES:

After completing this Mini Project course, students will be able to:

CO1: Set up React environment and create basic UI. (Understanding, Applying)

CO2: Build reusable functional components.(Creating)

CO3: Handle state, props, and events.(Creating, Analyzing)

CO4: Integrate REST APIs using React. (Applying, Creating, Analyzing)

CO5: Develop a mini SPA using Router. (Creating, Analysing)

COURSE CONTENT

Module 1: Setup & Components (10 Hours)

Installing Node.js and npm, configuring the development environment, initializing projects using *create-react-app* or *Vite*, understanding the project folder structure, creating functional components, writing JSX, embedding JavaScript expressions, styling components (inline, CSS modules), rendering lists using *map()*, implementing keys, and designing conditional UI using logical operators and ternary expressions.

Module 2: State & Events (10 Hours)

Working with the *useState* Hook to manage component-level state, building a Counter application with event handlers, creating a Todo List with add/remove/update functionality, passing data between components using props, lifting state up, handling click, change, and submit events, and debugging state-related issues in React DevTools

Module 3: Hooks & Forms (12 Hours)

Building forms using controlled components, capturing and validating user inputs, implementing a Login form with basic validation rules, using the *useEffect* Hook for side effects, fetching data on component mount, cleaning up effects, dependency arrays, and working with asynchronous operations in React

Module 4: API Integration (14 Hours)

Fetching and displaying data from APIs using the Fetch API, building a search/filter feature on fetched data, integrating Axios for improved HTTP handling, implementing CRUD (Create, Read, Update, Delete) operations with Axios, working with API error handling, loading indicators, and designing reusable API service functions

Module 5: Mini Project Development & Evaluation (14 Hours) Students will build one mini-project such as:

Todo Manager
Weather App
Student/Employee Directory
Blog UI

Project Requirements

At least **5 database fields**
Proper routing & MVC structure
CRUD with validation
Blade template with layout
Display tables with pagination
User-friendly UI
Final demonstration

Recommended Books

1. Learning React – Alex Banks, Eve Porcello (O'Reilly)
2. Fullstack React – Accomazzo et al.
3. React Up & Running – Stoyan Stefanov

Suggested Web Links

<https://react.dev>
<https://reactrouter.com> <https://javascript.info> <https://beta.reactjs.org/learn>

Suggested MOOCs (SWAYAM / NPTEL)

NPTEL – Joy of Computing with Modern JavaScript
SWAYAM – Full Stack Development using MERN
NPTEL – Introduction to React (IIT Roorkee)

Mapping of CO to Modules

Course Outcomes	M1	M2	M3	M4	M5
CO1	L	M			
CO2		L	M		
CO3		L	M	H	
CO4			L	M	
CO5				H	L

COURSE CODE: API INTEGRATION AND DEVELOPMENT

(3 Credits - 45 Hours) (L-T-P: 3-0-0)

COURSE OBJECTIVE:

The primary objective of this course is to enable students to understand, design, and implement Application Programming Interfaces (APIs) in modern web applications. Students will learn how APIs enable communication between different software systems and how they can be designed securely, efficiently, and scalably.

COURSE / LEARNING OUTCOMES:

On successful completion of the course, students will be able to:

CO1: Explain the fundamental concepts and architecture of APIs and their role in full stack development. (Understanding) CO2: Design and develop RESTful APIs using suitable frameworks and standards. (Applying)

CO3: Integrate external and third-party APIs within web applications for extended functionalities. (Applying) CO4: Implement authentication, authorization, and security mechanisms in API development. (Analyzing)

CO5: Test, deploy, and document APIs for real-world applications ensuring performance and scalability. (Evaluating, Creating)

COURSE CONTENT:

Module I: (8 Hours)

Introduction to APIs: Overview of APIs – Concepts, Need and Benefits; API types: REST, SOAP, GraphQL; HTTP Methods and Status Codes; API Architecture and Lifecycle.

Module II: (10 Hours)

RESTful API Design and Development: Designing RESTful APIs; JSON and XML data exchange formats; Tools and Frameworks (Node.js, Express, Flask, or Django REST Framework); CRUD Operations and Routing.

Module III: (8 Hours)

API Integration Techniques: Consuming third-party APIs; Using Fetch/Axios in Frontend; API Rate Limiting; Error Handling; Webhooks and Real-time APIs.

Module IV: (9 Hours)

API Authentication and Security: Authentication vs Authorization; Token-based authentication (JWT, OAuth 2.0); Securing APIs against threats (CORS, SQL Injection, CSRF, Rate Limiting).

Module V: (10 Hours)

Testing, Deployment, and Documentation: API Testing (Postman, Swagger, Newman); Versioning; CI/CD for API Deployment; API Documentation; Monitoring and Analytics.

Recommended Books

1. RESTful Web APIs by Leonard Richardson, Mike Amundsen, and Sam Ruby — O'Reilly Media
2. API Design Patterns by J J Geewax — Manning Publications
3. Flask Web Development: Developing Web Applications with Python by Miguel Grinberg — O'Reilly Media
4. Designing Web APIs: Building APIs That Developers Love by Brenda Jin, Saurabh Sahni, and Amir Shevat — O'Reilly Media
5. Node.js Design Patterns by Mario Casciaro and Luciano Mammino — Packt Publishing

Suggested Web Links

<https://swagger.io/resources/articles/best-practices-in-api-design/>

<https://www.postman.com/api-platform/api-testing/>
<https://developers.google.com/>
<https://rapidapi.com/learn>

Mapping of CO to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	L		
CO2		H	M	L	
CO3		M	H	M	
CO4			M	H	M
CO5				M	H

COURSE CODE: API INTEGRATION AND DEVELOPMENT LAB (1 Credit - 30 Hours) (L-T-P: 0-0-2)

COURSE OBJECTIVE:

This laboratory course aims to provide students with hands-on experience in building, consuming, and testing APIs commonly used in full-stack applications. Students will learn how to integrate external services, manage asynchronous communication, handle authentication, and test API workflows using industry-standard tools.

COURSE / LEARNING OUTCOMES:

On successful completion of the course, students will be able to:

- CO1: Demonstrate the use of RESTful APIs and HTTP methods for basic communication in applications. (Applying)
- CO2: Integrate third-party APIs into client-side or server-side applications (Applying)
- CO3: Develop simple APIs using frameworks like Node.js/Express or Python/Flask (Creating)
- CO4: Implement authentication, authorization, and secure API access mechanisms (Analyzing)
- CO5: Use API testing tools such as Postman or Thunder Client to validate API workflows (Evaluating)

Module I: (4 Hours)

Introduction to APIs: REST, JSON, HTTP Methods, Status Codes

Module II: (6 Hours)

API Integration: Fetching and Posting Data using Fetch/Axios

Module III: (8 Hours)

Building Simple REST APIs using Node.js/Express

Module IV: (6 Hours)

API Authentication: API Keys, Tokens, JWT Basics

Module V: (6 Hours)

API Testing using Postman; Mock Server Creation

Recommended Books

1. API Design Patterns – JJ Geewax, O'Reilly Media
2. RESTful Web APIs – Leonard Richardson & Mike Amundsen, O'Reilly
3. Node.js Design Patterns – Mario Casciaro & Luciano Mammino, Packt Publishing
4. Learning RESTful Web Services – Subbu Allamaraju, O'Reilly

Suggested Web Links

Postman Learning Center: <https://learning.postman.com> Node.js Documentation: <https://nodejs.org/docs> Express.js Guide: <https://expressjs.com>
Public APIs Directory (Free APIs): <https://github.com/public-apis/public-apis>

Mapping of COs to Modules:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	L		
CO2		H	M	L	
CO3		L	H	M	
CO4			M	H	L
CO5			L	M	H

COURSE CODE: INTRODUCTION TO NOSQL**(3 Credits - 45 Hours) (L-T-P: 3-0-0)****COURSE OBJECTIVE:**

The course aims to develop a clear understanding of the fundamental differences between SQL and NoSQL database systems while introducing learners to the major NoSQL models, including key-value, document, column-family, and graph databases. It equips students with practical skills in MongoDB, focusing on CRUD operations, indexing techniques, and aggregation pipelines. The course further builds conceptual knowledge of scalability, sharding, and replication to illustrate how NoSQL systems support large, distributed data environments. Overall, the course enables learners to apply NoSQL technologies effectively to address large-scale data management and processing problems.

COURSE / LEARNING OUTCOMES:

On successful completion of the course, students will be able to:

CO1: Describe NoSQL concepts & types. (Remembering, Understanding)

CO2: Model data for NoSQL systems. (Remembering, Understanding, Analysing) CO3: Perform CRUD operations in MongoDB. (Creating, Applying)

CO4: Use indexing & aggregation pipelines. (Creating, Applying)

CO5: Explain distributed data features like sharding & replication. (Understanding)

COURSE CONTENT:**Module I: Introduction (6 Hours)**

Introduction to NoSQL, SQL vs NoSQL, Need for flexible and scalable data models, CAP theorem and its implications, BASE vs ACID overview, NoSQL types overview (key-value, document, column-family, graph)

Module 2: Key-Value & Document Databases (6 Hours)

Key-value database fundamentals, Redis basics and use-cases, Document database principles, JSON data models, Schema flexibility, MongoDB overview, Collections and document structure

Module 3: CRUD in MongoDB (6 Hours)

Insert operations, Update operations, Delete operations, Query operators, Comparison and logical operators, Filters and projections, Working with collections, Basic query execution

Module 4: Indexing & Aggregation (6 Hours)

Single-field indexes, Compound indexes, Index selection and optimization, Aggregation framework overview, Match stage, Group stage, Project stage, Aggregation pipelines, Multi-stage data processing

Module 5: Scaling NoSQL Systems (6 Hours)

Replication concepts, Replica sets in MongoDB, Sharding principles, Horizontal scaling, Partitioning strategies, Data distribution across shards, High availability and fault tolerance, NoSQL use-cases in big data and real-time applications

Recommended Books

1. MongoDB: The Definitive Guide – Shannon Bradshaw
2. NoSQL Distilled – Pramod J. Sadalage & Martin Fowler
3. Practical MongoDB – Shakuntala Gupta

Suggested Web Links

MongoDB Documentation <https://www.mongodb.com/docs> MongoDB Atlas (Cloud Version) <https://www.mongodb.com/atlas> MongoDB University Courses <https://learn.mongodb.com>
Mongo Playground <https://mongoplayground.net>

Suggested MOOCs (SWAYAM / NPTEL) NPTEL – Big Data Computing SWAYAM – MongoDB for Developers

Mapping of COs to Modules:

Course Outcomes	M1	M2	M3	M4	M5
CO1	M				
CO2		L	M		
CO3			L	H	H
CO4				L	M
CO5			L	M	H

COURSE CODE: INTRODUCTION TO NOSQL LAB (1 Credit - 30 Hours) (L-T-P: 0-0-2)

COURSE OBJECTIVE:

By the end of this lab course, students will be able to install and configure MongoDB, perform essential CRUD operations and apply indexing for query optimization, execute aggregation pipelines for data analysis, and design effective NoSQL data models aligned with application requirements.

COURSE / LEARNING OUTCOMES:

On successful completion of the course, students will be able to:

CO1: Install, configure NoSQL database. (Understanding)

- CO2:** Perform CRUD operations. (Creating)
- CO3:** Use indexes for optimization. (Creating, Analyzing)
- CO4:** Execute aggregation pipelines. (Analyzing, Applying)
- CO5:** Build a small NoSQL-based dataset project. (Evaluating)

Module 1: MongoDB Installation, Setup & Basic Commands (5 Hours)

Install MongoDB Community Edition, Install MongoDB Compass GUI, Introduction to MongoDB Shell, Starting MongoDB server & connecting client, Creating databases and switching context (use *dbname*), Listing databases & collections, Understanding BSON vs JSON, Insert and view simple records

Module 2: CRUD Operations on Collections (5 Hours)

Insert documents (*insertOne*, *insertMany*), Read operations (*find*, *findOne*), Query operators (*\$gt*, *\$lt*, *\$in*, *\$or*, *\$and*), Update operations (*updateOne*, *updateMany*, *\$set*, *\$inc*), Delete operations (*deleteOne*, *deleteMany*), Projection (select specific fields), Sorting & limiting records

Module 3: Indexing, Query Optimization & Aggregation (6 Hours)

Need for indexing, Creating single-field and compound indexes, Viewing indexes, Aggregation pipeline basics, Using stages:
\$match, *\$group*, *\$project*, *\$sort*, *\$limit*
Counting, grouping, and summarizing data, Performance considerations

Module 4: MongoDB Shell, Compass & Data Modeling (6 Hours)

Designing document structure, Embedded documents vs references, Using MongoDB Compass for: CRUD, Visual query builder, Aggregation builder, Exporting data to JSON/CSV
Importing large datasets, Using *\$lookup* for performing joins in NoSQL, Best practices for data modeling

Module 5: Mini Project Development & Evaluation (8 Hours)

Students will build one mini-project
such as: At least 3–5 collections
Proper document structure (embedded/linked) CRUD operations
Indexing Aggregation pipeline
A short report with screenshots

Recommended Books

1. MongoDB: The Definitive Guide – Shannon Bradshaw
2. NoSQL Distilled – Pramod J. Sadalage & Martin Fowler
3. Practical MongoDB – Shakuntala Gupta

Suggested Web Links

MongoDB Documentation <https://www.mongodb.com/docs> MongoDB Atlas (Cloud Version) <https://www.mongodb.com/atlas> MongoDB University Courses <https://learn.mongodb.com>
Mongo Playground <https://mongoplayground.net>

Suggested SWAYAM / NPTEL MOOCs NPTEL – Big Data Computing SWAYAM – MongoDB for Developers

Mapping of COs to Modules:

Course Outcomes	M1	M2	M3	M4	M5
CO1	L				
CO2	M	H			
CO3		L	H		
CO4			L	H	
CO5				M	H

COURSE CODE: INTRODUCTION TO DATA SCIENCE

(3 Credits - 45 Hours) (L-T-P: 3-0-0)

COURSE OBJECTIVE:

The objective of this course is to introduce students to the fundamental concepts, tools, and techniques of Data Science. It enables learners to understand essential preprocessing methods, basic statistical analysis, and core machine learning approaches used in data-driven decision-making. The course further provides exposure to data visualization, time-series basics, and applications in business, social media, and big data analytics. By the end of the course, students will develop the ability to analyze datasets, build simple models, and interpret insights for real-world applications.

COURSE / LEARNING OUTCOMES:

On successful completion of the course, students will be able to:

- CO1: Explain the core concepts of data science, preprocessing, and visualization techniques. (Understanding)
- CO2: Apply descriptive statistics, probability concepts, and hypothesis testing to analyze datasets. (Applying)
- CO3: Implement basic machine learning algorithms for classification, regression, and unsupervised learning tasks. (Applying)
- CO4: Analyze time-series data and perform simple forecasting using classical models. (Analyzing)
- CO5: Describe real-world applications of data science in social media, business analytics, and big data ecosystems. (Understanding)

COURSE CONTENT:

Module I: Introduction, Preprocessing & Visualization (12 Hours)

Introduction to Data Science: Data Analytics Life Cycle, Types of Data Analysis, Types of Jobs in Data Analytics, Data Science Tools, Fundamentals Areas of Study in Data Science

Data Preprocessing: Data Types and Forms, Possible Data Error Types, Various Data Preprocessing Operations - Data Cleaning, Data Transformation, Data Reduction

Data Visualization: Basic plotting (Histograms, Bar Charts, Scatter Plots, Line Charts, Area Plots, Pie Charts, Donut Charts), Box Plots, Bubble Plots, Violin Plots, Heat Map, Wordclouds

Module II: Statistical Analysis & Machine Learning Basics (14 Hours)

Statistical Analysis: Kinds of Statistics, Descriptive Statistics (Measures of Frequency, Central Tendency, Dispersion, and Position), Hypothesis Testing (Introduction)

Machine Learning: supervised learning (linear regression, logistic regression, KNN), unsupervised learning (K-Means, PCA), Introduction to association rules

Module III: Time-Series & Intro to Deep Learning (9 Hours)

Time-Series: Components of Time-Series, Time-Series Forecasting Models using Stochastic Models (AR, MA and ARMA)

Deep Learning: Introduction to neural networks, activation functions, basics of ANN and CNN

Module IV: Applications – Social Media and Business Analytics (10 Hours)

Social Media Analytics: text analytics, sentiment analysis, trend analysis (overview).

Business Analytics: lifecycle, financial/market/customer analytics

Suggested Readings

1. G. Nandi, R. K. Sharma, **Data Science Fundamentals and Practical Approaches**, BPB, 1st Edition, 2020.
2. J. Grus, **Data Science from Scratch: First Principles with Python**, O'Reilly, 2nd Edition, 2019
3. Silberschatz, H. F. Korth, S Sudarshan, *Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools*, 1st Edition, Dreamtech, 2016
4. C. Neil, R. Schutt, **Doing Data Science: Straight Talk from the Frontline**, O'Reilly, 1st Edition, 2019.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	L
CO2	L	H	L	L
CO3	L	H	M	L
CO4	L	M	H	L
CO5	L	L	M	H

COURSE CODE: INTRODUCTION TO DATA SCIENCE LAB

(2 Credits - 60 Hours) (L-T-P: 0-0-4)

COURSE OBJECTIVE:

The objective of this lab course is to provide hands-on experience in the essential components of data science, including data preprocessing, exploratory data analysis, visualization, and basic machine learning workflows using Python. Students will learn how to clean, transform, and analyze datasets; create effective visualizations using libraries such as Matplotlib, Seaborn, and Plotly; and apply simple supervised and unsupervised learning models for practical problem-solving. The course aims to equip learners with applied data-handling skills and foundational analytical techniques essential for real-world data-driven decision-making.

COURSE / LEARNING OUTCOMES:

On successful completion of the course, students will be able to:

CO1: Perform data loading, cleaning, and preprocessing using Python and pandas. *(Applying)*

CO2: Conduct exploratory data analysis and generate statistical summaries. *(Analyzing)*

CO3: Create effective data visualizations using Matplotlib, Seaborn, and Plotly. *(Applying)*

CO4: Implement basic supervised and unsupervised machine learning models using scikit-learn. *(Applying)*

CO5: Develop a mini data analysis project involving preprocessing, visualization, and modelling. *(Creating)*

COURSE CONTENT:**Module I: Data Handling & Preprocessing (20 Hours)**

Introduction to Python for Data Science; Pandas for data loading; inspection of datasets; handling missing values; data cleaning; data type conversions; encoding categorical variables; outlier detection; normalization and standardization; feature extraction and feature selection basics.

Module II: Exploratory Data Analysis & Visualization (20 Hours)

Data summarization; measures of central tendency and dispersion; correlation analysis; univariate & multivariate analysis; plots using Matplotlib (line, bar, histogram, scatter); Seaborn (pairplot, heatmap, boxplot, violin); Plotly for interactive charts; visualization best practices.

Module III: Machine Learning Basics (20 Hours)

Train-test split, ML workflow; supervised learning (linear regression and logistic regression); unsupervised learning (k-means); model evaluation metrics—accuracy, precision, recall, RMSE
Mini project: data preprocessing → visualization → modelling → report.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO1	H	M	L
CO2	M	H	L
CO3	L	H	M
CO4	L	M	H
CO5	M	M	M

COURSE CODE: MACHINE LEARNING

(3 Credits - 45 Hours) (L-T-P: 3-0-0)

COURSE OBJECTIVE:

The objective of this course is to introduce the core concepts and techniques of Machine Learning, including supervised, unsupervised, and reinforcement learning. It aims to build foundational understanding of model training, evaluation, and key ML algorithms and tools, while also creating awareness of real-world applications and the ethical and societal implications of ML.

COURSE / LEARNING OUTCOMES:

- CO1: Explain the fundamental concepts, types, and applications of Machine Learning. (Understanding)
- CO2: Apply supervised learning algorithms for regression and classification problems. (Applying)
- CO3: Analyze unsupervised learning algorithms for clustering and dimensionality reduction. (Analyzing)
- CO4: Evaluate machine learning models using appropriate performance metrics. (Evaluating)
- CO5: Demonstrate understanding of advanced ML techniques, frameworks, and ethical considerations. (Understanding)

COURSE CONTENT:**Module I (9 Hours)**

Introduction to Machine Learning: Definition, history, and applications of ML; types of learning – supervised, unsupervised, semi-supervised, reinforcement; labeled vs. unlabeled data; learning framework – training, validation, and testing; overfitting and underfitting; performance evaluation metrics – confusion matrix, accuracy, precision, recall, F1-score, and AUC.

Module II (9 Hours)

Supervised Learning – Regression and Classification: Regression – linear, multiple, polynomial, and logistic regression; cost function and gradient descent; Classification – Naïve Bayes, K-Nearest Neighbors

(KNN), Decision Trees, Support Vector Machines (SVM); Regularization – Lasso and Ridge regression; evaluation metrics – MSE, RMSE, R^2 .

Module III (9 Hours)

Unsupervised Learning: Clustering – K-Means, Hierarchical Clustering, DBSCAN; cluster evaluation – silhouette score; Dimensionality Reduction – Principal Component Analysis (PCA); feature selection and extraction; Applications of clustering and PCA in visualization and data compression.

Module IV (9 Hours)

Model Evaluation and Optimization: Bias-variance trade-off; cross-validation methods – k-fold, stratified; Performance metrics – confusion matrix, precision, recall, F1-score, ROC curve, AUC; Hyperparameter tuning – grid search and random search; Ensemble techniques – bagging, boosting, random forest, and AdaBoost.

Module V (9 Hours)

Advanced Topics and Applications: Introduction to Neural Networks and Deep Learning; perceptron model; introduction to TensorFlow and Scikit-learn; Applications of ML in healthcare, finance, recommendation systems, image recognition, and natural language processing; Ethical issues and challenges in ML – bias, fairness, transparency, and explainability.

Suggested Readings

1. Rajiv Chopra - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024 (AICTE Recommended).
2. Tom Mitchell - Machine Learning, McGraw Hill Education, 2025.
3. Oliver Theobald - Machine Learning for Absolute Beginners: A Plain English Introduction, Sanage Publishing House, 2024.
4. Manaranjan Pradhan, U Dinesh Kumar - Machine Learning using Python, Second Edition Wiley, 2024.

Suggested Web Links

Scikit-learn Documentation, <https://scikit-learn.org/stable>

Coursera – Machine Learning by Andrew Ng <https://www.coursera.org/learn/machine-learning>

Fast.ai – Practical Deep Learning for Coders <https://course.fast.ai>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			M
CO2	L	H		
CO3		L	H	
CO4			M	
CO5				H

COURSE CODE: MACHINE LEARNING LAB (1 Credit - 30 Hours) (L-T-P: 0-0-2)**COURSE OBJECTIVE:**

The objective of this lab course is to provide hands-on experience in implementing core Machine Learning algorithms using Python, enabling students to understand and evaluate supervised and unsupervised learning techniques. It further aims to develop practical skills in model optimization, dimensionality reduction, and ensemble methods, while guiding students to build, analyze, and interpret predictive models using real-world datasets.

COURSE / LEARNING OUTCOMES:

- CO1: Implement and evaluate supervised learning algorithms such as KNN, linear and logistic regression, and measure model performance. *(Applying)*
- CO2: Apply and visualize clustering algorithms such as K-Means, hierarchical clustering, and DBSCAN for real-world data. *(Applying)*
- CO3: Perform dimensionality reduction using PCA and interpret the transformed features. *(Applying)*
- CO4: Develop and assess classification models using random forests, SVMs, and neural networks. *(Applying)*
- CO5: Demonstrate ensemble learning concepts through bagging and boosting techniques. *(Applying)*

LIST OF EXPERIMENTS

Lab No.	Task
1.	Implement linear regression on a dataset and visualize the regression line.
2.	Implement logistic regression on a binary classification dataset and plot the decision boundary.
3.	Implement and evaluate the performance of a Decision Tree (ID3/CART) classifier for a given dataset.
4.	Implement and evaluate the performance of the Naïve Bayes classifier on a dataset.
5.	Build and evaluate a Random Forest classifier using a numerical dataset.
6.	Implement a Support Vector Machine (SVM) for linearly separable data and visualize the decision boundary.
7.	Implement K-Means clustering on a dataset; visualize and evaluate the clusters.
8.	Implement hierarchical clustering on a dataset and plot the dendrogram.
9.	Implement DBSCAN clustering on a dataset and visualize and evaluate the clusters.
10.	Perform Principal Component Analysis (PCA) and compare model performance with and without feature reduction.
11.	Build a single-layer perceptron to classify AND, OR, and XOR problems (using TensorFlow/Keras); visualize decision boundaries.
12.	Demonstrate the concept of boosting using the AdaBoost algorithm.
13.	Optional Mini Project: Train and evaluate a complete ML pipeline on a real-world dataset (data preprocessing, training, evaluation, visualization).

Suggested Readings

1. Rajiv Chopra - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Khanna Book Publishing Company, 2024 (AICTE Recommended).
2. Tom Mitchell - Machine Learning, McGraw Hill Education, 2025.
3. Oliver Theobald - Machine Learning for Absolute Beginners: A Plain English Introduction, Sanage Publishing House, 2024.
4. Manaranjan Pradhan, U Dinesh Kumar - Machine Learning using Python, Second Edition Wiley, 2024.

Mapping of COs to Modules

Course Outcomes	Lab 1-2	Lab 3-5	Lab 6-9	Lab 10-11	Lab 12-13
C01	H				
C02		H	H		
C03				H	
C04		H		H	
C05					H

COURSE CODE: TIME SERIES ANALYSIS**(3 Credits - 45 Hours) (L-T-P: 3-0-0)****COURSE OBJECTIVE:**

The objective of this course is to provide learners with a solid foundation in the principles, methods, and applications of Time Series Analysis. The course aims to equip students with the knowledge and practical skills necessary to understand time-dependent data, analyze trend and seasonal patterns, apply classical and modern forecasting models such as ARMA and ARIMA, and evaluate forecasts responsibly using appropriate accuracy measures and real-world decision-making frameworks.

COURSE / LEARNING OUTCOMES:

C01: Explain the fundamental concepts of time series data, its components, and basic patterns. (*Understanding*)

C02: Apply classical techniques for trend estimation, seasonality analysis, smoothing, and deseasonalization to real datasets.

(*Applying*)

C03: Identify and interpret AR, MA, ARMA, and ARIMA models using ACF/PACF and perform basic forecasting. (*Analyzing*)

C04: Use Python tools to visualize time series, build forecasting models, and evaluate predictions with standard accuracy metrics (MAE, RMSE, MAPE). (*Applying/Analyzing*)

COURSE CONTENT:**Module I: Basics of Time Series (10 Hours)**

Introduction to time series data and simple real-life examples; Components of a time series — trend, seasonal, cyclic, irregular; Additive and multiplicative models; Plotting and understanding patterns; Concept of stationarity (very basic); Autocorrelation (ACF) — simple interpretation only.

Module II: Trend and Seasonal Analysis (12 Hours)

Trend estimation — semi-averages, moving averages, least-squares linear trend; Seasonal variation estimation — simple averages, ratio-to-trend, ratio-to-moving-average; Deseasonalization and reconstructing a time series; Smoothing methods — moving average, simple exponential smoothing.

Module III: ARMA and ARIMA Models (14 Hours)

Introduction to AR (Auto-Regressive) and MA (Moving Average) models — meaning, simple examples; ARMA models — interpretation using ACF/PACF; Introduction to ARIMA — idea of differencing, autoregression, moving average (no mathematical proofs); Identifying ARMA/ARIMA models from patterns in ACF/PACF; Simple forecasting using ARIMA (conceptual steps); Forecast accuracy — MAE, RMSE, MAPE.

Module IV: Applications and Practical Understanding (9 Hours)

Forecasting workflow — train/test split, plotting predictions; Demonstration of time series forecasting using Python libraries (pandas, statsmodels); Case examples: sales forecasting, weather patterns, website traffic;

Limitations and common issues in time series analysis; Practical tips for selecting forecasting methods.

Suggested Readings:

1. Time Series Analysis by James D. Hamilton, 1st Edition, Levant Books, 2012. ISBN: 978-9380663432
2. Time Series Analysis and Its Applications (With R Examples), Shumway, R.H., and Stoffer, D.S. 4th Edition, Springer-Verlag, New York. ISBN: 978-3319524511.
3. Introduction to Time Series Analysis and Forecasting by Montgomery, D.C., Jennings, C.L., & Kulahci, M., 2nd Edition, Wiley. ISBN: 978-1118745113

Suggested Web Links

[Udemy Course on Time Series Analysis in Python.](#)

NPTEL Course: [Applied Time Series Analysis](#)

NPTEL Course: [Time Series Modelling and Forecasting with Applications in R](#)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	L
CO2	L	H	M	L
CO3	L	M	H	M
CO4	L	L	M	H

COURSE CODE: TIME SERIES ANALYSIS LAB (1 Credit - 30 Hours) (L-T-P: 0-0-2)

COURSE OBJECTIVE:

The objective of this lab course is to equip learners with practical skills for analyzing, modeling, and forecasting time-dependent data. Students will gain hands-on experience in visualizing time series, applying smoothing techniques, estimating trends and seasonal components, building ARIMA-family models, and evaluating forecasting performance using standard accuracy metrics.

COURSE / LEARNING OUTCOMES:

At the end of the lab experiments, students will be able to learn-

- CO1:** Apply essential time series techniques—including visualization, decomposition, trend estimation, seasonality analysis, and smoothing—to explore and preprocess real-world datasets. (Applying)
- CO2:** Identify, build, and validate AR, MA, ARMA, and ARIMA models using ACF/PACF patterns, perform differencing where needed, and generate short-term forecasts. (Analysing)
- CO3:** Evaluate and interpret forecasting results using accuracy metrics such as MAE, RMSE, and MAPE, and compare model performance for decision-making. (Evaluating)

Lists of experiments:

Module I: Introduction to Time Series & Visualization (12 Hours)

- A. Import and clean real-world time series datasets (stock prices, weather, sales).
- B. Create line plots, lag plots, and ACF plots to identify trend, seasonality, and cyclic behaviour

Module II: Trend & Seasonal Estimation (16 Hours)

- A. Compute semi-averages and moving averages for long-term trend estimation.
- B. Fit a linear trend using least-squares method and evaluate goodness of fit.
- C. Compute seasonal indices using:
 - Simple averages
 - method Ratio-to-trend method
 - Ratio-to-moving-average method
- D. Perform deseasonalization and reconstruction of the original series

Module III: Smoothing & ARMA/ARIMA Modelling (16 Hours)

- A. Apply simple, weighted moving averages and simple exponential smoothing.
- B. Interpret ACF and PACF plots to identify the order of AR and MA components.
- C. Fit ARMA/ARIMA models using Python/R, tune parameters, and perform residual diagnostics (including Ljung–Box test).

Module IV: Forecasting & Accuracy Evaluation (16 Hours)

- A. Generate short-term and long-term forecasts and visualize forecast intervals.
- B. Compare forecasted and actual values using:
 - Mean Absolute Error (MAE)
 - Root Mean Square Error (RMSE)
 - Mean Absolute Percentage Error (MAPE)

Suggested Readings

1. Time Series Analysis by James D. Hamilton, 1st Edition, Levant Books, 2012. ISBN: 978-9380663432
2. Time Series Analysis and Its Applications (With R Examples), Shumway, R.H., and Stoffer, D.S. 4th Edition, Springer-Verlag, New York. ISBN: 978-3319524511.
3. Introduction to Time Series Analysis and Forecasting by Montgomery, D.C., Jennings, C.L., & Kulahci, M., 2nd Edition, Wiley. ISBN: 978-1118745113

Suggested Web Links

[Udemy Course on Time Series Analysis in Python.](#)

NPTEL Course: [Applied Time Series Analysis](#)

NPTEL Course: [Time Series Modelling and Forecasting with Applications in R](#)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	M	L
CO2	M	M	H	H
CO3	L	M	M	H

SEMESTER – VI

COURSE CODE: GENERATIVE AI
(2 Credits - 30 Hours) (L-T-P: 2-0-0)

COURSE OBJECTIVE:

The objective of this course is to provide learners with a solid foundation in the principles, models, and applications of Generative Artificial Intelligence. The course aims to equip students with the knowledge and practical skills necessary to understand core generative architectures, apply prompt engineering techniques, utilize modern generative tools, and evaluate outputs responsibly using appropriate metrics and ethical frameworks.

COURSE / LEARNING OUTCOMES:

At the end of this course students will be able to:

CO1: Explain and illustrate the fundamental concepts and probabilistic foundations underlying Generative AI models. (Understanding, Applying)

CO2: Analyze and apply core generative architectures — including VAEs, GANs, Diffusion Models, and Transformers — for content generation tasks. (Analyzing, Applying)

CO3: Design and implement effective prompts and utilize modern generative tools and APIs for text and image generation. (Creating, Applying)

CO4: Evaluate and interpret generative model outputs using established metrics, and assess ethical, creative, and responsible AI practices. (Evaluating)

Module 1: Fundamentals of Generative AI (8 Hours)

Overview of AI vs Generative AI, history and evolution, discriminative vs generative models, Applications, Probability basics: random variables, distributions, expectation, conditional probability

Module II: Core Generative Architectures (8 Hours)

Neural networks recap, Autoencoders, Variational Autoencoders (VAE), Generative Adversarial Networks (GAN): min-max game, DCGAN, WGAN, mode collapse, vanishing gradients; Transformer (self-attention, GPT architecture) and Diffusion Models, Large Language Models (LLMs) overview- scaling laws, in-context learning.

Module III: Prompt Engineering and Applications (8 Hours)

Principles of prompt design, zero-shot / few-shot prompting, chain-of-thought prompting, image prompt styles; APIs: ChatGPT, Hugging Face, DALL·E, Stable Diffusion, Midjourney; using APIs for generation (OpenAI, Hugging Face).

Module IV: Evaluation and Responsible AI (6 Hours)

Evaluation metrics for generative models — BLEU, ROUGE, FID, Inception Score, perplexity, human evaluation; Risks & Challenges: Hallucinations, bias, misinformation, deepfakes, Ethical Issues-copyright, authorship, IP in AI art/code; Responsible AI principles; Future directions of Generative AI- Reasoning models, AI agents, autonomous reasoning systems.

Suggested Readings

1. David Foster, Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, 2nd Edition, O'Reilly Media, ISBN: 978-1098134181
2. Ben Auffarth, Generative AI with LangChain: Build Large Language Model (LLM) Apps with Python, ChatGPT and Other LLMs, 1st Edition, Packt Publishing, ISBN: 978-1836200290
3. Navveen Balani, Prompt Engineering: Unlocking Generative AI: Ethical Creative AI for

All, 1st Edition, ISBN: 9798390549285

E Resources

1. Simplilearn course on Professional Certificate Program In Generative AI And Machine Learning
2. Coursera course on Generative AI: Introduction and Applications
3. Udemy course on Complete Generative AI Course with LangChain & Hugging Face
4. Coursera course on Prompt Engineering Specialization

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2	L	H	M	H
CO3		L	H	L
CO4			M	H

COURSE CODE: TIME SERIES ANALYSIS LAB**(2 Credits - 60 Hours) (L-T-P: 0-0-4)****COURSE OBJECTIVE:**

The objective of this lab course is to provide learners with hands-on experience in the use of generative AI tools, models, and APIs for text and image generation. It aims to help students understand, experiment with, and apply prompt engineering, fine-tuning, and evaluation methods to create responsible and creative AI-generated outputs.

COURSE / LEARNING OUTCOMES:

At the end of the lab experiments, students will be able to learn-

- CO1:** Apply foundational concepts of generative AI to create and manipulate text and image outputs using pre-trained models. (Applying)
- CO2:** Develop effective prompts and use generative AI APIs or open-source models for content creation and experimentation. (Applying, Creating)
- CO3:** Evaluate generated outputs using standard metrics and demonstrate awareness of ethical, bias, and responsible AI considerations. (Creating)

Lists of experiments:

Module I: Introduction to Generative AI Tools (6 Hours)

Explore text generation using ChatGPT or similar tools (story, summary, code). Generate and compare images using DALL·E or Stable Diffusion.

Module II: Prompt Engineering (8 Hours)

Experiments on zero-shot, few-shot, and chain-of-thought prompting. Role-based and negative prompts for refinement. Design structured prompts for image generation (style and composition).

Module III: Working with APIs and Simple Applications (8 Hours)

Write a program to generate text or image using a public API
 Build a simple generative application (e.g., chatbot or caption generator).
 Demonstrate model fine-tuning or customization concepts (LoRA, DreamBooth – conceptual).

Module IV: Evaluation and Responsible AI (8 Hours)

Use metrics such as BLEU, ROUGE, FID, or CLIPScore to assess text and image generation quality. Case studies on hallucination, misinformation, and content bias.

Suggested Readings

1. David Foster. Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play, 2nd Edition, O'Reilly Media, 2023. ISBN: 978-1098134181
2. Ian Goodfellow, Yoshua Bengio, and Aaron Courville. Deep Learning, 1st Edition, MIT Press, 2016. ISBN: 978-0262035613
3. Jakub Langr and Vladimir Bok. Deep Generative Modeling, 1st Edition, O'Reilly Media, 2019. ISBN: 978-1492041948
4. Melanie Mitchell. Artificial Intelligence: A Guide for Thinking Humans, 1st Edition, Penguin Books, 2019. ISBN: 978-0241404829

Suggested Web Links

[Udemy course on Complete Generative AI Course with LangChain & Hugging Face](#)
Learn Prompting: <https://learnprompting.org>
NPTEL Course: [Generative AI and Large Language Models](#)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	L
CO2	M	H	H	
CO3		M	M	H

COURSE CODE: SOFT SKILLS

(2 Credits - 30 Hours) (L-T-P: 1-1-0)

COURSE OBJECTIVE:

This course aims to equip students with essential soft skills required for personal and professional success by developing effective communication abilities, interpersonal competencies, and workplace etiquette. It focuses on enhancing presentation skills, business writing, teamwork, leadership, and problem-solving capabilities while fostering confidence for real-world interactions. The course also prepares students for employability by strengthening their résumé-building, interview performance, and group discussion skills, enabling them to transition smoothly into professional environments.

COURSE / LEARNING OUTCOMES:

At the end of this course, students will be able to:

- CO1: Explain the foundational concepts of soft skills, professional etiquette, and workplace communication. (Understanding)
- CO2: Apply effective interpersonal skills, teamwork strategies, and conflict-resolution techniques in simulated workplace settings. (Applying)
- CO3: Demonstrate proficiency in presentation skills, business writing, and public speaking. (Applying)
- CO4: Evaluate personal strengths, prepare résumés, and confidently participate in interviews and group discussions. (Evaluating)

COURSE CONTENT:

Module I: Introduction to Soft Skills (4 Hours)

Soft Skills - meaning, importance, and scope; Components of soft skills for IT professionals; Positive attitude, motivation, and emotional intelligence; Professional ethics and workplace behaviour; Time management techniques

Module II: Communication Skills (6 Hours)

Verbal and non-verbal communication, listening skills and barriers to communication, Interpersonal communication and relationship building, Email writing etiquette and formal communication, Business writing: circulars, memos, notices, minutes, public speaking basics

Module III: Presentation & Professional Skills (6 Hours)

Elements of an effective presentation, Slide design, storytelling and audience engagement, Body language, voice modulation, and stage presence, conducting meetings and making reports, Telephone and virtual meeting etiquette (Zoom/Teams)

Module IV: Teamwork & Leadership (6 Hours)

Working in teams: roles and responsibilities, Collaboration and conflict resolution, Leadership styles: democratic, transformational, situational; Problem solving and decision-making techniques, Creativity and innovation at the workplace

Module V: Career Skills & Employability Training (8 Hours)

Résumé and CV preparation (chronological, functional, hybrid), Cover letter writing, Aptitude basics: logical reasoning, numerical ability (overview)
Group Discussion skills: Do's, Don'ts, Mock Practice; Personal Interview skills: HR + Technical rounds; Grooming, confidence building, and personal branding; Professional networking (LinkedIn basics)

Suggested Readings

1. Soft Skills: Enhancing Employability by G. R. Kiran
2. Personality Development and Soft Skills by Barun Mitra
3. Communication Skills by Sanjay Kumar & Pushp Lata
4. Business Communication e-Resources (AICTE, NPTEL, SWAYAM)

COURSE CODE: MINOR PROJECT

(4 Credits - 120 Hours) (L-T-P: 0-0-8)

Learning Objective:

The Minor Project aims to provide students with an opportunity to apply their cumulative learning to a real-world problem by engaging in independent or group-based project work under faculty guidance. It enables students to integrate theoretical knowledge with practical implementation, develop problem-solving and analytical skills, and demonstrate competence in research, design, development, and evaluation of a functional solution or system. Through systematic project execution, documentation, and presentation, students gain hands-on experience, strengthen professional and technical skills, and prepare for industry-oriented roles or higher studies.

COURSE / LEARNING OUTCOMES:

After completing this Minor Project course, students will be able to:

CO1: Identify, define, and analyze a real-world problem by formulating clear objectives, scope, and requirements. (Analyzing)

- CO2:** Design the system architecture, workflow, or methodology using appropriate tools, techniques, or models. (Applying)
CO3: Implement the proposed solution using relevant technologies, frameworks, or programming environments. (Creating)
CO4: Demonstrate the project outcome through presentations, demonstrations, and justification of design and implementation decisions. (Evaluating)
CO5: Prepare a well-structured project report documenting requirements, methodology, results, and conclusions. (Creating)

EVALUATION OF PROJECTS

The guidelines for the conduct and evaluation of Minor Projects shall be laid down by the Department. The components of evaluation and allotment of marks may be as follows:

In Semester Evaluation (weightage 60)	Marks	End Semester Evaluation (Weightage 40)	Marks
Synopsis	10	Project Implementation	20
Progress Seminar presentation I (Analysis and Design)	20	Presentation	5
Progress Seminar presentation II (Implementation)	20	Report	10
Attendance	10	Viva Voce	5
TOTAL	60	TOTAL	40
GRAND TOTAL			100

COURSE CODE: BACK-END DEVELOPMENT USING NODE.JS AND EXPRESS.JS (3 Credits - 45 Hours) (L-T-P: 3-0-0)

COURSE OBJECTIVE:

This course aims to equip students with the foundational and advanced skills required for modern back-end web development using Node.js and Express.js. Students will understand the architecture of server-side applications, learn to build RESTful APIs, and manage asynchronous operations effectively.

COURSE / LEARNING OUTCOMES:

- CO1: Explain the core concepts of Node.js environment, event-driven architecture, and asynchronous programming. (Understanding)
 CO2: Develop server-side applications using Express.js framework and implement RESTful APIs. (Applying)
 CO3: Integrate Node.js applications with databases (MongoDB/MySQL) for CRUD operations. (Applying)
 CO4: Implement authentication, authorization, middleware, and security best practices in back-end development. (Evaluating)
 CO5: Deploy, test, and optimize Node.js applications using modern tools and cloud services. (Applying)

COURSE CONTENT:

Module 1: (8 Hours)

Introduction to Node.js: What is Node.js? Why use it? Node.js architecture and event-driven model, NPM (Node Package Manager); Asynchronous programming fundamentals: callbacks, promises, async/await; Basic modules: fs, http, events.

Module 2: (10 Hours)

Express.js Framework: Introduction to Express.js, Routing techniques, Middleware types (built-in, third-party, custom), Templating and static files, Error handling in Express.js.

Module 3: (9 Hours)

RESTful API Development: Principles of REST, Creating and structuring APIs, Handling requests and responses, Validation and sanitization of user input, Postman/Thunder Client for API testing

Module 4: (10 Hours)

Database Integration (MongoDB/MySQL): MongoDB: collections, documents, Mongoose ORM; MySQL: schema, tables, Sequelize ORM (optional); CRUD operations (Create, Read, Update, Delete); Connecting Node.js with database; Data modelling and indexing basics.

Module 5: (8 Hours)

Authentication, Security & Deployment: JWT-based authentication, Session management, Securing APIs: CORS, Helmet, rate limiting, Deployment on cloud platforms (Render, Railway, AWS, Vercel), Environment variables & production build management.

Recommended Books

1. Node.js Web Development by David Herron — Packt Publishing
2. Learning Node.js Development by Andrew Mead — O'Reilly Media
3. Express in Action: Writing, building, and testing Node.js applications" by Evan Hahn — Manning Publications
4. MongoDB: The Definitive Guide by Shannon Bradshaw, Eoin Brazil, Kristina Chodorow — O'Reilly
5. Web Development with Node and Express by Ethan Brown — O'Reilly Media

Suggested Web Links

Node.js Official Documentation: <https://nodejs.org>
 Express.js Documentation: <https://expressjs.com>
 MongoDB Documentation: <https://www.mongodb.com/docs>
 MySQL Documentation: <https://dev.mysql.com/doc>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	L	L		
CO2	L	H	H	M	
CO3		M	M	H	
CO4		M	M	M	H
CO5		L	M	M	H

COURSE CODE: INTRODUCTION TO DEVOPS

(2 Credits - 30 Hours) (L-T-P: 2-0-0)

COURSE OBJECTIVE:

The objective of this course is to introduce the principles, practices, and tools of DevOps that bridge the gap between software development and operations. It aims to help students understand continuous integration and deployment (CI/CD), automation, containerization, and monitoring practices to improve software delivery and reliability. The course also focuses on understanding the DevOps culture, tools, and workflow used in modern software engineering.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: Explain the fundamental concepts, culture, and principles of DevOps. (Remembering)

CO2: Understand the DevOps lifecycle, continuous integration and deployment pipeline, and automation process. (Understanding)

CO3: Apply DevOps tools for version control, build automation, and container management. (Applying)

CO4: Demonstrate the deployment and monitoring process in a DevOps environment. (Creating)

COURSE CONTENT:

Module I (10 Hours)

Definition, need, and evolution of DevOps; Traditional vs Agile vs DevOps; DevOps culture and principles; DevOps lifecycle and workflow; Benefits and challenges of DevOps adoption; Key components - Continuous Integration, Continuous Deployment, Continuous Testing, and Continuous Monitoring; Overview of DevOps tools ecosystem, Scripting and automation basics: YAML/JSON

Module II (10 Hours)

Version Control Systems - Introduction to Git and GitHub; Branching, Merging, and Pull Requests; Build Automation and Continuous Integration using Jenkins; Configuration Management - Introduction to Ansible, Puppet, and Chef; Containerization - Concepts of Docker, Images, Containers, and Docker Hub; Introduction to Kubernetes for container orchestration; Infrastructure as Code (IaC) fundamentals, Management of large-scale distributed systems using different tools: Apache Kafka, Zookeeper.

Module III (10 Hours)

Continuous Delivery and Continuous Deployment pipelines; Deployment strategies - Blue/Green, Canary, and Rolling deployments; Monitoring and Logging - Introduction to Prometheus, Grafana, ELK Stack; Security and DevSecOps overview; Case study on continuous integration / continuous delivery (CI/CD) implementation; DevOps Testing Strategies and Types, DevOps in cloud platforms - AWS, Azure, Google Cloud; Trends and future of DevOps.

Suggested Readings

1. Mikael Krief, Learning DevOps: The Complete Guide to Accelerate Collaboration with Jenkins, Kubernetes, Terraform and Azure DevOps, Packt Publishing, 2019
2. Moshe Zadka, DevOps in Python: Infrastructure as Python, Apress, 2019
3. Len Bass, Ingo Weber, and Liming Zhu, *DevOps: A Software Architect's Perspective*, Addison-Wesley, 2015.
4. Kim, G., Debois, P., Willis, J., & Humble, J. (2016). *The DevOps handbook: How to create world-class agility, reliability, and security in technology organizations*. IT Revolution Press.
5. Sricharan Vadapalli, *Implementing DevOps with AWS*, Packt Publishing, 2018.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO1	H	M	
CO2	M	H	M
CO3		H	M
CO4		M	H

COURSE CODE: EXPLORATORY DATA ANALYSIS
(3 Credits - 45 Hours) (L-T-P: 3-0-0)

COURSE OBJECTIVE:

The objective of this course is to equip students with a comprehensive understanding of exploratory data analysis. The course aims to develop the ability to visualize data effectively using Matplotlib and to conduct univariate, bivariate, and multivariate analyses to uncover underlying patterns, trends, and relationships within datasets. Additionally, it enables learners to apply appropriate visualization and exploration techniques for time series data, thereby strengthening their analytical skills for real-world data science applications.

COURSE / LEARNING OUTCOMES

At the end of this course, students will be able to:

- CO1: Understand the fundamentals of exploratory data analysis. (Understanding)
- CO2: Implement the data Visualization using Matplotlib. (Applying)
- CO3: Perform univariate data exploration and analysis. (Applying, Analyzing)
- CO4: Apply bivariate data exploration and analysis. (Applying, Analyzing)
- CO5: Use exploration and visualization techniques for multivariate and time series data. (Analyzing)

COURSE CONTENT:

Module I: Fundamentals of Exploratory Data Analysis (9 Hours)

Understanding basic of data science, Significance of EDA, Comparing EDA with classical and Bayesian analysis, Software tools for EDA, Visual Aids for EDA, Data transformation techniques - merging database, reshaping and pivoting, Transformation techniques.

Module II: EDA using Python (9 Hours)

Data Manipulation using Pandas- Pandas Objects, Data Indexing and Selection, Operating on Data, Handling Missing Data, Hierarchical Indexing, Combining datasets – Concatenate, Append, Merge and Join, Aggregation and grouping

Module III: Univariate Analysis (9 Hours)

Introduction to Single Variable Analysis, Distribution of Variables, Numerical Summaries of Level and Spread, Scaling and Standardizing, Inequality Measures

Module IV: Bivariate Analysis (9 Hours)

Relationships Between Two Variables, Percentage Tables, Analysis of Contingency Tables, Handling Several Batches, Scatterplots and Resistant Lines

Module V: MULTIVARIATE AND TIME SERIES ANALYSIS (9 Hours)

Introducing a Third Variable, Causal Explanations, Three-Variable Contingency Tables and

Beyond, Fundamentals of Time Series Analysis (TSA), Time-Based Indexing, Visualizing Time Series

Recommended Books

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data". First Edition, O Reilly, 2017.
3. Catherine Mars, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.
4. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
5. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly Publications, 2019.

Suggested Web Links

<https://www.geeksforgeeks.org/data-analysis/what-is-exploratory-data-analysis/>
<https://www.ibm.com/think/topics/exploratory-data-analysis>

<https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-data-analysis-eda-using-python/>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	L				H
CO2	M	M			
CO3			M	H	
CO4			H	H	
CO5				M	H

COURSE CODE: EXPLORATORY DATA ANALYSIS LAB

(2 Credits - 60 Hours) (L-T-P: 0-0-4)

COURSE OBJECTIVE:

The objective of this course is to equip students with essential skills in data analysis and visualization using industry-standard tools such as R, Python, Tableau Public, and Power BI. Through practical experimentation, students will learn to work with NumPy arrays and Pandas DataFrames, perform data cleaning using variable and row filters, and apply a variety of plotting techniques in Matplotlib. The course further aims to develop the ability to compute and interpret key statistical measures, visualize single- variable distributions, analyze relationships between variables using scatter plots, and explore trends in time series data.

COURSE / LEARNING OUTCOMES

At the end of this course, students will be able to:

CO1:Utilize libraries like Matplotlib/R for data visualization. (Applying)

CO2:Perform univariate data exploration and analysis. (Analyzing)

CO3:Conduct bivariate data exploration and analysis. (Analyzing, Evaluating)

CO4:Apply data exploration and visualization techniques to multivariate and time series data. (Applying, Evaluating)

LIST OF EXPERIMENTS:

1. Install the data Analysis and Visualization tool: R/ Python /Tableau Public/ Power BI.
2. Working with Numpy arrays, Pandas data frames , Basic plots using Matplotlib.
3. Explore various variable and row filters for cleaning data . Apply various plot features on sample data sets and visualize.
4. Calculate and interpret key statistical measures and visualize the distribution of single variables within a dataset.
5. Create 2D scatter plots to visualize the relationship between two numerical variables (e.g., weight vs height).
6. Perform Time Series Analysis and apply the various visualization techniques.
7. Perform Data Analysis and representation using Matplotlib.
8. Use a case study on a data set and apply the various EDA and visualization techniques and present an analysis report.

Recommended Books

1. Suresh Kumar Mukhiya, Usman Ahmed, "Hands-On Exploratory Data Analysis with Python", Packt Publishing, 2020.
2. Jake Vander Plas, "Python Data Science Handbook: Essential Tools for Working with Data". First Edition, O Reilly, 2017.
3. Catherine Mars, Jane Elliott, "Exploring Data: An Introduction to Data Analysis for Social Scientists", Wiley Publications, 2nd Edition, 2008.
4. Eric Pimpler, Data Visualization and Exploration with R, GeoSpatial Training service, 2017.
5. Claus O. Wilke, "Fundamentals of Data Visualization", O'reilly Publications, 2019.

Suggested Web Links

<https://www.geeksforgeeks.org/data-analysis/what-is-exploratory-data-analysis/>
<https://www.ibm.com/think/topics/exploratory-data-analysis>
<https://www.analyticsvidhya.com/blog/2022/07/step-by-step-exploratory-data-analysis-eda-using-python/>

Mapping of COs to Modules

Course Outcomes	Exp I	Exp II	Exp III	Exp IV	Exp V	Exp VI	Exp VII	Exp VIII
CO1	M	M	H				M	
CO2				M				
CO3					M			
CO4						M		H

COURSE CODE: BIG DATA ANALYTICS
(3 Credits - 45 Hours) (L-T-P: 3-0-0)
COURSE OBJECTIVE:

The objective of this course is to introduce students to the foundations of Big Data and its associated challenges. The course aims to develop the ability to work with Hadoop and the Hadoop ecosystem for large-scale data processing, and to implement MapReduce programs for solving real-world big data problems. Additionally, students will gain exposure to basic machine learning techniques to support data-driven analysis. Overall, the course equips learners with the conceptual understanding and applied skills required to work effectively with modern big data technologies.

COURSE / LEARNING OUTCOMES

At the end of this course, students will be able to:

CO1: List the components of Hadoop and Hadoop Ecosystem. (Remembering)

CO2: Understanding of big data basics and problems over big data. (Understanding)

CO3: Identify Big Data and its Business Implications. (Applying)

CO4: Make use of Hadoop and MapReduce programming to tackle big data problems. (Applying) CO5: Demonstrate Machine Learning Techniques using R/Python. (Understanding)

COURSE CONTENT:

Module I: (7 Hours)

Introduction to Big Data, Types of Digital Data, 5V concept of Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Ecosystem, IBM Big Data Strategy

Module II: (8 Hours)

HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures

Module III: (8 Hours)

Map Reduce: Anatomy of a Map Reduce Job, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features

Module IV: (12 Hours)

Hadoop Ecosystem: Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. HBase : HBasics, Concepts, Clients, Example, HBase Versus RDBMS.

Module V: (10 Hours)

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Introduction to Big Data Analytics with BigR

Recommended Books

1. Hadoop: The Definitive Guide, Third Edition, Tom White, 2012, O'reily Media.
2. Big Data Analytics, Seema Acharya, Subhasini Chellappan, 2015, Wiley.
3. Machine Learning (in Python and R), First Edition, J. P. Mueller, L. Massaron, 2016, Wiley

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H			H	
CO2	H	M			
CO3			M	H	
CO4			H	H	
CO5				M	H

COURSE CODE: BIG DATA ANALYTICS LAB (1 Credit - 30 Hours) (L-T P: 0-0-2)**COURSE OBJECTIVE:**

The objective of this laboratory course is to provide hands-on experience with big data technologies and distributed computing frameworks. Students will learn to install and configure Hadoop and its ecosystem tools, implement data processing tasks using MapReduce, and work with real-time data ingestion through Flume. The course also enables learners to apply analytical algorithms such as clustering and PageRank on large datasets and to manage unstructured data using NoSQL databases like MongoDB, Cassandra, or HBase. Overall, the lab aims to develop practical skills for building scalable big data solutions.

COURSE / LEARNING OUTCOMES

At the end of this course, students will be able to:

- CO1: Understand and set up Hadoop and its ecosystem components for large-scale data storage and processing. (Understanding)
- CO2: Design and implement MapReduce programs for solving real-world data processing tasks such as word count, matrix operations, clustering, and PageRank. (Analyzing)
- CO3: Apply streaming data ingestion tools like Apache Flume to capture, transport, and analyze real-time data streams. (Applying)
- CO4: Develop analytical workflows using Big Data tools. (Analyzing)
- CO5: Install and configure NoSQL databases such as MongoDB, Cassandra, or HBase for unstructured data management. (Applying)

LIST OF EXPERIMENTS:

1. Installation of Hadoop Framework, its components and study of the HADOOP ecosystem.
2. Write a program to implement word count program using MapReduce.
3. Implementing Matrix Multiplication algorithms in Map-Reduce.
4. Implement and Perform Streaming Data Analysis using flume for data capture.
5. Implement any one Clustering algorithm (K-Means/CURE) using Map-Reduce.
6. Implement Page Rank Algorithm using Map-Reduce.
7. Install and configure MongoDB/ Cassandra/ HBase to execute NoSQL Commands.

Suggested Readings

1. Hadoop: The Definitive Guide, Third Edition, Tom White, 2012, O'reilly Media.
2. Big Data Analytics, Seema Acharya, Subhasini Chellappan, 2015, Wiley.
3. Machine Learning (in Python and R), First Edition, J. P. Mueller, L. Massaron, 2016, Wiley.

Mapping of COs to Modules

Course Outcomes	Exp I	Exp II	Exp III	Exp IV	Exp V	Exp VI	Exp VII
CO1	M						
CO2		H	H			H	
CO3				H			
CO4					H		
CO5							H

SCHOOL OF COMMERCE AND MANAGEMENT

DEPARTMENT OF MANAGEMENT

PROGRAMME: BACHELOR OF BUSINESS ADMINISTRATION

DEGREE: BBA (HONOURS)/ BBA (HONOURS) WITH RESEARCH

VISION:

The BBA curriculum strives to grow into a significant position in Management education to create graduates in the field of business and management to become future business leaders, entrepreneurs who are socially responsible professionals capable of adapting into the dynamic corporate world having a globally acceptable vision.

MISSION:

To focus on imparting the highest quality education with a strong foundation of management concepts for students to excel and enhance their skills.

To develop a strong industry-academia interface for project based learning, internships and placements

To create academic excellence at par with International standards in order to make the students accepted worldwide as managers.

Programme Outcomes (PO)

On successfully completing the program the student will be able to:

PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Ethical and responsible citizen:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them. : Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO 6: **Leadership, Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Programme Specific Outcomes (PSO)

On the successful completion of B.B.A., the students will be able to:

PSO 1: **Knowledge of Marketing, HR, Finance and Aviation management:** Comprehend the various concepts, processes and significance; to develop an insight and analytical abilities and also to develop the ability to provide solutions for effective decision making in practical business problems

PSO 2: **Development of managerial skills:** To provide an opportunity for gaining practical understanding of the workplace and develop various leadership and interpersonal skills through internship training and also to make the students industry ready and to enhance critical thinking skills in understanding business challenges related to global business.

PSO 3: Entrepreneurship development skills: To promote entrepreneurial skills by understanding the fundamentals of new business ventures.

Mapping of Courses with POs/PSOs

Course Names	PO1	PO2	PO3	PO4	PO5	PO6	PSO 1	PSO 2	PSO 3
1.1	H	M	M	M	L	M	M	H	M
1.2	M	L	L	L	L	L	M	M	M
1.3	M	L	L	L		L	L	L	M
1.4	L	H	M	L		L		L	
1.5	L	L		L	L	L	L	L	H
1.6	L		L	H	H				
1.7	L		L	H		L			
2.1	L	L		L		L	H	M	
2.2	L	L		L		L	M	H	
2.3	L			L	H	L		L	L
2.4	L	H	L			L	M		
2.5	L	L	L	M		L		H	
2.6	L	M	L	L		M		H	
2.7			H	M	L	M			
3.1	L	L		L		M	H	H	
3.2	L	L		L		M	H	H	
3.3	M	L	L	L					
3.4	M	M	M	M		L		M	
3.5		H	M			L			
3.6	L	L	M			M	M	M	
4.1	H			L		L	M	M	L
4.2	H				H	L		M	M
4.3	H			L		L	M	M	L
4.4	M			L	H	L	M	M	L
4.5	L			L		M	M	L	
4.6	L	L		L		M	M	L	
4.7	L		L			L	L	L	
4.8		H				L		L	
5.1	M			L	M	L		M	
5.2	M	M	L	L		L	H	M	
5.3		L		H		M		L	
5.4	L	L				M	L	L	
5.5	M	L	L	L		M	H	H	L
5.6	L	L	L	H		L		L	
5.7	L			L		L	L	L	
6.1	M			L	M	L		M	
6.2	H			L		L	M	M	L
6.3			L	H		L			
6.4	L	L	L	M		L	M	L	
6.5	M	L		L		M	H	H	L

6.6		M					M	M	M	
6.7		M	L		L	L	M	M		
6.8		L					L	M	M	
7.1 (BBA Hons)		L					M	L	H	L
7.2 (BBA Hons)		L					M	L	H	L
7.3 A (BBA Hons)		M	L				L	L	L	
7.3 B (BBA Hons)		L					L	L	L	
7.4 (BBA Hons)		H					M	M	M	
7.5 (BBA Hons)		H	L		L		M	M	M	
7.1 (BBA Res)		H	L				L	M	L	
7.2 (BBA Res)		H	L	L	M		L	M	L	
8.1 (BBA Hons)		M	L	M	L	M	L	L	L	
8.2 (BBA Hons)		M			L		M	L	L	
8.3 (BBA Hons)		L			M		L		M	
8.4 (BBA Hons)		H	L	L	M		L	M	L	
8.1 (BBA Res)		H	L	L	M		L	M	L	

DETAILED SYLLABUS MAJOR COURSES

Semes-ter	Category	Course Code	Course Name	Cred-its
1	Major Course 1	MTMP100T	Management Process, Principles and Practices	4
2	Major Course 2	MTHB101T	Fundamentals of Human Resources Management & Organisation Behaviour	4
3	Major Course 3	MTMM200T	Marketing Management	4
3	Major Course 4	MTAI201T	Introduction to Aviation Industry	4
4	Major Course 5	MTFM202T	Fundamentals of Financial Management	5
4	Major Course 6	MTCB203T	Consumer Behaviour	5
4	Major Course 7	MTMD204T	Business Mathematics and Statistics for Decision Making	4
5	Major Course 8	MTME300T	Managerial Economics	5

5	Major Course 9	MTEG301T	Business Ethics and Corporate Governance	5
5	Major Course 10	MTPO302T	Production and Operations Management	4
6	Major Course 11	MTPM303T	Business Policy and Strategic Management	4
6	Major Course 12	MTFI304T	Financial Markets and Institutions	4
6	Major Course 13	MTCL305T	Corporate and Business Law	4
6	Major Course 14	MTMP306P	Minor Project - 1	4
7	Major Course 15	MTCF400T	Corporate Finance	5
7	Major Course 16	MTSC401T	Supply Chain Management	5
8	Major Course 17	MTSM402T	Services Marketing	5
8	Major Course 18	MTCR403T	Corporate Restructuring	5

MTMP100T: MANAGEMENT PROCESS, PRINCIPLES AND PRACTICES

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s)

The objective of this course is to develop an understanding of the Principles and processes of management covering the basic management functions and challenges in the emerging perspective.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Define the meaning of MPP. (Remembering)

CO 2: Explain the theory of planning and control. (Understanding)

CO 3: Determine the organisational process. (Applying)

Module I: Introduction to MPP (15 Hours)

Introduction: Concept, Nature, Process and Significance of Management; Managerial Roles (Mintzberg); Development of Management Thought- Classical, Neo -classical, Behavioural and Management Science Approach, System and Contingency Approaches.

Module II: Planning & Control (15 Hours)

Planning and Control: Concept, Process and Types; Planning Tools- Forecasting and Scheduling; Decision -making concept and process; Bounded rationality; Management by objectives; Corporate Planning- Environment analysis and Diagnosis

Module III: Organising (15 Hours)

Organising: Concept, nature, process and significance; Authority and Responsibility relationships Delegation, Decentralisation; Departmentation basis and formats (Project and Matrix); Formal and Informal Organisation; Changing patterns in Organisation structures in the Knowledge economy. Directing-Motivating and Leading People at work.

Module IV: Communication and Decision Making (15 Hours)

Role of communication; Communication media and technology, communication networks - formal vs. informal; barriers to effective communication; communication skills; persuasion in communication; active listening; participative decision making techniques; group vs. the individual; the decision making process

Suggested Readings

Joseph L. Massie :Essentials of Management .PHI, New Delhi; 2015

James F.Stoner: Management. Pearsons Education, Delhi ; 2020

Harold Koontz, Heinz Weihrich: Management. Tata McGraw Hill Pub. Co., Delhi; 2015

Amitai Etzioni: Modern Organizations. PHI, New Delhi; 2021

Jones, Gareth R. and Jennifer M. George: Contemporary Management. Tata McGraw Hill

Charles Hill, W.L. and Steven L. McShane: Principles of Management. Tata McGraw Hill

E Resources

<https://www.youtube.com/watch?v=q6LMjurECZM>

<https://www.youtube.com/watch?v=GZ2dmbDmB5I>

Mapping of COs with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M

MTHB101T: FUNDAMENTALS OF HUMAN RESOURCES MANAGEMENT & ORGANISATION BEHAVIOUR

(Credits: 4- 60 hours) (L-T-P: 4-0-0)

Objective(s)

The objective of this paper is to provide the students an insight into the various fundamental concepts of human resource management and organizational behaviour and its relation to other activities in an organization

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Define the nature and scope of HRM and OB and its significance (Remembering)

CO 2: Describe the importance of HRM and the procurement functions (Understanding)

CO 3: Explain the cognitive processes and dynamics of organizational behavior (Applying)

CO 4: Analyse the concepts of perception, learning and motivation (Analyzing)

CO 5: Evaluate the change and organisational development and stress management (Evaluating)

Module I: Importance of Human Resource Management (12 Hours)

Meaning, Nature and Scope, Functions and Role of HR Manager; Advisory and service function to other department; HRM function planning; objectives and policies, organizing the HRM department

Module II: Procurement and Development Functions: (12 Hours)

Job Analysis, Job description, job specification, staffing functions: recruitment, selection, interview, training, placement and induction

Module III: Introduction to the basics of Organisation Behaviour (12 Hours)

Nature and scope of OB, Challenges and opportunities for OB, Organization Goals, Models of OB, Impact of Global and Cultural diversity on Organisation Behaviour

Module IV: Cognitive processes of organizational behavior (12 Hours)

Concept, Personality, Perception and its role in individual decision making, Learning, Motivation: Hierarchy of needs theory, Theory X and Y, Motivation Hygiene theory, Vroom's expectancy theory.

Module V: Behavior Dynamics (12 Hours)

Interpersonal behavior, Communication, Leadership: Its Theories and prevailing leadership styles in Indian Organizations. Group Behavior: Definition and classification of Groups, Types of Group Structures, Group decision making, Teams Vs Groups

Suggested Readings

Robbins, Judge, and Vohra (2013); Organizational Behavior; Prentice Hall Inc.; 15th Edition.

Fred, Luthans (2005); Organisational Behavior; UK: McGraw Hill; 10th Edition.

G, Moorhead & Griffith. (2007). Organizational Behavior. Houghton Muffin Co.

Harold Koontz & Heinz Weihrich, Essentials of Human Resource Management, Tata Mc Graw Hill.

Stoner, Freeman, Gilbert Jr., Human Resource Management, Prentice Hall.

E Resources

<https://www.youtube.com/watch?v=bl9RZjF-538>

https://www.youtube.com/watch?v=MnvWxZhsvKA&list=PLdinyWzDfipO-aYB_oPdWBDHqQwFBtyfGk

Mapping of COs with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M
CO4				M	
CO5					M

MTMM200T: MARKETING MANAGEMENT

(Credits: 4 - 60 hours) (L-T-P: 4-0-0)

Objective(s)

The Objective of the course is to introduce the students to the domain of marketing and to its practical applications.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Enumerate the fundamentals of marketing management. (Understanding)

CO 2: Assess the marketing environment. (Analyse)

CO 3: Analysing market segmentation. (Analysis)

CO 4: Examine pricing strategy and distribution channels. (Analysis)

CO 5: Importance of communication in marketing (Creating)

Module I: Fundamentals of Marketing (8 Hours)

Conceptual Framework of Marketing, Core Concepts of Marketing, Marketing Philosophies, Marketing Myopia, Marketing Practices developed over 21st Century; Different Contexts of Marketing Applications.

Module II: Marketing Environment (10 Hours)

Analysis of marketing environment: Macro and Micro components and their impact on marketing decisions, Macro & Micro environment of Marketing – Industry & Competitor analysis, Developing strategies.

Module III: Market Segmentation and Product Overview (13 Hours)

Consumer buying Model, Market segmentation, Targeting and Positioning, Market and Marketing research and Marketing Information System, Marketing Mix, Product mix strategies, : Product and service concept, Product Lines- Length, Breadth & depth, Product life cycle, New product Development, Brand concept, Brand Equity.

Module IV: Pricing and Distribution Strategies (14 Hours)

Pricing strategies, Price setting, Price determination. Channels of distribution: Types, Designing Distribution Channels, Managing Conflicts and Controls in Channels, Retailing, and Wholesale, E-Retailing.

Module V: Marketing Communication Mix (15 Hours)

Marketing Communication, Integrated Marketing Communication, Promotional Mix Components- Advertising Vs Promotion, Advertising Vs Publicity, Sales Promotion, Public Relations, Personal Selling and Direct Marketing, Digital Marketing Emerging issues in marketing, Ethical issues, Green marketing, Consumerism, CSR in marketing, Payment related issues in the cashless era.

Suggested Readings

Kotler, P., Keller, K., Koshy, L., & Jha, M: Marketing Management: A South Asian Perspective. Pearson Education, New Delhi; 2019.
Saxena, R: Marketing Management. Tata McGraw Hill, New Delhi; 2015.
Stanton: Fundamentals of Marketing, McGraw Hill; 2020.
S. Jayachandran: Marketing Management, Tata McGraw Hill; 2015.
Ramaswamy, V. S., & Namakumari, S: Marketing Management: Global Perspective Indian Context. Laxmi Narayan Publication, New Delhi; 2014.

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3			H		
CO4				H	
CO5					M

MTAI201T: INTRODUCTION TO AVIATION INDUSTRY

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s)

The Objective of the course is to introduce the students to the domain of Aviation Industry and its different facets.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO1: demonstration of aviation industry (Understanding)
- CO2: assessing the essentials of Aviation industry. (Evaluating)
- CO3: assessing the organisational structure of aviation industry (Evaluating)
- CO4: categorise the airport services. (Analysis)
- CO5: evaluating the safety and security (Evaluating)

Module I: Introduction (10 Hours)

Airline Industry – Scope, Types. Scheduled and Non-Scheduled Flights; Air Cargo Transport – Economic and Social impact; Regulatory Bodies; Key Performance indicators

Module II: Fundamentals of Aviation Industry (12 Hours)

Airline Profitability, Main Industry, Characteristics of Passenger airlines, Service Industry – Characteristics

Module III: Organisational Structure (12 Hours)

Airline Alliances, Development of commercial airlines, Deregulation – Impact of Deregulated Airline industry, Organizational Structure, Types of Airline Personnel, Flight crew and Cabin Crew Training, Organizational Culture.

Module IV: Airport and services (12 Hours)

Airports – Personnel, Processing Passengers and Freight, Airport Security, Air Navigation Services, Air Traffic Control, Airplanes – Manufacturers – Types of Aircraft

Module V: Safety and Security (14 Hours)

Air Safety and Security, Role of Regulatory Agencies, Airside Safety, Culture of Safety, Issues in Air safety, Accident and Incident Investigation, Future of Airline Industry

Suggested Readings

Andreas Wald, Sven Grossand Hanns Christian Wirtz, Introduction to Aviation Management, published by Routledge

Dr Richard Shevell, Fundamentals of Aviation and Aerospace, published by CRC Press in 2018
National Research Council, Aviation and the Role of Government, published by National Academies Press in 1998

Bijan Vasign, Ken Flemming and Thomas Tacker, Introduction to Airport EconomicsL From Theory to Applications, published by Routledge in 2015

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L	M		L	
CO 2	L	L			
CO 3			M	M	M
CO 4			H		
CO 5					H

MTFM202T: FUNDAMENTALS OF FINANCIAL MANAGEMENT

(5 credits- 75 hours) (L-T-P: 5-0-0)

Objective(s)

This course aims to provide students with an understanding of fundamental concepts of business finance.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Explain the objectives & scope of financial management in context of business (Remembering)

CO 2: Explain various aspects of financial environment (Understanding)

CO 3: Apply the concept of time value of money (Applying)

CO 4: Evaluate investment opportunities using the capital budgeting process (Evaluating)

Module I: Introduction (15 Hours)

Meaning of finance; Basic areas of finance; Finance functions; Finance in the organization structure of a firm; Forms of business organizations; Goals of financial management; relationship with other functions; Career in finance.

Module II: Financial Environment: Markets, Institutions, Interest Rates and Taxes (20 Hours)

Financial markets: concept and types; Financial Institutions: concept, role in funds transfer, and types; Interest rates: level of Interest rate, determinants of market interest rates, the term structure of interest rate and yield curve: Taxes: corporate tax, marginal tax and average tax.

Module III: Time Value of Money (20 Hours)

Future Value: Single period, multiple period; Present Value: single period and multiple period; Future Value and Present value for multiple cash flows; Present value of an annuity; Future value of an annuity; Perpetuities: present value; Effective annual rate.

Module IV: Capital Investment Decisions (20 Hours)

Concept of investment decisions; Generating investment project proposal; Process of Capital budgeting decision; Classification of capital projects; Project cash flows; Incremental cash flows, sunk costs, opportunity costs, net working capital, financing costs and other issues; Net present value, payback method, internal rate of return.

Suggested Readings

Financial Management and Policy, James C. Van Horne and Sanjay Dhamija, Pearson Education.

Principles of Financial Management, Levy H. and M. Sarnat, Pearson Education.

Fundamentals of Financial Management, Brigham and Houston, Cengage Learning.

Basic Financial Management, Khan and Jain, McGraw Hill Education

Fundamentals of Financial Management, Prasanna Chandra, McGraw Hill Education

Financial Management-text and Problems, Singh, J.K, Dhanapati Rai and Company, Delhi

Fundamentals of Financial Management, Rustagi, R.P, Taxmann Publications Pvt. Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

MTCB203T: CONSUMER BEHAVIOUR

(5 credits- 75 hours) (L-T-P: 5-0-0)

Objective(s)

The objective of the course is to make the students understand the different concepts of consumer behavior, role of social and cultural settings on consumer behavior and consumer buying process.

Course/ Learning Outcomes:

At the end of this course students will be able to:

CO 1: Define the consumer behaviour. (Remembering)

CO 2: Explain the models of consumer decision process. (Understanding)

CO 3: Apply the factors influencing consumer behavior in developing marketing strategies, identify purchase decision and post purchase behaviour in varied marketing situations (Applying)

CO 4: Analyse market segmentation and segmentation of consumer markets, (Analysing)

CO 5: Assess the positioning strategies on buying behaviour. (Evaluating)

Module I: Contemporary Dimensions of Consumer Behaviour (15 Hours)

Consumer Behaviour, Consumer Decision-Making, Models of Consumer Decision –Making, Types of Consumer Buying Behaviour, Factors influencing Consumer Behaviour, Market Segmentation, Segmentation of Consumer markets, Positioning, Differentiation and Marketing Mix, Marketing Research; Consumer Research Process, Types of Research Methods.

Module II: Implications Social and Cultural Settings on Consumer Behaviour (15 Hours)

Influence of culture and Subculture on Consumer Behaviour, Influence of Social Class on Consumer Behaviour, Social Stratification and Marketing Strategy, Group Influence on Consumer Behaviour, Household and Family Influence on Consumer Behaviour, Socialisation of family Members, Family Purchasing Decision-Making and Consumption Related Roles, family Life Cycle.

Module III: Consumer Buying Process (15 Hours)

Stages of Consumer Buying Process, Purchase Decision and Post Purchase Behaviour, Traditional and Contemporary Models of Consumer Behaviour; Case study

Module IV: Advertising as a communication process (20 Hours)

Advertising as a tool of communication; Meaning, nature and importance of advertising; Types of advertising; Advertising objectives. Audience analysis; Setting of advertising budget: Determinants and major methods.

Major media types-their characteristics, internet as an advertising media, merits and demerits; Factors influencing media choice; media selection, media scheduling, Advertising through the Internet-media devices

Module V: Evaluating communication and sales effects (10 Hours)

Evaluating communication and sales effects; Pre- and Post-testing techniques

Suggested Readings

Blackwell, Roger D, Paul W Miniard and James F Engel, Consumer Behaviour, Thomson Learning Inc., 2002.

Duhan S.N., GarimaSahni N.K. , Consumer Behaviour, 1st edition, 2016, Kalyani Publishers Loudon, David I., and Albert J. Della Bitta, Consumer Behaviour, Tata McGraw Hill, New Delhi Schiffman, Leon G., and Leslie Kanuk, Consumer Behaviour, Prentice Hall, New Delhi Schiffman, Kanuk L L., S Ramesh Kumar, Consumer Behaviour, 10th edition, Pearson Dheeraj Sinha, Consumer India Inside the Indian Mind and Wallet, 2011, Jain Book Depot

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H		M	L	
CO 2		M			
CO 3			L	H	
CO 4		H			M

MTMD204T: BUSINESS MATHEMATICS & STATISTICS FOR DECISION MAKING

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The objective of this course is to familiarize students with the applications of mathematics and statistical techniques in business decision-making

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Apply matrices in business and economic models (Applying)

CO 2: Illustrate the use of differentiation in business and economic models. (Applying)

CO 3: Identify the methods of calculating interest rates (Applying)

CO 4: Summarize data sets using descriptive statistics (Understanding)

CO 5: Analyse the relationship between two variables (Analysing)

CO 6: Determine the trend and seasonality in time series data (Evaluating)

Part – A: Business Mathematics

Module I: Matrices (7 Hours)

Definition of a matrix. Types of matrices; Algebra of matrices. Calculation of values of determinants up to third order; Adjoint of a matrix; Finding inverse of a matrix through adjoint; Applications of matrices to solution of simple business and economic problems

Module II: Differential Calculus (13 Hours)

Mathematical functions and their types – linear, quadratic, polynomial; Concepts of limit and continuity of a function; Concept of differentiation; Rules of differentiation – simple standard forms. Applications of differentiation – elasticity of demand and supply; Maxima and Minima of functions (involving second or third order derivatives) relating to cost, revenue and profit.

Module III: Basic Mathematics of Finance (5 Hours)

Simple and compound interest Rates of interest – nominal, effective and continuous – their interrelationships; Compounding and discounting of a sum using different types of rates

Part – B: Business Statistics

Module IV: Uni-variate Analysis (15 Hours)

Measures of Central Tendency including arithmetic mean, geometric mean and harmonic mean: properties and applications; mode and median. Partition values - quartiles, deciles, and percentiles. Measures of Variation: absolute and relative. Range, quartile deviation and mean deviation; Variance and Standard deviation: calculation and properties.

Module V: Bi-variate Analysis (10 Hours)

Simple Linear Correlation Analysis: Meaning, and measurement. Karl Pearson's co-efficient and Spearman's rank correlation Simple Linear Regression Analysis: Regression equations and estimation. Relationship between Co-relation and regression coefficients

Module VI: Time-based Data: Index Numbers and Time-Series Analysis (10 Hours)

Meaning and uses of index numbers; Construction of index numbers: Aggregative and average of relatives – simple and weighted, Tests of adequacy of index numbers, Construction of consumer price indices. Components of time series; additive and multiplicative models; Trend analysis: Finding trend by moving average method and Fitting of linear trend line using principle of least squares.

Suggested Readings

Mizrahi and John Sullivan. Mathematics for Business and Social Sciences. Wiley and Sons.

Budnick, P. Applied Mathematics. McGraw Hill Publishing Co.

N. D. Vohra, Business Mathematics and Statistics, McGraw Hill Education (India) Pvt Ltd 4.

J.K. Thukral, Mathematics for Business Studies, Mayur Publications

J. K. Singh, Business Mathematics, Himalaya Publishing House.

J. K. Sharma, Business Statistics, Pearson Education.

S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.

S.P. Gupta and Archana Gupta, Elementary Statistics, Sultan Chand and Sons, New Delhi.

Richard Levin and David S. Rubin, Statistics for Management, Prentice Hall of India, New Delhi.

M.R. Spiegel, Theory and Problems of Statistics, Schaum's Outlines Series, McGraw Hill Publishing Co.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H				
CO 3			H			

CO 4				H		
CO 5					H	
CO 6						H

MTME300T: MANAGERIAL ECONOMICS

(5 credits-75 Hours) (L-T-P: 5-0-0)

Objective(s)

The purpose of this course is to apply micro economic concepts and techniques in evaluating business decisions taken by firms. The emphasis is on explaining how tools of standard price theory can be employed to formulate a decision problem, evaluate alternative courses of action and finally choose among alternatives. Simple geometry and basic concepts of mathematics will be used in the course of teaching.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the mechanics of supply and demand in allocating goods and services and resources (Remembering)

CO 2: Illustrate how changes in demand and supply affect markets (Understanding)

CO 3: Apply the choices made by a rational consumer (Applying)

CO 4: Interpret the relationships between production and costs (Evaluating)

CO 5: Discuss key characteristics and consequences of different forms of markets (Creating)

Module I (20 Hours)

Demand, Supply and Market equilibrium: individual demand, market demand, individual supply, market supply, market equilibrium; Elasticity of demand and supply : Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, elasticity of supply; Theory of consumer behavior : cardinal utility theory, ordinal utility theory(indifference curves, budget line, consumer choice, price effect, substitution effect, income effect for normal, inferior and giffen goods), revealed preference theory.

Module II (15 Hours)

Producer and optimal production choice: optimizing behavior in short run(geometry of product curves, law of diminishing marginal productivity, three stages of production), optimizing behavior in long run (isoquants, iso-cost line, optimal combination of resources) Costs and scale : traditional theory of cost (short run and long run, geometry of cost curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.

Module III (20 Hours)

Theory of firm and market organization : perfect competition (basic features, short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of changes in demand, cost and imposition of taxes) ; monopoly (basic features, short run equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination; monopolistic competition (basic features, demand and cost, short run equilibrium, long run equilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma

Module IV (20 Hours)

Factor Market: demand for a factor by a firm under marginal productivity theory (perfect competition in the product market, monopoly in the product market), market demand for a factor, supply of labour, market supply of labour, factor market equilibrium.

Suggested Readings

Dominick Salvatore (2009). Principles of Microeconomics (5th ed.) Oxford University Press

Lipsey and Chrystal. (2008). Economics. (11th ed.) Oxford University Press
 Koutosyannis (1979). Modern Micro Economics. Palgrave Macmillan
 Pindyck, Rubinfeld and Mehta. (2009). Micro Economics. (7th ed.). Pearson.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		H		
CO 3			H	
CO 4				H
CO 5	H			M

MTEG301T: BUSINESS ETHICS AND CORPORATE GOVERNANCE

(Credits: 5-75 hours) (L-T-P: 5-0-0)

Objective(s)

The objective of this paper is to make the students aware about the importance of ethics in the business, practices of good governance to encourage moral imagination and heightening sensitivity towards the ethical dimension of managerial problems.

Course/Learning Outcomes

At the end of this course the students will be able to:

CO 1: Define Business Ethics and best practices of business ethics (Remembering)

CO 2: Explain the various Corporate Social Responsibilities (Understanding)

CO 3: Plan the need and importance of corporate and professional responsibility (Applying)

CO 4: Analyse the corporate governance frameworks (Analyzing)

Module I: Business Ethics (15 Hours)

Business ethics: Introduction, Meaning of ethics, Types of business, ethical issues, why ethical problems occur in business, Ethical dilemmas and principles in business,

Case Study: Personal companies like Tata related to Ethics in Business in Indian context

Module II: Corporate Governance (20 Hours)

Corporate governance: concept, need to improve corporate governance standards, Features of good governance, Corporate governance abuses, Role played by regulators to improve corporate governance. Different Approaches to Corporate Governance, Leadership and Corporate Governance, Rights and Privileges of shareholders; Investor's Problem and protection; Board of Directors; Role, Duties and Responsibilities of Auditors, Bank and Corporate Governance.

Case Study: International experience- UK scenario (Cadbury committee; US scenario(Tread way commission, Blue ribbon committee); Indian experience- imperatives, CII code of best practices, Kumar Mangalam Birla, Narayan Murthy committee report.

Module III: Moral issues in business (20 Hours)

Moral issues in business: Importance of moral issues and reasoning, Principles of moral reasoning, Quality of work life, implications of moral issues in different functional areas of business like finance, HR and marketing.

Whistle blowing: Kinds of Whistle blowing, Marketing truth and advertising: Marketing, Advertising, Truth and advertising, Allocation of moral responsibility in advertising Trade secrets, corporate disclosure, insider trading: Trade secrets, corporate disclosure, insider trading Accounting, finance Affirmative action, Ethics and Environment

Module IV: Corporate Social Responsibility (20 Hours)

Corporate Social Responsibility: Meaning, Evolution of Corporate Social Responsibility, Limits of Corporate Social Responsibility, Voluntary Responsibility Vs. Legal requirements, Profit maximization vs. social Responsibility, Socially Responsive Management: Strategies of response,

formulating socially responsive strategies, Implementing social responsiveness, Financial incentives for social responsibility, Role of self regulation in discharge of social responsibility. Case studies on Indian companies like Tata, Godrej etc related to Corporate Social Responsibility

Suggested Readings

Crane. A., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Taxmann Publishing House.
 Manuel G Velasquez. Business Ethics: Concept and Cases
 William H. Shaw, Business Ethics: A Textbook with Cases
 Tom L. Beauchamp and Norman E. Bowie, Ethical Theory and Business
 Jill Solomon, Corporate Governance and Accountability
 R. I. Tricker, Corporate Governance: Principles, Policies, and Practices

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	L
CO 2		M		H
CO 3		M	L	H
CO 4		H		L

MTPO302T: PRODUCTION AND OPERATIONS MANAGEMENT

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective(s)

This course aims at acquainting the students with the functions of production and operations management and basic issues and tools of managing production and operation functions of an organization. The course also intends to provide the students a system theoretic view on project management and helps develop an understanding on why today's organizations are cultivating a formal project management process to gain competitive advantage.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: Define a production system. (Remembering)

CO 2: Explain the tools and techniques to measure work study, motion study. (Understanding)

CO 3: Demonstrate the procedure for product development and design. (Applying)

CO 4: Compute project completion time and Analyse and evaluate project risk management techniques. (Evaluating)

Module I: Introduction and Work Study (15 Hours)

Introduction to Production and operations management- Meaning and scope, subdivisions of work study Method/Motion, study and work measurement

Module II: Plant Location and layout (15 Hours)

Objectives, Locational factors, Economics of plant location

Meaning, objectives and types of plant layout and their relevance to mass, batch and job- order production systems. c) Systematic Layout Planning (SLP) procedure

Module III: Product design and Development and PPC (15 Hours)

Meaning of product, Product life cycle (PLC) and Product mix

Decisions to be taken during product development and design

Procedure for product development and design

Value of a product – its meaning, Value Analysis (VA) – its objectives, procedure and example, Simplification and Standardization.

Meaning and Objectives of PPC, Effects of types of production

Module IV: Project Management (15 Hours)

a) Project management framework, Project management processes, Cost and Time management, Project integration management, Project risk management, Project Quality management, Project communication management.

Suggested Readings

Adam, Ebert, Production and Operations Management, PHI.

R. Panneerselvam, Production and Operations Management, PHI.

K. Aswathappa & K. Shridhara Bhat, Production and Operations Management, Himalaya Publishing

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	L
CO 2		M		H
CO 3		M	L	H
CO 4		H		L

MTPM303T: BUSINESS POLICY & STRATEGIC MANAGEMENT

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course is designed to enhance knowledge on business policy and strategy adopted for managing the business. It will help a student to get broad exposure to understand the business policy and strategic management adopted by different business for their smooth running and facing the competition.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: develop an understanding of underlying concepts, tools, frameworks, issues and challenges (Remembering)

CO2: achieve development of an understanding of the increasing competition (Understanding)

CO3: explain the different circumstances & situations arising from ever changing strategic situation (Analysing)

Module I: Introduction to Business Strategy and Formulation (15 Hours)

Introduction & Concept of Strategy, Corporate Policy as a field of study, Nature, Importance, purpose and objective of business policy, Chief Executive job, roles and responsibilities of board of Directors, An overview of strategic management, its nature and process, Formulation of strategy, Environment, environment scanning, environment appraisal, Identifying corporate competence & resource.

Module II: Introduction to Strategic Management (15 Hours)

Corporate Strategy, Personal and Ethical Values, Business ethics, Industry structure, Reconciling divergent values, Modification of values, moral components of corporate strategy, community considerations and corporate social responsibility (CSR).

Module III: Strategic Management Process (15 Hours)

Corporate portfolio analysis, competitor & SWOT analysis, strategic audit & choice, strategic plan, routes to sustainable competitive advantage (SCA)

Module IV: Strategic Planning and Implementation (15 Hours)

Strategy Implementation, Structural implementation, organisational design and change, behavioural implementation, leadership, corporate culture, corporate politics and use of power, functional implementation - financial, marketing, Operation personnel (HR) policies and their integration, strategic evaluation and control

Suggested Readings

Wheelen, Thomas L , Hunger, J David & Rangarajan, Krish (2001) Concepts in Strategic Management & Business Policy, Pearson Education.

David, Fred R (2005), Strategic Management Concepts & Cases, PHI.

Kazmi, A. (2000); Business Policy, McGraw Hill.

Pearce, John A , Robinson, Richard B , Mital, Amita (2005) , 10th Edition., Strategic Management – Formulation, Implementation & Control, McGraw Hill.

Mapping of COs with Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2		H		
CO 3			H	H

MTFI304T: FINANCIAL MARKETS AND INSTITUTIONS

(4 credits – 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The objective of this paper is to introduce students to the different aspects and components of financial Institutions and financial markets and also to introduce them with the emerging application of technologies in the system. The study of the course will enable them to take rational decisions in the growing financial environment.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Describe the Indian banking system (Understanding)

CO 2: Explain the role of regulatory bodies in regulating the system (Understanding)

CO 3: Analyze the operative system of financial markets in India (Analyzing)

CO 4: Evaluate the types of debt instruments and their characteristics. (Evaluating)

CO 5: Elaborate the links between the theories of financial markets (Creating)

Module I: Structure of Indian Financial System (12 Hours)

An overview of the Indian financial system, financial sector reforms: context, need and objectives; major reforms in the last decade; competition; deregulation; capital requirements; issues in financial reforms and restructuring; future agenda of reforms; Regulation of Banks, NBFCs & FIs, Salient provisions of banking regulation act and RBI Act; Role of RBI as a central banker; Products offered by Banks and FIs: Retail banking and corporate banking products. Universal Banking: need, importance, trends and RBI guidelines.

Module II: Emerging Technologies in Indian Financial System (12 Hours)

Core banking solution (CBS); RTGS, IMPS and internet banking, mobile banking, NBFCs and its types; comparison between Banks and NBFCs; payment bankers such as PayTM, Google Pay etc

Module III: Introduction to Financial Markets in India (12 Hours)

Role and Importance of Financial Markets, Financial Markets: Money Market; Capital Market; Factors affecting Financial Markets, Linkages Between Economy and Financial Markets, Debt Market- role and functions of these markets, Issue of Corporate Securities: Public Issue through Prospectus, Rights Issue, On- Line IPO, Book Building of Shares, Disinvestment of PSU, Employees Stock Options, Preferential Issue of Shares,

Module IV: Secondary Market in India (12 Hours)

Introduction to Stock Markets, Regional and Modern Stock Exchanges, International Stock Exchanges, Comparison between NSE and BSE, Raising of funds in International Markets; Indian

Stock Indices and their construction, Factors influencing the movement of stock markets, indicators of maturity of stock markets, Major Instruments traded in stock markets, Myths attached to Investing in Stock Markets. Trading of securities on a stock exchange; Selection of broker, capital and margin requirements of a broker, DEMAT System

Module V: Money Markets & Debt Markets in India (12 Hours)

Money Market: Meaning, role and participants in money markets, Segments of money markets, money market instruments. Role of STCI and DFHI in money market, Debt Market: Introduction and meaning, Market for Government/Debt Securities in India, Secondary market for government/debt securities, over subscription and devolvement of Government Securities, Government securities issued by State Governments, Municipal Bonds, Corporate Bonds vs. Government Bonds

Suggested Readings

Khan, MY.(2010).Financial Services(5th ed.).Mc Graw Hill Higher Education.

Bharati V. Pathak, Indian Financial System, Pearson

Shahani, Rakesh(2011). Financial Markets in India : A Research Initiative. Anamica Publications

Goel, Sandeep.(2012).Financial services. PHI.

Gurusamy, S.(2010).Financial Services. TMH.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M			L	
CO 3		H	H		
CO 4			H	M	M
CO 5				H	

MTCL305T: CORPORATE AND BUSINESS LAW

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s)

The objective of this paper is to introduce students to the different aspects of Corporate and Business Law. To introduce them with the relevance and applications of the different laws

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: define what a company is and how it is formed. (Remembering)

CO 2: explain the concepts related to the essential documents of companies (Understanding)

CO 3: explain the knowledge regarding administration of a company (Applying)

CO 4: Identify the legal provisions in the partnership business and its Act. (Analysing)

Module I: Introduction (12 Hours)

Introduction of Companies Act, 2013, meaning and characteristics of a company; types of companies including one person company, small company, and dormant company; association not for profit; illegal association; lifting of corporate veil; Registration and Incorporation of company, on-line filing of documents, promoters, their legal position ,pre-incorporation contract; on-line registration of a company, Tribunal courts like NCLT, NCLAT etc

Module II: Documents of Companies (12 Hours)

Memorandum of association, Doctrine of ultra vires, Articles of association, Doctrine of constructive notice and indoor management, prospector-shelf and red herring prospectus, mis-statement in prospectus, book-building; issue, allotment and forfeiture of share, transmission of shares, buyback and provisions regarding buyback; issue of bonus shares.

Module III: Administration and Management of Company (12 Hours)

Classification of directors, women directors, independent director, small shareholder's director; disqualifications, director identity number (DIN); appointment; Legal positions, powers and duties; removal of directors; Key managerial personnel, managing director, manager;

Meetings: Meetings of shareholders and board of directors; Types of meetings, Convening and conduct of meetings, Requisites of a valid meeting, postal ballot, meeting through video conferencing, e-voting.

Committees of Board of Directors- Audit Committee, Nomination and Remuneration Committee, Stakeholders Relationship Committee, Corporate Social Responsibility Committee

Module IV: The Indian Contract Act, 1872 (12 Hours)

Proposal- its communication, acceptance and revocation; Agreement vis-à-vis contract, void agreement & voidable contract

Consideration – essential elements, exception to rule- No consideration no contract; privity of contract and consideration

Capacity to contract; free consent – coercion, undue influence, misrepresentation, fraud; Mistake – of fact and of law

Legality of object – agreements opposed to public policy and in restraint of marriage, trade & legal proceedings; Contingent contracts

Performance of contract–liability of joint promisor; Consequences of breach of contract–liquidated damages and penalty

Quasi contract; Indemnity guarantee–surety's liability

Bailment–Duties and liabilities of bailor and bailee, bailment of pledges;

Agency–types of agency, agents duty to principal and vice-versa, ratification and revocation of agent's authority

Module V: The Partnership Act, 1932 (12 Hours)

a) Nature of Partnership; Relation of partners-inter se; Relation of partners to third parties; Incoming and outgoing partners b) Dissolution of Firm; Registration of Firms-effect of non-registration

Suggested Readings

1. Chadha, Reena & Chadha, Sumant; Corporate Laws, Scholar Publishing House, New Delhi
2. Kuchhal, M.C & Kuchhal, Vivek, Business Law, Vikas Publishing House
3. Kapoor, N.D; Business Law; Sultan Chand & Sons, New Delhi.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2	L	H		
CO 3		L	H	
CO 4				L
CO 5				H

MTMP306P: MINOR PROJECT – 1

(4 Credits – 120 hours)

Objective(s)

The objective of the minor project-1 is to give students an idea of research. In which they need to undertake a field survey for collecting data. Further they need to analyse the data and present a report on the topic in which they have conducted research.

The evaluation will be done on the basis of the project report, presentation and viva-voce examination.

Guidelines Related To Project:

The entire project will be carried out in one phase in the particular semester

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the different types of research project. (Remembering)

CO 2: Explain the various steps of designing research project (Understanding)

CO 3: Build questionnaire and schedules (Applying)

CO 4: Assess the data for analysis (Analyzing)

CO 5: Appraise the findings in the report (Evaluating)

CO 6: Design a research project report (Creating)

Module I: Contents of the Report

Introduction

Brief Review of Literature

Research Methodology

Data Analysis and Interpretation

Findings, suggestions and conclusion

MTCF400T: CORPORATE FINANCE

(5 Credits - 75 hours) (L-T-P: 5-0-0)

Objective(s)

To acquaint students with the techniques of financial management and their applications for business decision making.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the strategic objectives of the organisation for finance function. (Remembering)

CO 2: Explain the different sources of corporate finance (Understanding)

CO 3: Interpret the impact of risk and cost of capital impact on investment appraisal. (Applying)

CO 4: Analyze the factors impacting the cost of capital (Analyzing)

CO 5: Evaluate a corporation's capital structure (Evaluating)

Module I: Nature of Financial Management (20 Hours)

Nature of Financial Management: Finance and related disciplines; Scope of Financial Management; Profit Maximization, Wealth

Maximization - Traditional and Modern Approach; Functions of finance – Finance Decision, Investment Decision, Dividend Decision; Objectives of Financial Management; Organisation of finance function; Concept of Time Value of Money, present value, future value, and annuity.

Module II: Long -term investment decisions (20 Hours)

Long -term investment decisions: Capital Budgeting - Principles and Techniques; Nature and meaning of capital budgeting; Estimation of relevant cash flows and terminal value; Evaluation techniques - Accounting Rate of Return, Net Present Value, Internal Rate of Return & MIRR.

Concept and Measurement of Cost of Capital: Explicit and Implicit costs; Measurement of cost of capital; Cost of debt; Cost of perpetual debt; Cost of Equity Share; Cost of Preference Share; Cost of Retained Earning; Computation of overall cost of capital based on Historical and Market weights

Module III: Capital Structures (20 Hours)

Capital Structures: Approaches to Capital Structure Theories - Net Income approach, Net Operating Income approach,

Modigliani-Miller (MM) approach,

Dividend Policy Decision - Dividend and Capital; The irrelevance of dividends: General, MM hypothesis; Relevance of dividends:

Walter's model, Gordon's model;

Leverage Analysis: Operating and Financial Leverage; EBIT-EPS analysis; Combined leverage.

Module IV: Working Capital Management (15 Hours)

Working Capital Management: Management of Cash - Preparation of Cash Budgets (Receipts and Payment Method only); Cash management technique (Lock box, concentration banking), Receivables Management – Objectives; Credit Policy, Cash Discount, Debtors Outstanding and Ageing Analysis; Costs - Collection Cost, Capital Cost, Default Cost, Delinquency Cost, Inventory Management (Very Briefly) - ABC Analysis; Minimum Level; Maximum Level; Reorder Level; Safety Stock; EOQ (Basic Model), Determination of Working Capital.

Suggested Readings

Berk & DeMarzo, Fundamentals of Corporate Finance, Prentice Hall.

M.Y. Khan & P.K. Jain, Financial Management, Tata McGraw Hill Publishing Co. Ltd.

Rustogi, Financial Management

I.M. Pandey, Financial Management

L.J. Gitman & C.J. Zutter, Managerial Finance

R.A. Brealey, S.C. Myers, F. Allen & P. Mohanty, Principles of Corporate Finance

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		L	M	
CO 3		M	H	
CO 4		M	H	
CO 5				H

MTSC401T: SUPPLY CHAIN MANAGEMENT

(5 credits – 75 Hours) (L-T-P: 5-0-0)

Objective(s)

The objective of this paper is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for an international firm.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the process of supply chain management. (Remembering)

CO 2: Demonstrate operational purchasing methods and techniques on supplier management (Understanding)

CO 3: Explain the strategic importance of logistics elements (Understanding)

CO 4: Apply sales and operations planning, MRP and lean manufacturing concepts. (Applying)

CO 5: Analyse creation of new value in supply chain for customers & society. (Analysing)

Module I: Basic Framework (15 Hours)

Concept of supply chain management (SCM); SCM and trade Logistics; Business view of SCM; Push and pull of SCM; Decision phases; Impellers and drivers in SCM Process views of SCM, planning and operations; Supply chain modeling; Role of Relationship marketing in SCM; managing relationships with suppliers and customers; Designing strategic distribution network; Factors influencing distribution network.

Module II: Supply Chain and Information Management Systems (15 Hours)

Purchasing Process- Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle; Supplier selection and evaluation; Vendor development; Importance of information management; Distribution and sharing of information; Information Technology as a platform for effective and efficient supply chain management

Module III: Logistic System (10 Hours)

Concept, objectives and scope of logistics; System elements; Inbound and Outbound logistics. Reverse inventory, Value added role of logistics, Logistics interface with manufacturer and marketing, Packing, Marking, Just in time concept; Third party logistic outsourcing—challenges and future directions

Module IV: Transportation (20 Hours)

Importance of effective transportation system; Service choices and their characteristics; inter-modal services; Transport cost characteristics and rate fixation; Carrier selection determinants and decision; Structure of Shipping: World seaborne trade; international shipping - characteristics and structure ;Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Charter, party agreement; Development in sea transportation-Unitization, containerization, inter and multimodal transport; CFC and ICD; Indian shipping – growth, policy and problems; Ports and port trust; International Air transport: International set up for air transport: Freight rates; India's exports and imports by air – Problems and prospects; Carriage of Goods by sea, sea and combined transport.

Module V: Warehousing and Inventory Management (15 Hours)

Warehousing And Marketing Strategy; Objectives and functions of warehousing; Warehouse Strategies; Material handling equipment and material mobility Warehousing evaluation and requirements

Inventory management-inventory categories, EOQ, LT, ICC; Inventory levels; Material planning and sourcing of procurement; Methods of cost reduction.

Suggested Readings

Ballau, R.H., Business Logistics Management, Prentice Hall, Englewood Cliffs.

Bes, J., Chartering Practices.

Bes, J., Dictionary of Shipping and chartering Practices.

Christopher, M., Logistics and Supply Chain Management, Prentice Hall.

ICAO Journal, New York., various issues

Indian Shipping and Transport, Mumbai, Various issues.

Murphy, Paul R. and Donald F. Wood, Contemporary Logistics, Prentice Hall.

Marks, Daniel, Shipping Cartels.

Shapiro, R., Logistics Strategy: Cases and Concepts, West Publishing, St. Paul.

Coughlan, A., Anderson, E. and Louis W. Stern, Marketing Channels, Prentice Hall.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L				
CO 2		M			
CO 3			M		
CO 4		M		H	
CO 5	M		H		H

MTSM402T: SERVICES MARKETING

(Credits: 5- 75 Hours) (L-T-P: 5-0-0)

Objective(s)

The objective of this course is to make the students know the service concept, its evolution and growth. To make the students understand Marketing Mix in service marketing and its effective management and to know the service marketing techniques applied in various sectors.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: relate the importance of service economy and Services characteristic. (Remembering)

CO2: explain the concept of Service Marketing Mix (Understanding)

CO3: identify the various service deliver gap and developing appropriate solutions (Applying) CO4: analyse the reasons for service failure

(Analysing)

Module I: Introduction to Service Economy (15 Hours)

Emergence of the service economy, Concept and nature of Service, Difference between goods and services, Service marketing Mix, Service Management Trinity

Module II: Service Consumer Behaviour (20 Hours)

Understanding the Service Customer as a Decision Maker, service purchase and risk association, Service Evaluation process, The

Service Consumer Decision Process, and The Decision-making Process in the Service Sector, Components of Customer Expectations, Service Satisfaction, Service Quality Dimensions

Module III: Service Delivery Process (20 Hours)

Managing Service Encounters, Common Encounter Situations, Managing Service Encounters for Satisfactory Outcomes, Service Failure, Service Recovery, Process of Service Recovery, Customer Retention and Benefits

Module IV: Delivering Quality Service (20 Hours)

Causes of Service delivery failure – Quality Gaps. The Customer Expectations *versus* Perceived Service gap. Factors and

Techniques to Resolve this Gap. Customer Relationship Management. Gaps in Services – quality standards, Factors and

Solutions – The Service Performance Gap – Key Factors and Strategies for Closing the Gap. External Communication to the Customers – the Promise *versus* Delivery Gap – Developing Appropriate and Effective Communication about Service Quality

Suggested Readings

Service Marketing, C. Bhattacharjee, Excel Books

Service Marketing, R. Nargundkar, Tata McGraw Hill

Service Marketing the Indian Perspective, R Shakeran R, Excel Books

The Essence of Service Marketing, M.P. Newton, A Payne, PHI

Service Marketing - The Indian Context R. Srinivasan, PHI

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M	M	
CO4				H	H

MTCR403T: CORPORATE RESTRUCTURING

(Credits: 5- 75 Hours) (L-T-P: 5-0-0)

Objective(s)

To familiarize the students with various concept and technique that can help in effective corporate structuring in business. Focus will be on the practical application of the concepts learnt.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the concept and function of joint venture (Remembering)

CO 2: Explain the theories of merger and acquisition (Understanding)

CO 3: Identify takeover and its types (Applying)

CO 4: Discover the various techniques of valuation of firms during merger (Analyzing)

CO 5: Assess the impact of merger on shareholders and different stakeholders (Evaluating)

Module I: Joint Ventures: (15 Hours)

Joint Ventures: Concept & Meaning of Joint Ventures, Need & Types of Joint Ventures, Structures & Problems faced in Joint Ventures, some relevant case study of successful and failed joined ventures.

Module II: Mergers and Acquisitions (20 Hours)

Mergers and Acquisitions: Introduction to mergers, types of mergers, theories of mergers & acquisitions, merger strategy - growth, synergy, operating synergy, financial synergy, diversification; Cross-border mergers and acquisitions, issues and challenges in cross border M&A. Handling cross-culture and taxations issues in cross-border M&A. Analysis of Post-Merger Performance. Demerger, types of demergers, reverse merger, buyback of shares, leverage buy-out strategy, Takeover and its types, takeover strategy, takeover bids, legal framework for mergers and acquisitions, leverages and buyouts; Hostile tender offers and various anti-takeover strategies.

Module III: Mergers and Acquisitions (20 Hours)

Deal Valuation and Evaluation: Factors affecting valuation basics, methods of valuation, cash flow approaches, economic value added (EVA), sensitivity analysis, and valuation under takeover regulation, valuation for slump sale, cost-benefit analysis, and swap ratio determination.

Module IV: Post-Merger Evaluation (20 Hours)

Post-Merger Evaluation: Financial Evaluation of Mergers & Acquisitions, Impact on shareholders' Wealth; Methods of payment and financing options in mergers & acquisitions, financing decision, Merger, Acquisition and Competition law 2002, SEBI (Securities & Exchange Board of India) Takeover Code 2011 and criteria for negotiating friendly takeover.

Suggested Readings

Sundarsanam (2006); Creating Value from Mergers and Acquisitions, (1st ed.) Pearson Education

Ramanujan. S. (1999); Mergers: The New Dimensions for Corporate Restructuring, McGraw Hill
Narayankar, Ravi, (2013): Merger and Acquisitions Corporate Restructuring, Strategy and Practices, (2nd ed.). International Book House Pvt. Ltd.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		L		
CO 3			H	
CO 4			H	
CO5				H

MINOR COURSES

Semes-ter	Category	Course Code	Course Name	Cred-its	Page No
1	Minor Course 1	MTBO102T	Business Organisation	4	183
2	Minor Course 2	MTMF103T	Management Fundamentals	4	184
3	Minor Course 3	MTBI205T	Banking and Insurance	4	185
4	Minor Course 4	MTFT206T/ MTCM207T/ MTIM208T/ MTAO209T	Fundamentals of Investment / Compensation Management/ International Marketing / Airport Operations	4	186 187 188 189
5	Minor Course 5	MTSH307T/ MTPF308T/ MTMR309T/ MTGH310T	Strategic HRM/ Personal Financial Planning / Marketing Research/ Ground Handling Services at Airport	4	190 192 193 194
6	Minor Course 6	MTIR311T/ MTIP312T/ MTDM313T/ MTAC314T	Management of Industrial Relations/ Investment Analysis and Portfolio Man- agement/ Digital Marketing / Air Cargo Operations	4	195 196 197 198
7	Minor Course 7	MTBE404T/ MTAR405T	Business Environment / Airport Resource Planning and Ser- vices Management	3	199 200
7	Minor Course 8	MTRM406T	Research Methodology	2	201
8	Minor Course 9	MTIB407T	International Business	3	202

MTBO102T: BUSINESS ORGANIZATION

(4 credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

To familiarize students with the basics of business, the different forms of organisations, the process and the basic concepts and functions of management

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the nature, objectives and social responsibilities of business (Remembering)

CO 2: Describe the different forms of organisations (Understanding)

CO 3: Understand the process and the basic concepts of management (Understanding)

CO 4: Describe the different functions of management (Applying)

CO 5: Explain the different types of business (Evaluating)

Module I: Introduction to Business (10 Hours)

Meaning, Nature, Scope and Social responsibility of Business, Objectives, Essentials of successful business; Functional areas of business; Concept of Business Organisation

Module II: Forms of Business Organization (15 Hours)

Sole proprietorship: Definitions, Features, Merits and Demerits. Partnership: Definitions, partnership deed, Features, Merits and Demerits. Joint Stock Company: Definitions, Features, Merits and Demerits. Co-operatives: Definitions, Features, Merits and Demerits

Module III: Public Enterprises and Public Private Partnerships (15 Hours)

Departmental Undertaking: Definitions, Features, Merits and Demerits. Public Corporations: Definitions, Features, Merits and Demerits. Government Companies: Definitions, Features, Merits and Demerits. PPP Model: characteristics, different models of PPP, its success factors, some examples of PPP model from Indian context.

Module IV: Business Combinations (10 Hours)

Meaning Definitions, Causes, Types, Forms, merits and demerits of Business Combinations, Recent Trends in Business Combinations

Module V: Management of Organizations (10 Hours)

Management- Meaning, Definitions, Difference between Management and Administration, Levels of Management, Objectives of Management, Functions of management- planning, organizing, staffing, directing, coordinating, controlling, Principles of Management.

Suggested Readings

C B. Gupta - Business Organisation and Management, Sultan Chand & Sons.

Dr. S. C. Saxena - Business Administration & Management, Sahitya Bhawan

E Resources

[https://www.youtube.com/watch?v=Bar-](https://www.youtube.com/watch?v=Bar-cVAOT_fs&list=PL9Cd7H8NFRQxDwIEOu_MBT5AUJoysq4NgF)

[cVAOT_fs&list=PL9Cd7H8NFRQxDwIEOu_MBT5AUJoysq4NgF](https://www.youtube.com/watch?v=Bar-cVAOT_fs&list=PL9Cd7H8NFRQxDwIEOu_MBT5AUJoysq4NgF)

[https://www.youtube.com/watch?v=Ewzhw63biOU&list=PL47Z0ywCYly-](https://www.youtube.com/watch?v=Ewzhw63biOU&list=PL47Z0ywCYly-ykGNxHpB6_LN5MvTO8hPGD)
[ykGNxHpB6_LN5MvTO8hPGD](https://www.youtube.com/watch?v=Ewzhw63biOU&list=PL47Z0ywCYly-ykGNxHpB6_LN5MvTO8hPGD)

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		H		
CO 3			H	
CO 4				H
CO 5				H

MTMF103T: MANAGEMENT FUNDAMENTALS

(4 Credits: - 60 hours) (L-T-P: 4-0-0)

Objective(s)

The objective for this course to provide an understanding of the task and functions of management and to acquaint the participants with the developments in concept. Theories and practices in the overall field of management.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the nature and significance of Management (Remembering)

CO 2: Explain the nature and significance of planning (Understanding)

CO 3: Describe the staffing functions and explain the significance of communication (Applying)

Module I: Nature and significance of Management (15 Hours)

Nature of management; significance of management; Approaches of management, Contributions of Taylor, Fayol and Barnard, Functions of a Manager, Social responsibility of Managers, Values in management.

Module II: The Nature of significance of Planning (15 Hours)

Nature of Planning, significance of planning, objectives, steps of planning, decision making as key step in planning; process and techniques of decision making; organisation: nature and significance; approaches, departmentation, line and staff relationships; delegation and decentralisation

Module III: Staffing functions (15 Hours)

Nature and significance of staffing functions; selection, interview, training, appraisal and development of managers; directing: Issues in managing human factors, motivation, nature and significance

Module IV: Communication (15 Hours)

Definition and Significance of Communication, Its process, barriers of communication, building effective communication system. Controlling: definition and elements; Control techniques, Coordination, determinants of an effective control system, Managerial Effectiveness.

Suggested Readings

Joseph L. Massie :Essentials of Management .PHI, New Delhi; 2015

James F.Stoner: Management. Pearsons Education, Delhi; 2020

Harold Koontz, Heinz Weihrich: Management. Tata McGraw Hill Pub. Co., Delhi; 2015

Amitai Etzioni: Modern Organizations. PHI, New Delhi; 2021

Jones, Gareth R. and Jennifer M. George: Contemporary Management. Tata McGraw Hill

Charles Hill, W.L. and Steven L.McShane: Principles of Management. Tata McGraw Hill

E Resources

<https://www.youtube.com/watch?v=I6-QB-EldsE&list=PLJtJvO3aaWe16eq-L7sJ1Ww3021CWJU9>

<https://www.youtube.com/watch?v=q6LMjurECZM>

Mapping of COs with Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		H			
CO 3			H	M	M

MTBI205T: BANKING AND INSURANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course is designed to provide students with the necessary skills and knowledge in the context of the functioning of banking and insurance.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the basic principles of banking and insurance. (Remembering)

CO 2: Relate the various services provided by banks. (Understanding)

CO 3: Apply the concept of Internet Banking in day-to-day transactions. (Applying)

CO 4: Examine the situations to relate the risk and insurance. (Analysing)

Module I: Introduction (10 Hours)

Origin of banking: definition, banker and customer relationship, General and special types of customers, Types of deposits, Origin and growth of commercial banks in India. Financial Services offered by banks, changing role of commercial banks, types of banks.

Module II: Cheque and Paying Banker (10 Hours)

Crossing and endorsement - meaning, definitions, types and rules of crossing. Duties, Statutory protection in due course, collecting bankers: duties, statutory protection for holder in due course, Concept of negligence.

Module III: Banking Lending (6 Hours)

Principles of sound lending, secured vs. unsecured advances, types of advances, Advances against various securities.

Module IV: Internet Banking (10 Hours)

Meaning, Benefits, Home banking, Mobile banking, Virtual banking, E-payments, ATM Card/ iometric card, Debit/Credit card, Smart card, NEFT, RTGS, ECS (credit/debit), E-money, electronic purse, Digital cash.

Module V: Insurance (9 Hours)

Basic concept of risk, Types of business risk, Assessment and transfer, Basic principles of utmost good faith, Indemnity, Economic function, Proximate cause, Subrogation and contribution, Types of insurance: Life and Non-life, Re-insurance, Risk and return relationship, Need for co-ordination. Power, functions, and Role of IRDA, Online Insurance

Suggested Readings

Agarwal, O.P., Banking and Insurance, Himalaya Publishing House
 Satyadevi, C., Financial Services Banking and Insurance, S. Chand
 Suneja, H.R., Practical and Law of Banking, Himalaya Publishing House
 Chabra, T.N., Elements of Banking Law, Dhanpat Rai and Sons
 Arthur C. And C. William Jr., Risk Management and Insurance, McGraw Hill
 Saxena, G.S. Legal Aspects of Banking Operations, Sultan Chand, and Sons
 Varshney, P.N., Banking Law and Practice, Sultan Chand, and Sons
 Jyotsna Sethi and Nishwan Bhatia, Elements of Banking and Insurance, PHI Learning

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4				M	H

MTFT206T: FUNDAMENTALS OF INVESTMENT

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective(s)

This course aims to provide students with an understanding of fundamental concepts of business finance and investment.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explain the objectives & scope of financial management in context of business (Remembering)
- CO 2: Apply the concept of time value of money (Applying)
- CO 3: Evaluate investment opportunities using the capital budgeting process (Evaluating)
- CO 4: Explain Indian securities market including the derivatives market (Understanding)
- CO 5: Evaluate mutual funds as an investing avenue. (Evaluating)

Module I: Introduction (10 Hours)

Meaning of investment; Basic areas of investment; Investment functions; Forms of business organizations; Goals of investment management; concept of returns and Interest rates: level of Interest rate, determinants of market interest rates

Module II: Time Value of Money (10 Hours)

Future Value: Single period, multiple period; Present Value: single period and multiple period; Future Value and Present value for multiple cash flows; Present value of an annuity; Future value of an annuity

Module III: Capital Investment Decisions (10 Hours)

Concept of investment decisions; Generating investment project proposal; Process of Capital budgeting decision;; Net present value, payback method, internal rate of return.

Module IV: Basics of Investing (20 Hours)

Basics of Investment & Investment Environment. Risk and Return, Instruments of Investment - Equity shares, Preference shares, Bonds and Debentures. Indian Security Markets - Primary Markets (IPO, FPO, Private placement, Offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE, NSE, MSEI. Security Market Indices: Nifty & Sensex.

Module V: Investing in Mutual Funds (10 Hours)

Concept and background on Mutual Funds: Advantages, Disadvantages of investing in Mutual Funds, Types of Mutual funds: Open ended, close ended, equity, debt, hybrid, money market and entry load vs. exit load funds. Factors affecting choice of mutual funds. CRISIL mutual fund ranking and its usage, calculation and use of Net Asset Value

Suggested Readings

Principles of Financial Management, Levy H. and M. Sarnat, Pearson Education.
Fundamentals of Financial Management, Brigham and Houston, Cengage Learning.
Basic Financial Management, Khan and Jain, McGraw Hill Education
Fundamentals of Financial Management, Prasanna Chandra, McGraw Hill Education
Financial Management-text and Problems, Singh, J.K, Dhanapati Rai and Company , Delhi 6.
Fundamentals of Financial Management, Rustagi, R.P, Taxmann Publications Pvt.Ltd.
Singh J K , Singh Amit Kumar, Investing in Stock Markets, A K Publications, Delhi.
Tripathi, Vanita and Pawar, Neeti (2019), Investing in Stock Market, Taxmann Publications

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M				
CO 2		M			
CO 3			M		
CO 4				H	H

MTCM207T: COMPENSATION MANAGEMENT

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The course aims to clarify the principles and basic concepts of compensation management in organizations, including the role of human resources management in dealing with employees, and methods used to provide compensation.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Define Compensation Management (Remembering)

CO 2: Explain the principles and importance of compensation management. (understanding)
 CO 3: Develop and design compensation system. (Applying)
 CO 4: Analyze the present trends in calculation of incentives and other pay systems. (Analyzing)

Module I: Introduction to Compensation Management (15 Hours)

Definition of Compensation Management - objectives of compensation – Principles of Compensation Management – Importance of Compensation Management - Types of wages. Exploring and defining the compensation context – Intrinsic compensation - Extrinsic compensation -- Compensation Trends in India. - The 3-P compensation concept

Module II: Compensation Planning & Bases of Compensation (15 Hours)

Compensation Planning: Level, Structure and Systems Decision – Factors influencing compensation level planning: internal factors and external factors.

Traditional Bases for Pay-Seniority and Longevity Pay Merit Pay- Performance Appraisal- Methods- Biases -Strengthening the Pay for Performance Link- Possible Limitations of Merit Pay

Module III: Incentive Pay & Other Pay Systems (15 Hours)

Exploring Incentive Pay- Contrasting Incentive Pay with Traditional Pay.

Individual Incentives- Types of Individual Incentives- Advantages and Disadvantages

Group Incentives- Types of Group Incentives- Advantages and Disadvantages

Companywide Incentives- Types- Designing Incentive Pay Programmes

Person Focused Pay- Competency Based Pay, Pay for Knowledge and Skill Based Pay, Team based pay- Concepts.

Module IV: Designing Compensation System (15 Hours)

Building internally consistent Compensation System - Creating Internal Equity through Job Analysis and Job Valuation

Building Market Competitive Compensation System – compensation surveys - Integrating Internal Job Structures with External Market; Building Pay Structures that Recognise Individual Contribution: Constructing pay structure. Pay structure variations – Broad banding- two tier pay structure.

Suggested Readings

Tapomoy Deb, Compensation Management text & cases, Excel Publication, 2014.

Joseph J. Martocchio, Strategic Compensation- A Human Resource Management Approach- Pearson Education, 2012, 3rd Ed.

Dipak Kumar Bhattacharya, Compensation Management, Oxford University Press, 2014.

Richard.I. Henderson: Compensation Management in A Knowledge Based World - Prentice-Hall, 2012, 9th Ed.

Milkovich & Newman, Compensation, Tata McGraw –Hill, New Delhi, 2015.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		M		
CO 3			M	
CO4				H

MTIM208T: INTERNATIONAL MARKETING

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

To familiarize the students with the concept and issues of international marketing and enable them to be able to analyse the foreign market environment and develop international marketing strategies for a business firm.

Course/ Learning Outcomes

At the end of this course, students will be able to:

CO 1: Define international marketing (Remembering)

CO 2: Explain International Product Planning and Pricing decisions (Understanding)

CO 3: Identify the traditional to modern channel structures, Intermediaries (Applying)

CO 4: Analyse the international distribution decisions in terms of issues and planning (Analysing)

CO 5: Evaluate the different aspects of international promotional strategies (Evaluating)

Module I: Introduction: Introduction to International Business (14 Hours)

An overview; International marketing management process, International marketing information system. International Marketing Environment: Influence of physical, economic, socio - cultural, political and legal environments on international marketing decisions; International marketing information system. International Market Segmentation, Selection and Positioning; International market entry strategies – Exporting, licensing, contract manufacturing, joint venture, setting -up of wholly owned subsidiaries abroad.

Module II: International Product Planning and Pricing decisions (14 Hours)

Major Product decisions-product design, labeling, packaging, branding and product support services; Product standardization vs. adaptation; Managing product line; International trade product life cycle; New product development. Pricing decisions for International Markets: Factors affecting international price determination; International pricing process and policies; Delivery terms and currency for export price quotations; Transfer pricing; Counter trade as a pricing tool- types and problems of counter trading.

Module III: International Distribution Decisions (12 Hours)

Distribution channel- from traditional to modern channel structures, Intermediaries for international markets their roles and functions; Alternative middlemen choices, Factors affecting choice of channels; Locating, selecting and motivating channel members; International distribution logistics- Issues and Planning.

Module IV: International Promotion Strategies (12 Hours)

Communications across countries-complexities and issues; Country -of-origin effect; Sales promotions in international markets, trade fairs and exhibitions, International public relations, International Advertising decisions, Personal selling and sales management; Developing international promotion campaign.

Module V: Emerging trends in International Marketing (8 Hours)

International Marketing through Internet; Ecological concerns and international marketing ethics.

Suggested Readings

1. Cateora, Philip R, Graham John L and Prashant Salwan, International Marketing, Tata Mc Graw Hill
2. Czinkota, Michael R. and Illka A. Ronkainen, International Marketing, Cengage Learning
3. P K Vasudeva, 4th edition, 2010, Excel Books , New Delhi.
4. Jain, Subash C., International Marketing, South-Western.
5. Keegan, Warran J and Mark C Green, Global Marketing, Pearson
6. Kotabe, Masaaki and Kristiaan Helsen, Global Marketing Management, John Wiley and Sons.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		M			
CO 3			H		

CO 4				M	L

MTAO209T: AIRPORT OPERATIONS

(4 credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The course objective of Airport Operation in Bachelor of Business Administration (BBA) is to provide Students' with an understanding of the various aspects of airport operations, including airport management, airport security, and airport marketing

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the basic concepts of airport operations (Remembering)

CO 2: Explain airline navigation systems (Understanding)

CO 3: Analyze the process of airport safety and security (Analyzing)

CO 4: Critically judge the various aspects of Airport Planning and Services (Evaluating)

Module I: Introduction (15 Hours)

Airport Definition – Aerodrome and Airport, ICAO set-up and functions, Aerodrome Data and Physical characteristics, Declared Distances, Obstacle Limitation Surfaces.

Module 2: Airline Navigation (15 Hours)

Navigational Aids; Runway, Taxiway and Apron; Airfield Lighting; Visual Aids, Category of ILS (Instrument Landing System), Air Traffic Services and aeronautical communication (RT phraseology); Aeronautical Information Publication, NOTAM, Meteorological Report and Forecast, Facilitation (ICAO Annex – 9).

Module 3: Airport Safety and Security (15 Hours)

Security – Safeguarding civil aviation; Safe transportation of dangerous goods; Basic Safety Concept at Airport; Hazards; Safety Risk Assessment; SMS framework; Phased approach of SMS implementation.

Module 4: Airport Planning and Services (15 Hours)

Airport Planning (Master planning); Set-up of an international airport; Terminal Management; Airfield Management; Airport Operations Control Centre; Landside Management; Immigration and Customs Procedure; APHO Services; Ramp Handling Services; Cargo Operations; Commercial Management; Airport's economic performance; National Civil Aviation Policy (2016).

Suggested Readings

Airport Operations, Third Edition by Norman Ashford, Pierre Coutu, and John Beasley – Publisher: McGraw Hill Education, Year: 2014

Airport Planning and Management, Sixth Edition by Alexander T. Wells and Seth B. Young - Publisher: McGraw Hill Education, Year: 2017

Airport Systems: Planning, Design, and Management, Third Edition by Richard de Neufville and Amedeo Odoni - Publisher: McGraw Hill Education, Year: 2012

Introduction to Air Transport Economics: From Theory to Applications, Second Edition by Bijan Vasigh, Ken Fleming, and Thomas Tacker - Publisher: Routledge, Year: 2015.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2		M		
CO3			M	
CO4				H

MTSH307T: STRATEGIC HUMAN RESOURCE MANAGEMENT

(4 Credits - 60 hours) (L-T-P: 4-0-0)

Objective(s)

The objective of this course is to develop within the students the understanding of the student with relevant concepts, roles and challenges related to strategic human resource management practices in the workplace and design the requisite skills to be competent contributors in the organization's strategic decision-making process and make them competent to for various managerial and administrative positions in different organizations.

Course/ Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the hierarchy of strategy, classify between traditional HR and strategic HR. (Remembering)

CO 2: Demonstrate the aims of strategic HRM (Understanding)

CO 3: Analyse the concept of HR strategies, explain the approaches of developing HR strategies (Analysing)

CO 4: Examine the strategic role of the HR director, determine the strategic role of the HR specialists (Analysing) CO 5: Evaluate the various approaches to motivation (Creating)

Module I: Introduction to Strategic Human Resource Management (12 Hours)

Introduction, Strategy, Hierarchy of Strategy, Corporate Level Strategy, Business Level Strategy, Functional Level Strategy, Strategic HRM, Emergence of Strategic Human Resource Management (SHRM), The Evolutionary Stages of Strategic HRM, Difference Between Traditional HR and Strategic HR, Case study

Module II: Concepts of Strategic Human Resource Management (12 Hours)

Introduction, Trends in Strategic Human Resource Management, HR Practitioners Role, Human Resource as Competitive Advantage, Aims of Strategic HRM, Approaches to Strategic HRM, Formulation of HR Strategies, The Classical Sequential Approach, The Empirical Need-based Approach, Achieving Strategic Fit, Problems in Achieving Strategic Fit, Benefits of Strategic HRM, Barriers to Strategic HRM, Case study

Module III: Human Resource Strategies and its Implementation (12 Hours)

Introduction, HR Strategies, Types of HR Strategies, Overarching Strategies, Specific HR Strategies, Criteria for an Effective HR Strategy, Developing HR Strategies, Methodology for Formulating HR Strategies, Setting Out the Strategy, conducting a Strategic Review, Implementing HR Strategies Barriers to the Implementation of HR Strategies, Overcoming the Barriers, Case study

Module IV: Roles in Strategic Human Resource Management (12 Hours)

The Strategic Role of Top Management, The Strategic Role of Front-line Management, The Strategic Role of the HR Director, The Strategic Role of the HR Specialists, The New Mandate for HR, The Specific Strategic Roles of HR, Business Partner, The Innovation Role, The Change Manager Role, The Implementer Role, Case study

Module V: Challenges in Strategic Human Resource Management (12 Hours)

Introduction, The Challenges of Workplace Diversity, The Management of Workplace Diversity, Managing Diverse Workforce in an Organisation, Planning a Mentoring Program, Organising Talents Strategically, Retention Strategy, Talent Management Strategy and its components, Approaches to Human Resource Planning, Managing Executive Information Systems, Challenges for HR Managers, HRM Strategic Challenges, Case study

Suggested Readings

Sharma A, Khandekar A, Strategic Human Resource Management – An Indian Perspective, SAGE Publications

Schuler, R. S., & Jackson, S. E., 2009, Strategic Human Resource Management. 2nd ed., Wiley-India

Sharma, A and Khandekar, A., 2006, Strategic Human Resource Management: an Indian perspective. 1st ed., Response Books

MTPF308T: PERSONAL FINANCIAL PLANNING

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective(s)

The course aims to familiarize learners with different aspects of personal financial planning like savings, investment, taxation, insurance, and retirement planning and to develop the necessary knowledge and skills for effective financial planning.

Course/ Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the meaning and the relevance of financial planning. (Remembering)

CO 2: Understand the concept of investment planning and its methods. (Understanding)

CO 3: Examine the scope and ways of personal tax planning. (Applying)

CO 4: Analyse insurance planning and its relevance. (Analysing)

CO 5: Develop insight into retirement planning and its relevance. (Evaluating)

Module I: Introduction to Financial Planning (12 Hours)

Financial goals, steps in financial planning, budgeting incomes and payments, time value of money. Introduction to savings, benefits of savings, management of spending & financial discipline, Setting alerts and maintaining sufficient funds for fixed commitments

Module II: Investment Planning (12 Hours)

Process and objectives of investment, concept and measurement of return & risk for various asset classes, measurement of portfolio risk and return, diversification & portfolio formation. Gold bond; Real estate; Investment in greenfield and brownfield

Projects; Investment in fixed income instruments, financial derivatives & commodity market in India. Mutual fund schemes; International investment avenues. Currency derivatives and digital currency

Module III: Personal Tax Planning (12 Hours)

Tax structure in India for personal taxation, Scope of personal tax planning, exemptions and deductions available to individuals under different heads of income and gross total income. Comparison of benefits - Special provision u/s 115 BAC vis-à-vis General provisions of the Income-tax Act, 1961, tax avoidance versus tax evasion

Module IV: Insurance Planning (12 Hours)

Need for insurance. Life insurance, health insurance, property insurance, credit life insurance and professional liability insurance

Module V: Retirement Benefits Planning (12 Hours)

Retirement planning goals, process of retirement planning, Pension plans available in India, Reverse mortgage, Estate planning.

Suggested Readings

Deb Tapomoy, Strategic Approach to Human Resource Management Concept, Tools and Application, Atlantic Publishers & Distributors Pvt Ltd.

Nayantara Padhi, Strategic Human Resources Management: Theory and Practice, Atlantic Publishers and Distributors Pvt. Ltd; 1 edition

Mello Jeffrey A., Strategic Management of Human Resources, Cengage Learning, 3rd edition

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	L	L	L
CO 2	L	H			
CO 3			H		
CO 4		M		H	
CO 5	M		H		H

MTMR309T: MARKETING RESEARCH

(4 Credits- 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define marketing research (Remembering)

CO 2: Explain sample and sampling design (Understanding)

CO 3: Identify various data collecting methods and tools (Applying)

CO 4: Analyse data hypothesis and testing procedures (Analyzing)

Module I: Introduction of Marketing Research (15 Hours)

Define Marketing Research, Aims and Objectives of Marketing Research. Applications of Marketing Research, Marketing

Information System, Evaluation and Control of Marketing Research, Value of Information in Decision Making, Steps in Marketing Research. Research Design: Formulating the Research Problem, Choice of Research Design, Types of Research Design, Sources of Experimental Errors.

Module II: Sample and Sampling Design (15 Hours)

Some basic terms, Advantages and Limitation of Sampling, Sampling process, Types of Sampling, Types of Sample Designs, Determining the Sample Size, Sampling Distribution of the Mean. Scaling Techniques: The concept of Attitude, Difficulty of Attitude Measurement, Types of Scales, Applications of Scaling in Marketing Research.

Module III: Data Collection (15 Hours)

Secondary Data, Sources of Secondary Data, Primary Data, Collection of Primary Data, Methods of Data Collection- Observation, Questionnaire, Designing of Questionnaire. Data Processing and Tabulation: Editing, Coding and Tabulation.

Module IV: Data Analysis (15 Hours)

Testing of Hypothesis, Measurement of Central Tendency, Dispersion, Univariate Analysis, Multiple Regression, Factor Analysis, Cluster Analysis, Multidimensional Scaling, Conjoint Analysis; Interpretation and Report Writing, Types of Research Reports

Suggested Readings

Satyabhushan D., Malhotra NK., (2015) Marketing Research: An Applied Orientation, 7th Edition, Pearson publisher.

Bajpai N., (2011) Business Research Methods: Pearson publisher.

Cooper & Schindler (2015) Business Research Methods, 12th Edition, Mcgraw-Hill.

Green, Tull & Albaum (2010) Research for Marketing Decisions, 5th Edition, PHI Pvt. Ltd, New Delhi.

Levine, Khrehbiel & Berenson (2013) Business Statistics, 6th Edition, Pearson Education.

Luck D. & Rubin D. (2006) Marketing Research, 7th edition, PHI, New Delhi

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M		M	
CO3			H		
CO4			M	M	H

MTGH310T: GROUND HANDLING SERVICES AT AIRPORT

(4 credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The paper is to demonstrate conceptual understanding of the scope of Ground Handling Operations in aviation industry and also to analyze the challenges faced by Ground Handling companies while providing services to the clients. The paper also focuses on understanding the work culture of Ground Handling organizations and analyze regulatory framework prevalent in the industry.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the fundamentals of ground handling (Remembering)

CO 2: Understand the fundamentals of passenger handling. (Understanding)

CO 3: Apply the baggage handling procedure (Applying)

CO 4: Analyse the cargo handling procedure. (Analysing)

CO 5: Describe the ramp handling procedure (Evaluating)

Module I: Ground Handling overview (15 Hours)

Meaning and importance - IATA SAFETY AUDIT for GROUND OPERATIONS (ISAGO) – Airport Operations Control Centre – Role of Turn-Around Coordinator – Ground Handling Equipment.

Module II: Passenger Handling (15 Hours)

Check In and security – Transfer and Transit Passenger handling – Special Category of Passengers – Passenger Embarkation/Disembarkation – Role of Human Factors

Module III: Baggage handling procedures (10 Hours)

Baggage types – World Tracer – Dangerous Goods in Baggage, Checking of baggages.

Module IV: Cargo and Mail handling procedures (10 Hours)

Special cargo – Dangerous Goods – Aircrafts Holds, Load Control Procedures – Process flow – Aircraft Weight & Balance Principles – Centralized Load Control.

Module V: Ramp handling procedures (10 Hours)

Aircraft Loading/Unloading – Interior and exterior cleaning – Regulatory authorities – MOCA, BCAS, DGCA

Suggested Readings

"Ground Handling: Theory and Practice" by Konstantinos Zografos and Theodoros Kostouros, published by Routledge in 2016

"Airport Ground Handling" by Alexandre G. de Barros and Paulo Roberto de Oliveira, published by CRC Press in 2015

Michael J Kroes, William A Watkins, Frank J. Delp and Walter J. Boyne, "Aviation Ground Handling" published By McGraw – Hill Education in 2004

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4				H	
CO5					M
CO6					M

MTIR311T: MANAGEMENT OF INDUSTRIAL RELATIONS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

The course focuses on acquainting students with concepts of Industrial Relations and various legislations related to Labour Welfare and Industrial laws.

Course/Learning Outcomes

At the end of this course students will be able to :

CO 1: Define the conceptual knowledge on industrial relations (Remembering)

CO 2: Explain the extent to which the workers can participate in management (Understanding)

CO 3: Apply the mechanism for resolving industrial disputes (Applying)

CO 4: Analyse the provision for payment of wages (Analysing)

CO 5: Discuss the legal framework of factories act (Evaluating)

Module I: Concept of Industrial Relations (15 Hours)

Aspects of industrial relations, conflict and cooperation, parties in industrial relations, workers employers and government, trade unions, objectives process, prerequisites of collective bargaining.

Module II: Workers Participation in Management (10 Hours)

Levels & Mode of participation, Works Committee, Joint Management councils, Worker Director, Grievance Procedure, QC.

Module III: Trade Union Act 1926 (15 Hours)

Immunity granted to Registered Trade Unions, Recognition of Trade Unions. The Industrial Employment (Standing Orders) Act 1946, scope, coverage, certification process, modification, interpretation, and enforcement. The Industrial Disputes Act 1947, forum for settlement of disputes.

Module IV: Payment of Wages Act (10 Hours)

Salient features, coverage of employees and employers, rules and benefits relating to The Payment of Wages Act 1936, The Payment of Gratuity Act 1972, The Minimum Wages Act 1948, The Payment of Bonus Act 1965.

Module V: The Factories Act 1948 (10 Hours)

Definition, approval, licensing and registration, health and welfare measures , employment of women and young persons, leave with wages and weekly holidays.

Suggested Readings

C.B.Mamoria, Mamoria & Gankar, Dynamics of Industrial Relations, Himalaya Publishing House Pvt Ltd, 13th Edition, 2014

C.S. Venkat Rathnam, Industrial Relations, Oxford University Press, New Delhi, 2012.

Arun Monappa, Industrial Relations, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T N Chhabra, Industrial Relations and Labour Laws, Dhanpat Rai Publishing House, Edition 5th, 2013 2. S C Srivastava, Industrial Relations and Labour Laws, Vikas Publishing House.2012

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H	M		
CO3		H	H	L	
CO4				H	
CO5					H

MTIP312T: INVESTMENT ANALYSIS & PORTFOLIO MANAGEMENT

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

To learn the basics of investing and decide where to invest with less risk.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the investment environment, different types of investment vehicles (Remembering)

CO 2: Explain the logic of investment process (Understanding)

CO 3: Apply the quantitative methods for investment decision making (Applying)

CO 4: Analyse the portfolio theory and the process of investment portfolio formation (Analysing)

CO 5: Analyze relevance of stocks and bonds for the investments (Analysing)

Module I: Basics of risk and return (15 Hours)

Concept of returns, application of standard deviation, coefficient of variation, beta, alpha. Bonds: present value of a bond, yield to maturity, yield to call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve and theories regarding shape of yield curve. Unsystematic risk and non-risk factors that influence yields. Duration and modified duration, immunization of a bond portfolio. Fundamental analysis, Economic analysis, Expected direction of movement of stock prices with macroeconomic variables in the Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOT analysis, financial analysis of an industry

Module II: Share valuation (15 Hours)

Dividend discount models- no growth, constant growth, two stage growth model, multiple stages; Relative valuation models using P/E ratio, book value to market value. Technical analysis: meaning, assumptions, difference between technical and fundamental analysis; Price indicators- Dow theory, advances and declines, new highs and lows. Volume indicators- Dow Theory, small investor volumes. Other indicators- futures, institutional activity, Trends analysis: line chart, bar chart, candle chart, point & figure chart. Patterns: head & shoulders, triangle, rectangle, flag, cup & saucer, double topped, double bottomed, Indicators: moving averages. Efficient market hypothesis; Concept of efficiency: Random walk.

Module III: Portfolio analysis (15 Hours)

Portfolio risk and return, Markowitz portfolio model: risk and return for 2 and 3 asset portfolios, concept of efficient frontier & optimum portfolio. Market Model: concept of beta systematic and unsystematic risk. Investor risk and return preferences: Indifference curves and the efficient frontier, Portfolio management services: Passive – Index funds, systematic investment plans. Active – market timing, style investing.

Module IV: Capital Asset Pricing Model (CAPM) (15 Hours)

Efficient frontier with a combination of risky and risk-free assets. Assumptions of single period classical CAPM model. Characteristic line, Capital Market Line, Security market Line. Expected return, required return, overvalued and undervalued assets. Mutual Funds: Introduction, calculation of Net Asset Value (NAV) of a Fund, classification of mutual fund schemes by structure and objective, advantages and disadvantages of investing through mutual funds. Performance Evaluation using Sharpe's Treynor's and Jensen's measures .

Suggested Readings

Security Analysis & Portfolio Management, Fischer, D.E. & Jordan, R.J ; Pearson Education.
Investment Analysis and Portfolio Management, Prasanna Chandra, Tata McGraw Hill Education Private Limited

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3	M	H	H	L
CO4		M	H	H
CO5		L	M	H

MTDM313T: DIGITAL MARKETING

(4 credits - 60 hours) (L-T-P: 4-0-0)

Objective(s)

After studying this course, the students will be able to learn about the different knowledge and skills needed for effective digital marketing in the corporate sectors and entrepreneurial ventures.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the fundamentals of website marketing. (Remembering)

CO 2: Explain the fundamentals of search engine technology (Understanding)

CO 3: Interpret the various types of social media marketing. (Applying)

CO 4: Analyze the models of digital marketing (Analyzing)

CO 5: Evaluate the web analytics and social media analytics (Evaluating)

Module I: Introduction to Digital Marketing (10 Hours)

Introduction to Digital Marketing, Fundamentals of Website Marketing, Search Engine Marketing, Social Media Marketing, Key

Concepts and Important Terminologies, Fundamentals of Metrics and its importance in digital marketing, Fundamentals of Programmatic Advertisement and Performance Marketing, Traditional marketing vs Digital Marketing

Module II: Search Engine Optimization (15 Hours)

Introduction to SEO, Fundamentals of Search Engine Technology, Overview of Search Engine Upgrades, Fundamentals of Google Search, Basics of Google Ads, Keyword Research, On-page and Off-page optimization, Core Elements of Optimization, Understanding Backlinks and Value Network, Organic and Paid Optimization and Techniques of Optimization

Module III: Social Media Marketing (10 Hours)

Introduction Social Media Marketing, Understanding Platforms; types and categories, Relevance in Marketing, Platform Selection, Performance Marketing, Social Media Mentions and Spread, Social Media Sentiment, Lead Generation, Creating a sales funnel.

Module IV: Models of Digital Marketing (10 Hours)

Communication Model (10-C), 7P's of Marketing for content development, AIDA, Framework for targeting and positioning, BOS framework for Channel Development, Integrated Marketing Communication for Efficiencies.

Module V: Web and Social Media Analytics (15 Hours)

Fundamentals of Web Analytics and Social Media Analytics, Understanding Analytical Dimensions, Preparation of Analytical Plan, Identification of Core Metrics and KPIs, Formulation of Metrics, Interpretation of Platform Inbuilt Dashboards (Facebook,

Instagram etc and Google Analytics) Channels and Content Development. Designing a website (non-programming), Designing a Social Media Page, Merger of Accounts, Understanding Content, Classification of Content, Content Marketing Channels, Post Strategies, Target Identification

Suggested Readings

Ahuja V. Digital Marketing, Oxford University Press.
 Dodson, I. (2016). The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns (1st ed.). Hoboken, New Jersey Wiley.
 Kelsey, T., & Springerlink (Online Service. (2017). Introduction to Social Media Marketing : A Guide for Absolute Beginners. Apress.
 Reza Zafarani, Mohammad Ali Abbasi, & Huan Liu. (2014). Social media mining: an introduction. Cambridge University Press.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			M	M	H
CO 4				M	
CO 5					M

MTAC314T: AIR CARGO OPERATIONS

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective(s)

This course provides air cargo operations overview and freight forwarders perspective about the air cargo industry. This course cargo operations would focus on the business, operations and regulatory fundamentals. It will explore how the air cargo industry is changing and how to identify opportunities to become more successful as a manager in your company. The purpose of this course is to enlighten the students about various cargo handling process and system which are prevalent in business industry.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Define air freight and cargo (Remembering)
- CO 2: Demonstrate the cargo terms and glossary. (Understanding)
- CO 3: Identify the various the airport documentation (Applying)
- CO 4: Categorize the cargo weight, packing etc. (Analysis)
- CO 5: Evaluate the cargo laws (Evaluating)

Module I: Air Freight Forwarder (15 Hours)

The Air Freight Forwarder, The Airlines, Geography, The Governing Bodies, Cargo Requiring Special Handling, Aircrafts & ULDs, International Time calculators

Module II: Glossary of cargo terms (10 Hours)

Glossary of cargo terms, Aircraft type: Holds and Compartments.

Module III: Introduction, classification of dangerous goods (15 Hours)

Introduction, classification, limitation, identification, packing, documentation, unitization, handling, acceptance, and the carriage of dangerous goods

Module IV: General cargo, special cargo (10 Hours)

General cargo, special cargo, weight & dimension, packing, marking, labeling, handling label, coding and decoding, all types of cargo requiring special handling

Module V: Introduction, principles and rules governing liability (10 Hours)

Introduction, principles and rules governing liability, the liability of freight forwarder, carriage of Goods by Sea, the Hague rules, Hamburg rules, Warsaw convention, Montreal convention.

Suggested Readings

Bhalla, A. S. B., Vankar, A. A., & Zala, L. B. Runway Pavement Design of a proposed Airport with the use of FAARFIELD Software.

Hanlon, J. P. (2000). Strategic Airport Planning, Robert E. Caves and Geoffrey D. Gosling, Pergamon, Oxford, 1999, ISBN 0 08 042764 2, 451

Jarach, D. (2017). Airport marketing: Strategies to cope with the new millennium environment. Routledge

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4				H	
CO5				M	M

MTBE404T: BUSINESS ENVIRONMENT

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective(s)

To apply relevant knowledge, skills and exercise professional judgement in understanding the macro environment in which a business organisation operates. The course would also make the students capable of analysing and understanding policies of the government implemented from time to time and assess their impact on business

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define economic systems in depth (Remembering)

CO 2: Explain how an entity operates in a business environment (Understanding)

CO 3: Identify the role of Public and Private sector in the business environment (Applying)

CO 4: Examine the trade environment in details (Analysing)

Module I: Business Environment (6 Hours)

Concept, Components and importance; Indian Business Environment; Cultural, social, political, technological, economic and legal environment; scanning techniques of environmental forecasting; SWOT- Internal environment -their impact on policy formulation.

Module II: Economic trends (6 Hours)

Economic reforms in India –Liberalization, privatization and globalization; Competitive Strength of Indian industry; Impact of liberalization policy on different sectors; Foreign Investments policy in India.

Module III: Multinational Corporations (6 Hours)

Multinational corporations and their participation in India; strategies of multinational corporations; competitive strengths policies and performance

Module IV: Business Ethics and Social Responsibilities (6 Hours)

Business ethics and social responsibilities; relationship between business and society; Corporate power social accountability;

Ethical issues and values in business; Corporate Social policies - issues and challenges; Ecological and environmental issues

Module IV: Economic Development of North Eastern Region (6 Hours)

Special package for economic development of the north eastern region; DONER and its role in economic development, infrastructure and industry; Brief study of the tea industry, paper industry, food processing industry, silk industry and bell metal industry; tourism industry of Assam

Suggested Readings

Wheelen, Concepts of Strategic Management and Business policy, Pearson Education, New Delhi.

Islam Swabera & Kharkongor; Business Environment, Taxman's Publication, New Delhi.

Misra S.K., Puri V.K.; Indian Economy, Himalaya Publishing House, Mumbai.

Deepashree, Indian Economy, Tata McGraw Hill, New Delhi.

Dutta Rnddar and Sundaram KPM, S. Chand & Co. Ltd., New Delhi.

Agarwal A.N., Indian Economy, New Delhi.

Kazhmi Azhar, Business Policy

Gupta, Liberalisation - its impact on Indian Economy, Macmillan.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	L	L	L		
CO 2	M		H		
CO 3		M		H	
CO 4	L				M

MTAR405T: AIRPORT RESOURCE PLANNING & SERVICES MANAGEMENT

(3 Credits -45 hours) (L-T-P: 3-0-0)

Objective(s)

The main objective of Airport Planning & Management course is to help the students to acquire and develop skill to take rational decisions in the process of planning costly airport infrastructure. The paper also familiarizes the students in understanding on various customer handling standard operating procedures. This will be helpful to increase and develop skill of independent thinking and decision making.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define airport and airport operations (Remembering)

CO 2: Explain the airspace and air traffic control. (Understanding)

CO 3: Develop the airport system planning (Applying)

CO 4: Analyse the airport customer

services. (Analysis) CO 5: Evaluate

the branding strategies (Evaluating)

Module I: Airport and Airport Systems (10 Hours)

Introduction of airport and airport system - National Plan of Integrated Airport system - Rules govern airport system- Organizations that influence airport regulatory policies - Profiles of regulatory bodies of airport - Organization and administration, The components of the airport - The airfield - Components of an airport - The airfield coastal & geotechnical survey - NAVAIDS on the airfield - Weather reporting facilities - Security infrastructure.

Module II: Airspace and air traffic Control (8 Hours)

Brief history of ATC - Present day ATC management & operating infrastructure - Basics of ATC - Current & future enhancement to ATC - Airport terminal and ground access - Historical development of airport terminals - Components of airport terminal - Airport ground access.

Module III: Airport system planning Airport master plan (10 Hours)

Forecasting - Facilities Requirement - Design alternatives - Financial plans - Land use planning - Environmental planning - Airport capacities and delays - Defining capacity - Factors affecting capacity & delay - Estimating capacity - Illustrating capacity with a time space diagram - FAAA approximation chart - Simulation models.

Module IV: Customer service (8 Hours)

Introduction, concept of customer service, objectives of customer service, role of customer service representative, objectives of customer services. Dealing with various complaints, reasons and causes of complaints

Module V: Branding Strategies (9 Hours)

Branding strategies with customer services at airports: marketing ambience of airport, role of service and social media in customer service, performance and quality of service offered.

Suggested Readings

1. Khanna, S. K., & Arora, M. G. (1971). Airport Planning and Design. Mom Chand.
2. Freathy, P. (2003). Managing airports: an international perspective: Anne Graham.
3. Butterworth-Heinemann, Oxford, 2001, pp. 240, ISBN 075064823.
4. Wensveen, J. G. (2016). Air transportation: A management perspective. Routledge
5. Sudhir, A. (2007). Introduction to tourism and hospitality industry. Tata McGraw-Hill.
6. Bazargan, M. (2016). Airline operations and scheduling. Routledge

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4				H	
CO5					M

MTRM406T: RESEARCH METHODOLOGY

(2 Credits - 30 Hours) (L-T-P: 2-0-0)

Objective(s)

This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the various kinds of research, objectives of doing research (Remembering)

CO 2: Apply the basic knowledge on qualitative research techniques (Understanding)

CO 3: Analyze of data analysis-and hypothesis testing procedures (Analysing)

Module I: Introduction (6 Hours)

Meaning of Research, Objectives of Research, Types of Research, Research Process, Research Problem formulation; Research

Design: Features of a good research design; Different Research Designs; Measurement in Research; Data types; Sources of Error

Module II: Measurement and Scaling (8 Hours)

Primary Level of Measurement- Nominal, Ordinal, Interval, Ratio, Comparative and Non-competitive Scaling Techniques, Questionnaire Design, Sampling Process, Sampling Techniques- Probability and Non-Probability Sampling, Sample Size Decision.

Module III: Data Collection (10 Hours)

Primary & Secondary Data; Survey Method of Data Collection, Classification of Observation Method; Fieldwork and Data Preparation. Hypothesis: Null Hypothesis & Alternative Hypothesis; Type-I & Type-II Errors; Hypothesis Testing: Z-Test, T-Test, ANOVA, Concepts of Multivariate Techniques.

Module IV: Research Report (6 Hours)

Meaning, Types and Layout of Research Report; Steps in Report Writing, Tabular & Graphical Presentation of Data, Citations, Bibliography and Annexure in Report, Avoid Plagiarism; Use of Statistical Software to Analysis the Data.

Suggested Readings

Satyabhushan D., Malhotra NK., (2015) Marketing Research: An Applied Orientation, 7th Edition, Pearson publisher.

Bajpai N., (2011) Business Research Methods: Pearson publisher.

Cooper & Schindler (2015) Business Research Methods, 12th Edition, Mcgraw-Hill.

Green, Tull & Albaum (2010) Research for Marketing Decisions, 5th Edition, PHI Pvt. Ltd, New Delhi.

Levine, Khrehbiel & Berenson (2013) Business Statistics, 6th Edition, Pearson Education.

Luck D. & Rubin D. (2006) Marketing Research, 7th edition, PHI, New Delhi

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			H	M	M

MTIB407T: INTERNATIONAL BUSINESS

(Credits-3 - 45 hours) (L-T-P: 3-0-0)

Objective(s)

This course provides an overview of the environment, concepts, and basic differences involved in international business.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Describe the foundation of international business.

CO 2: Describe international organizations and multinational corporations.

CO 3: Define forms of foreign involvement.

CO 4: Evaluate various international trade theories.

Module I: Introduction to Global Business (10 Hours)

Global Business: Scope, Global Linkages today; Culture and Global Business: Elements of culture, Training Challenge; Global Trade and Investment Theory: Mercantilism, Classical Trade Theory, Factor Proportion Theory, International Trade and Product cycle theory, Theory of International Investments; Structure of Indian Foreign Trade: Composition & direction; EXIM Bank; Exit Policy of India; Regulation and Promotion of Foreign Trade.

Module II: Global Financial Markets (10 Hours)

Foreign exchange markets; Fixed and Floating Foreign exchange rates; Significant monetary events; Exchange rates, interest rates and economic policy; Economic Integration; Government Trade Policies.

Module III: Global Business Environment (15 Hours)

Private International Law; Public International Law; Risk to Global Business; Doctrine of Sovereign Immunity; Doctrine of Eminent Domain; Labour Law Differences; Theoretical foundations of International Business; Balance of Payments; International Liquidity; International Economic Accounting and Tax differences; Multinational Corporations; Foreign Direct Investment.

Module IV: International Finance (10 Hours)

Financing exports and imports; International Capital and Cash Management; Capital Structure: International Dimensions; International Capital Markets; International Banking and Security Markets; IMF; World Bank; IFC; ITA; ADB; WTO.

Suggested Readings

Joshi Rakesh Mohan: International Business, Oxford University Press.

Cherunilam F: International Business: Text and Cases, PHI Learning.

Mapping of COs to Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2		H		
CO 3			H	M
CO 4	H			

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	MTED104L	Entrepreneurship Development	3
2	S E Course 2	MTOM105L	Office Organization and Management	3
3	S E Course 3	MTRM210L	Retail Management	3

MTED104L: ENTREPRENEURSHIP DEVELOPMENT

(3 Credits - 45 Hours) (L-T-P: 4-0-0)

Objective(s):

The purpose of the paper is to orient the learner toward entrepreneurship as a career option and creative thinking and behavior.

Course/ Learning Outcomes

At the end of the course students will be able to:

CO 1: Define the concept of entrepreneur. (Remembering)

CO 2: Classify different types of entrepreneurs and entrepreneurial ventures. (Understanding)

CO 3: Describe the dimensions of entrepreneurial orientation. (Applying)

CO 4: Identify strengths, weaknesses of oneself. (Analysing)

Module I: Introduction (8 hours)

Meaning, elements, determinants and importance of entrepreneurship and creative behavior; Entrepreneurship and creative response to the society's problems and at work; Dimensions of

entrepreneurship: intrapreneurship, technopreneurship, cultural entrepreneurship, international entrepreneurship, netpreneurship, ecopreneurship, and social entrepreneurship

Module II: Entrepreneurship and Micro, Small and Medium Enterprises (8 hours)

Concept of business groups and role of business houses and family business in India; The contemporary role models in Indian business: their values, business philosophy & behavioural orientations; Conflict in family business and its resolution

Module III: Sustainability of Entrepreneurship (8 hours)

Public and private system of stimulation, support and sustainability of entrepreneurship. Requirement, availability and access to finance, marketing assistance, technology, and industrial accommodation, Role of Industries/entrepreneur's association and self-help groups, The concept, role and functions of business incubators, angel investors, venture capital and private equity fund

Module IV: Sources of business ideas and tests of feasibility (12 hours).

Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation, planning & control; preparation of project report (various aspects of the project report such as size of investment, nature of product, market potential may be covered); Project submission/ presentation and appraisal thereof by external agencies, such as financial/non-financial institutions

Module V: Mobilising Resources (9 hours).

Mobilising resources for start-up. Accommodation and utilities; Preliminary contracts with the vendors, suppliers, bankers, principal customers; Contract management: Basic start-up problems

Suggested Readings

Kuratko and Rao, Entrepreneurship: A South Asian Perspective, Cengage Learning.

Hisrich R, Peters M, Dean Shepherd, Entrepreneurship, McGraw Hill Education

Desai, Vasant. Dynamics of Entrepreneurial Development and Management. Mumbai, Himalaya Publishing House.

Dollinger, Mare J. Entrepreneurship: Strategies and Resources. Illinois, Irwin.

David H. Entrepreneurship: New Venture Creation. Prentice-Hall of India, New Delhi.

Singh, Nagendra P. Emerging Trends in Entrepreneurship Development. New Delhi: ASEED.

Khanka S S, Entrepreneurial Development, S. Chand & Co, Delhi.

E Resources

<https://www.youtube.com/watch?v=rA4uKly5gO0&list=PLsh2FvSr3n7fQIID-bfKutmSL26TsWitGQ>

<https://www.youtube.com/watch?v=DiKduSs7o34>

Mapping of COs with Syllabus

Course Outcomes	Module-1	Module-2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	M
CO4			H	L

MTOM105L: OFFICE ORGANIZATION AND MANAGEMENT

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective(s)

The course aims to establish the importance of office organisation and management and its role in the workplaces. It also prepares the students to acquire basic knowledge and skills necessary for different tasks and aspects in different industries

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the basic knowledge of office organisation and management (Remembering)

CO 2: Demonstrate skills in effective office organisation (Understanding)

CO 3: Organise and to maintain the office records (Applying)

CO 4: Ability the different types of digital records. (Analysing)

CO 5: Appraise the different types of organisation structures (Evaluating)

Module I: Fundamentals of Office Management (10 Hours)

Introduction: Meaning, importance and functions of modern office Modern Office Organisation: Meaning; Steps in office organisation; Principles of Office organisation, Organisation structure types, Nature of office services: Types of services in a modern office, decentralisation and centralisation of office services, Office management: Meaning, Elements and major processes of Office management Office Manager: Functions and qualifications of Office manager

Module II: Administrative Arrangement and Facilities (8 Hours)

Office Accommodation and its Importance: Location of Office, Choice of Location: Urban vs Sub-urban, Factors to be Considered in Selecting the Site, Securing Office Space, Office Lay-out: Objectives of Office Lay-out, Types of offices: Open Office and Private Office- advantages and disadvantages.

Module III: Office Environment (10 Hours)

Meaning and Components of Office Environment Interior Decoration: Colour Conditioning, Floor Coverings, Furnishings, Furniture and Fixtures: Types of Furniture, Choice between Wooden and Steel Furniture, Principles Governing Selection of Furniture Lighting and Ventilation, Noise: Internal Noise, External Noise , Cleanliness, Sanitation and Health Safety and Security;

Module IV: Introduction to Records & Filing System (8 Hours)

Importance of Records, types of office records, Records Management: Meaning, Principles of Record Keeping, Functions of Records; Management Filing: Elements of Filing and Filing Functions, Objectives and Importance of Filing, Advantages of Filing, Essentials of a Good Filing System, Classification of Files. Filing Methods: Horizontal and vertical Filing. Office manual: contents, Importance, types of office manuals. Indexing: Meaning, importance, advantages and essentials of good indexing, Retention and disposal of files: Meaning and benefits of record retention, need for disposal of files, life-cycle stages of files.

Module V: Office Mechanisation and Data Processing (9 Hours)

Meaning, Importance and Objectives of Office Mechanisation, Advantages and disadvantages of Office Mechanisation, Factors Determining Office Mechanisation Kinds of Office Machines: Duplicating Machines and Photocopying Machines, Distinction between Data and Information, Importance of Data and Information, Classification of Data, Classification of Information, Data Collection Methods- Primary and secondary data collection methods Data processing using computers: Computer Applications in Office Management, Advantages and Limitations of Computerisation

Suggested Readings

S.P Arora, Office Organisation and Management, Vikas Publishing House Pvt Ltd
 M.E Thakuram Rao, Office organisation and Management, Atlantic
 Judith Read, Mary Lea Ginn, Record Management, 10th Edition, Cengage Learning.

E Resources

<https://www.youtube.com/watch?v=8iwOCXklmml>
https://www.youtube.com/watch?v=QE6TBuGbScA&list=PL7c2_MFoYT-4WajZ71x4gZt2aZ_Wrbi

Mapping of COs with Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4			H	H	
CO5				M	M

MTRM210L: RETAIL MANAGEMENT

(Credits: 3- 45 hours) (L-T-P: 3-0-0)

Objective(s)

The course aims to establish the importance of retail management. It also prepares the students to acquire basic knowledge and skills necessary for different tasks and aspects of retail management.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: List the types and forms of Retail business. (Understanding)
 CO 2: Examine Consumer Behavior in various environment. (Applying)
 CO 3: Analyze various Retail operations and evaluate them. (Analysing)
 CO 4: Determine the retail marketing mix. (Knowledge)
 CO 5: Application of IT in retail sector (Applying)

Module I: Introduction to Retail Business (8 Hours)

Definition – functions of retailing - types of retailing – forms of retail business ownership. Retail theories – Wheel of Retailing – Retail life cycle. Retail business in India: Influencing factors – present Indian retail scenario.

Module II: Consumer Behaviour in Retail Business (10 Hours)

Buying decision process and its implication on retailing – Influence of group and individual factors, Customer shopping behaviour, Customer service and customer satisfaction.

Module III: Retail Operations (12 Hours)

Factors influencing location of Store - Market area analysis – Trade area analysis – Rating Plan method - Site evaluation. Retail Operations: Stores Layout and visual merchandising, Stores designing, Space planning, Inventory management, Merchandise Management, Category Management.

Module IV: Retail Marketing Mix (8 Hours)

Introduction -Product: Decisions related to selection of goods (Merchandise Management revisited) – Decisions related to delivery of service. Pricing: Influencing factors – approaches to pricing Place : Supply channel – SCM principles – Retail logistics – Promotion : Setting objectives – communication effects - promotional mix.

Module V: Information Technology in Retailing (7 Hours)

Non store retailing (e-retailing) - The impact of Information Technology in retailing - Integrated systems and networking – EDI – Bar coding – Electronic article surveillance – Electronic shelf labels – customer database management system.

Suggested Readings

Suja Nair; Retail Management, HPH

Karthic – Retail Management, HPH

S.K. Poddar & others – Retail Management, VBH.

R.S Tiwari ; Retail Management, HPH

Mapping of COs with Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H		
CO4				H	
CO5					H

INTERNSHIPS

Se- mester	Category	Course Code	Course Name	Credits
2	Internship	MTIN106I	Internship	4
4	Internship	MTIN211I	Internship	4
5	Internship	MTIN315I	Internship	2

MTIN106I/MTIN211I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits- 120 Hours) (L-T-P: 0-0-4)

Objective(s)

The students are required to undergo an internship in work related to Commerce and Management during the semester break at the end of fourth Semester or fifth Semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Identify career alternatives prior to graduation. (Understanding)

CO 2: Translate theory into practice. (Applying)

CO 3: Improve work habits and attitudes towards job success in workplace (Creating)

INTRODUCTION

The field of Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the BBA programme the students are made acquainted with the various facets of General Management, Marketing, HR and Finance functions. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

The internship should be for a minimum duration of **three weeks for 120 hours** which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.

The students have to undergo the internship at the end of 1st Year or 2nd Year if they choose to leave the programme. Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student. The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management.

After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department. e. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise of the following:

- a. Recommendation Letter from the Department.
- b. Completion Certificate from the Organisation where the student has worked as intern.
- c. Internship Diary as per the prescribed format.
- d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.
- e. The Contents of the Report must include:
 - I. Introduction.
 - II. Objectives of the Internship.
 - III. About the Organisation (Sector, Activities, Operations).
 - IV. Description of the work.

The Assessment for the internship must have the following components:

- a. Internship Report: 20 marks
- b. Internship Diary: 20 marks
- c. Seminar Presentation: 30 marks
- d. Viva-Voce Examination: 30 marks

MTIN315I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits- 60 Hours) (L-T-P: 0-0-2)

Objective(s)

The students are required to undergo an internship in work related to Commerce and Management during the semester break at the end of fourth Semester or fifth Semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Identify career alternatives prior to graduation. (Understanding)
- CO 2: Translate theory into practice. (Applying)
- CO 3: Improve work habits and attitudes towards job success in workplace (Creating)

INTRODUCTION

The field of Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the BBA programme the students are made acquainted with the various facets of General Management, Marketing, HR and Finance functions. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

The internship should be for a minimum duration of **two weeks for 80 hours** which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.

1. The students have to undergo the internship during the semester break at the end of 3rd semester examination or at the end of 5th semester examination.
2. Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student
3. The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management.
4. After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department. e. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise of the following:

- a. Recommendation Letter from the Department.
- b. Completion Certificate from the Organisation where the student has worked as intern.
- c. Internship Diary as per the prescribed format.
- d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.
- e. The Contents of the Report must include:
 - I. Introduction.
 - II. Objectives of the Internship.
 - III. About the Organisation (Sector, Activities, Operations).
 - IV. Description of the work.

The Assessment for the internship must have the following components:

- a. Internship Report: 20 marks
- b. Internship Diary: 20 marks
- c. Seminar Presentation: 30 marks
- d. Viva-Voce Examination: 30 marks

RESEARCH PROJECT/DISSERTATION

BBA (Honours)				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	MTDI408P	Dissertation-I	6
8	Research Project/Dissertation	MTDI409P	Dissertation-II	6
BBA (Honours) with Research				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	MTDI410P	Dissertation-I	18
8	Research Project/Dissertation	MTDI411P	Dissertation- II	20

BBA (Honours)**MTDI408P: RESEARCH PROJECT/ DISSERTATION - I**

(6 Credits - 180 Hours) (L-T-P: 0-0-6)

Objective(s)

The basic objective of the project work is to give students an idea of research during 7th semester. In which they need to undertake a field survey for collecting data. Further they need to analyse the data and present a report on the topic in which they have conducted research. The evaluation is done on the basis of the project report, presentation and viva-voce examination.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Define the different types of research project. (Remembering)
- CO 2: Explain the various steps of designing research project (Understanding)
- CO 3: Build questionnaires and schedules (Applying)
- CO 4: Assess the data for analysis (Analyzing)
- CO 5: Appraise the findings in the report (Evaluating)
- CO 6: Design a research project report (Creating)

Guidelines Related To Project:

The entire project will be carried out in one phase during 7th semester. It includes Introduction and Review of Literature part, Research Methodology, Data Analysis and Interpretation and Findings, suggestions and conclusion part.

The Dissertation will comprise of the following:

- Synopsis: Submission of a write up on a specific area/topic of study
- Review of Literature: Submission of a specified number of reviews to respective guide
- Research Methodology: Lecture based on the topic of study
- Referencing Style: Lecture on referencing style to be followed while submitting report
- Training on application of Statistical software used in research
- Submission of Progress Report

Report should comprise of Introduction, Review of Literature, Research Methodology and References.

EVALUATION:

A diary is to be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester.

Evaluation will be done by the respective guide based on timely submission of part-work and quality of work as follows: Synopsis (30 marks)

Review of Literature (30 marks)
Research Methodology (30 marks)
Publication in Referred Journal: (10 marks)

MTDI409P: RESEARCH PROJECT/ DISSERTATION - II

(6 Credits - 180 Hours) (L-T-P: 0-0-6)

Objective(s): *The basic objective of the project work is to give students an idea of research during 7th semester. In which they need to undertake a field survey for collecting data. Further they need to analyse the data and present a report on the topic in which they have conducted research. The evaluation is done on the basis of the project report, presentation and viva-voce examination.*

Course / Learning Outcomes

At the end of this course students will be able to:

- CO1: define the different types of research project. (Remembering)
- CO2: explain the various steps of designing research project (Understanding)
- CO3: build questionnaires and schedules (Applying)
- CO4: assess the data for analysis (Analyzing)
- CO5: appraise the findings in the report (Evaluating)
- CO6: design a research project report (Creating)

Guidelines Related To Project:

The entire project will be carried out in one phase during 7th semester. It includes Introduction and Review of Literature part, Research Methodology, Data Analysis and Interpretation and Findings, suggestions and conclusion part.

The Dissertation will comprise of the following:

Synopsis: Submission of a write up on a specific area/topic of study
Review of Literature: Submission of a specified number of reviews to respective guide
Research Methodology: Lecture based on the topic of study
Referencing Style: Lecture on referencing style to be followed while submitting report
Training on application of Statistical software used in research
Submission of Progress Report
Report should comprise of Introduction, Review of Literature, Research Methodology and References.

EVALUATION:

A diary is to be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester.
Evaluation will be done by the respective guide based on timely submission of part-work and quality of work as follows:

Synopsis (30 marks)
Review of Literature (30 marks)
Research Methodology (30 marks)

Publication in Referred Journal: (10 marks)

BBA (Honours) with Research

MTDI410P: Dissertation-I

(18 Credits - 540 Hours) (L-T-P: 0-0-18)

Objective(s)

The objective of the course would be to educate the students about the various dimensions of a research based project work. The students will also be taught about the application of statistical tools through SPSS. In 7th sem (BBA – Research)

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the different types of research project. (Remembering)

CO 2: Explain the various steps of designing research project (Understanding)

CO 3: Build questionnaires and schedules (Applying)

CO 4: Assess the data for analysis (Analyzing)

CO 5: Appraise the findings in the report (Evaluating)

CO 6: Design a research project report (Creating)

The Dissertation will comprise of the following:

Synopsis: Submission of a write up on a specific area/topic of study

Review of Literature: Submission of a specified number of reviews to respective guide

Research Methodology: Lecture based on the topic of study

Referencing Style: Lecture on referencing style to be followed while submitting report

Training on application of Statistical software used in research

Submission of Progress Report

Report should comprise of Introduction, Review of Literature, Research Methodology and References.

EVALUATION:

A diary is to be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester.

Evaluation at Phase I will be done by the respective guide based on timely submission of part-work and quality of work as follows:

Synopsis (30 marks)

Review of Literature (30 marks)

Research Methodology (30 marks)

Publication in Referred Journal: (10 marks)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			H	M	
CO4				H	
CO5				H	
CO6					H

MTDI411P: DISSERTATION-II

(20 credits - 600 hours) (L-T-P: 0-0-20)

Objective(s)

The objective of the course would be to develop analytical skills among the students for solving any research queries. The students will also be taught about the preparation of a project report. In 8th semester of BBA Research

Course/ Learning Outcomes

At the end of this course students will be able to:

- CO 1: Define the different types of research project. (Remembering)
- CO 2: Explain the various steps of designing research project (Understanding)
- CO 3: Build questionnaires and schedules (Applying)
- CO 4: Analyse the data for analysis (Analyzing)
- CO 5: Appraise the findings in the report (Evaluating)
- CO 6: Design a research project report (Creating)

DISSERTATION GUIDELINES

Chapter I INTRODUCTION

Broad introduction to thesis topic and method.

Research problem. State broadly, in question form. Give sub-questions. Explain carefully. In On sense, usually the problem is to expand the body of knowledge examined in the literature review.

Need for the research. Who will benefit? Discuss applied and scientific contributions.

Nominal definitions. Define central terms.

Context. Add further info to clarify the research problem.

Chapter II THEORY Literature review

Organize by idea; avoid stringing together abstracts of articles.

a. Overview. Theoretical foundations

b. Literature. Group articles by ideas. For a given idea, first discuss common strands in the literature, then departures.

c. Model of a process, usually. Based on the literature reviewed.

Hypotheses (in broad sense of the term; also called Propositions). For each, give brief restatement of justification tied to earlier sections; explain derivation and implications. Include assumptions. Explicitly state plausible rival hypotheses (explanations of process) of a substantive nature. Scope of the study. Theoretical assumptions; discuss limitations they impose.

Chapter III METHODS

Outline in a few pages.

Introduction. General description of method and design

Design. Experiment, quasi-experiment, survey, and so forth. Detailed description

Sample. Universe, population, element, sample design, tolerance, probability.

Measurement. Operational definitions. Include, as applicable, detailed discussion of indexes/scales. Specify methods used to assess validity and reliability.

Analysis. Techniques to be used; justification. Nature of relationships expected (e.g., asymmetrical, symmetrical, reciprocal; linear, monotonic, other curvilinear; necessary, sufficient, necessary and sufficient). Include dummy tables and worked examples of statistics.

Validity. Design: Internal and external, with relevant subtypes. Methodological assumptions. Discuss limitations they impose.

APPENDICES

Schedule. In Gantt Chart form. Facilities. Faculty and staff expertise, library and computer resources, other special facilities contributing to a successful study.

Budget. Bibliographic essay. Sources searched (indexes, abstracts, bibliographies, etc.).

Strengths and weaknesses of literature.

Chapter IV FINDINGS

a. Brief overview

Results of application of method; any unusual situations encountered. Nature of sample

Descriptive analysis. One-way frequency distributions on central variables

Validity/reliability analysis.

b. Tests of hypotheses

ANOVAs, cross tabulations, correlations, and such, depending on techniques used; give in same order as hypotheses.

Chapter V DISCUSSION

When discussing implications, deal with both the theoretical and the practical. Present only interpretations of the findings, not opinion.

Brief overview.

Discussion of results of application of method. Implications.

Discussion of descriptive analysis. Implications.

Discussion of tests of hypothesis. Implications.

Post-hoc analysis. Implications.

Chapter VI CONCLUSION

a. May include writer's opinion

b. Summary of entire thesis in a few pages.

c. Conclusions. Refer to lit review. Implications. Speculate about broadest possible consequences, both theoretical and practical. Label speculation clearly.

d. Limitations. Theory, method.

e. Suggestions for future research.

Appendices. Bibliographic essay. Questionnaire and coding manual, if any. Raw data.

BIBLIOGRAPHY. Include all relevant sources examined, whether cited or not.

Department of Commerce
PROGRAMME: Bachelor of Commerce in Business Analytics Under NEP-2020

DEGREE: BCOM in Business Analytics with Honours / BCOM in Business Analytics (Honours) with Research
(4 years/8 semesters Degree programme)

Vision: To develop industry-ready commerce graduates capable of driving data-driven decision-making, equipped with strong analytical skills, ethical business values, and the ability to contribute to innovation and sustainable growth in a rapidly evolving digital world.

Mission

1. To provide students with strong fundamentals in commerce and business.
2. To develop practical analytical skills using modern tools and technologies.
3. To promote industry-oriented learning through projects and case studies.
4. To encourage ethical, responsible, and data-driven decision-making.
5. To prepare students to apply analytical thinking in diverse business environments.

Graduates of the B.Com in Business Analytics program will specifically be able to:

Program Outcomes (POs) for B COM-Business Analytics: Upon successful completion of the B.Com in Business Analytics program, graduates are expected to demonstrate the following outcomes:

PO 1: Subject Knowledge: Building strong foundation in business fundamentals and experiential learning in all the functional areas of business.

PO 2: Analytical Skills: Ability to develop analytical skills in analyzing, interpreting & deriving insights from data.

PO 3: Proficiency in Data Analytics tools: Proficiency in managing large volumes of data and deriving actionable insights with the help of different Analytics Tools.

PO 4: Problem-Solving Skills: Develop critical thinking and problem-solving skills through real-world projects and case studies, enabling students to address organizational challenges effectively.

PO5: Ethical and Social Responsibility: Capability to make ethical decisions and a sense of responsibility in handling data, ensuring compliance with data privacy and ethical business practices.

PO6: Lifelong Learning: Develop a mindset of continuous learning and adaptability to keep pace with advancements in technology and evolving business environments.

Program Specific Outcomes (PSOs) for B COM-Business Analytics:

PSO 1: In depth understanding of the theories of all the functional areas of business.

PSO2: use of statistics and mathematical models for business analytics.

PSO 3: Apply Computational tools in business decision making.

COURSE OUTCOMES MAPPING WITH POs/PSOs

Cours e	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3
1.1	M	H		M		M	H	M	
1.2	L					H	L	L	
1.3			H				M		
1.4	M			L			L		H
1.5	L	M							M
1.6	M								
1.7							M		
1.8	L							M	
1.9	L				H				
2.1	M	L					M	M	
2.2	M		M				L	L	
2.3							M	L	

2.4	M	M		M		M	M	L	
2.5	M			M					H
2.6	M	L					M	M	
2.7	M		M				L	L	
2.8							M	L	
3.1	M	M		M		M	M	L	
3.2	M			M					H
3.3	M	L					M	M	
3.4	M		M				L	L	
3.5							M	L	
3.6	M	M		M		M	M	L	
4.1	M			M					H
4.2	M	L					M	M	
4.3	M		M				L	L	
4.4							M	L	
4.5	M	M		M		M	M	L	
5.1	M			M					H
5.2	M	L					M	M	
5.3	M		M				L	L	
5.4							M	L	
5.5	M	M		M		M	M	L	
5.6	M			M					H
6.1	M	L					M	M	
6.2	M		M				L	L	
6.3							M	L	
6.4	M	M		M		M	M	L	
6.5	M			M					H
7.1	M	L					M	M	
7.2	M		M				L	L	
7.3							M	L	
7.4	M	M		M		M	M	L	
7.5	M			M					H
8.1	M	L					M	M	
8.2	M		M				L	L	
8.3							M	L	
8.4	M	M		M		M	M	L	
7.1	M			M					H
7.2	M	L					M	M	
8.1	M		M				L	L	

Detailed Syllabus**Course Structure: B. Com in Business Analytics**

Se- mes- ter	Category	Course	Cred- its	NEP 2023 hand- book- ADBU

I	Major	Financial Accounting	4	
	Minor	Business Organisation and Management	4	
	Multi-Disciplinary	Mathematics- I	3	
	Ability Enhancement	Indian Language/ Foreign Language/ Communicative English-I/ Communicative English – 2	2	
	Skill Enhancement	Word Processing and Spreadsheet	3	
	Common value based	Understanding India/Digital and Technological solution/ Health, Yoga, Sports and Wellness	1	
	Common Value based	Understanding India/Digital and Technological solution/ Health, Yoga, Sports and Wellness	1	
	Community Engagement	Service learning theory	2	
		Indian Knowledge System	2	
	Total Credits		22	
II	Major	Financial Management Theory & Application	4	
	Minor	Micro Economics Theory & Practice	4	
	Multi-disciplinary	Business Statistics in Decision Making	3	
	Ability Enhancement	Indian Language/ Foreign Language/ Communicative English-I/ Communicative English – II	2	
	Skill Enhancement	Introduction to Data analytics using Python-I	3	
	Common value based	Understanding India/Digital and Technological solution/ health, Yoga	1	
	Common Value based	Understanding India/Digital and Technological solution/ Health, Yoga, Sports and Wellness	1	
	Community Engagement	Service learning practice	2	
	Total Credits		20	
III	Major	Marketing Management Theory and Application	4	
	Major	Cost and Management Accounting	4	
	Minor	Indian Financial System	4	
	Multi-disciplinary	Macro Economics Theory and Analysis	3	
	Skill Enhancement	Introduction to Data analytics using Python-II	3	
	Ability Enhancement	Indian Language/ Foreign Language/ Communicative English-I/ Communicative English – 2	2	
	Total Credits		20	
IV	Major	Human Resource Management Theory & Application	5	
	Major	Advanced Accounting	5	
	Major	Data Visualisation and Communication	4	
	Minor	Legal Aspects in Business	4	

	Ability Enhance-ment	Indian Language/ Foreign Language/ Communicative English-I/ Communicative English – 2	2	
	Total Credits		20	
V	Major	International Business	5	
	Major	Financial Analytics	5	
	Major	Mathematics -II	4	
	Minor	Entrepreneurship Development	4	
	Internship	Internship-	2	
	Project	Minor project-Phase-I	P/NP	
	Total Credits		20	
VI	Major	Advertisement & Brand Management	4	
	Major	Business Analytics using R and Tableau	4	
	Major	Auditing and Corporate Governance	4	
	Minor	Supply chain management/operation management	4	
	Project	Minor project-Phase-II	4	
	Total Credits		20	
VII	Major	Predictive Analysis for Business using Python and R	5	
	Major	Investment Analytics	5	
	Minor	Cyber Law	3	
	Research Methodology	Research Methodology	2	
	Project	Dissertation-Phase-I	6	
	Total Credits		21	
VIII	Major	Human Research Analytics	5	
	Major	Marketing Analytics	5	
	Minor	Database Management in Business	3	
	Project	Dissertation-Phase-II	6	
	Total Credits		19	
BCOM in Business Analytics with Research				
VII	Research Methodology	Research Methodology	2	
	Project-Dissertation	Project-Dissertation-Phase-I	18	
	Total Credit		20	
VIII	Project-Dissertation	Project-Dissertation-Phase-II	20	
	Total Credits		20	

Financial Accounting, Course Code:.....

(4 Credits-60 hours) (L-T-P: 4-0-0)

Course Objectives:

The course aims to develop a conceptual understanding of basic accounting principles and international reporting standards while providing comprehensive knowledge on the preparation and

presentation of financial statements in accordance with the Companies Act, 2013 and the relevant Ind AS. It explains the measurement and recognition criteria for various financial elements using applicable Indian Accounting Standards and enables students to read, interpret, and analyse financial statements with the help of different analytical tools and techniques. The course also familiarises learners with recent developments in accounting, including fair value accounting, as well as human resource and natural resource accounting.

Course Outcomes:

CO1 (Remembering): Identifying fundamental accounting concepts and accounting standards.

CO2 (Understanding): Understand the key provisions of the Companies Act, 2013 related to financial statements and Indian Accounting Standards.

CO3 (Apply): Apply appropriate accounting standards and policies to recognize and measure accounting elements and in preparation of Financial Statements.

CO4 (Analyze): Perform comparative, common-size, and trend analysis of financial statements for decision-making purposes.

CO5 (Evaluate): Calculate and interpret key financial ratios, cash flow components, and perform DuPont analysis to evaluate financial performance.

Module 1: Accounting Concepts & Reporting Standards: (15 Hours): Basic Accounting Concepts, Overview of GAAP – AS, IND-AS, IAS, IFRS. Adoption vs. convergence of IFRS. Recent advances in accounting- Ind AS and Fair value accounting, Human resource accounting & Natural resource accounting. Point of Difference between Accounting Standards (AS) and Indian Accounting Standards (IND AS)

Module2: Financial Statements: (15 Hours): Preparation & presentation of Financial Statements as per Companies Act, 2013. Sections related to Financial Statements under Companies Act, 2013 – Sec 2(40), Sec 128, Sec 129 and Sec 133. Preparation of Consolidated Financial Statements as per IND AS 110, Preparation of Statement of Cash Flows as per Ind AS 7, Interim Financial Reporting as per Ind AS 34, preparation of Separate Financial Statements as per Ind AS 27.

Module 3: Measurement based on Accounting Policies (15 Hours) Indian Accounting Standard 8 for Accounting Policies, Changes in Accounting Estimates and Errors, Ind AS 10 for Events after the Reporting Period, Ind AS 113 Fair Value Measurement, Ind AS 16 Property Plant and Equipment.

Module 4: Financial Statement Analysis (15 Hours): How to read the Financial Statements? Financial Statement Analysis -Comparative Financial Statements: Analysis over different periods, Common-size Statements: Vertical analysis of Income Statement and Balance Sheet, Trend Analysis, Ratio Analysis - Profitability Ratios, Liquidity Ratios, Activity Ratios Solvency Ratios and Market Ratios, Cash Flow Analysis and DuPont Analysis.

Suggested Readings

Accounting: Text and Cases: 13th Edition, authored by Anthony, Robert N., David Hawkins, and Kenneth Merchant. New York: McGraw-Hill/Irwin, 2013.

Student's Guide to Accounting Standards (IND-AS Based), authored by D.S. Rawat, Taxmann Publications (Ind-AS concepts, measurement, and standards).

Financial Statement Analysis, 10e, authored by K. R. Subramanyam and John Wild. McGraw Hills Education (India) Pvt. Limited, New Delhi.

Financial accounting for Management, 4th edition, authored by N. Ramachandran and Ram Kumar Kakani, McGraw Hills Education (India) Pvt. Limited, New Delhi.

Accounting for Managers, authored by M.E. Tukaram Rao. New Age International Publishers.

Mapping of Cos to syllabus

	M1	M2	M3	M4
CO1	H	L	L	L
CO2	H	M	H	M
CO3	L	H	H	M
CO4	L	M	M	H
CO5	L	L	L	H

Business Organisation and Management Course code:

(4 Credits-60 hours) (L-T-P: 4-0-0)

Minor

Course Objectives

The course is designed:

1. To introduce the foundational principles of business organization and its forms.
2. To develop an understanding of key management functions and their application in the real world.
3. To explain the structure and role of various types of business enterprises.
4. To equip students with the ability to analyze and apply managerial tools for effective decision-making.
5. To examine contemporary issues in business and the global business environment.

Course Outcomes

Upon completion of this course, students will be able to:

1. **CO1 (Understand)** – Explain the fundamental concepts of business and distinguish between different forms of business organization.
2. **CO2 (Understand)** – Describe the process of company formation and interpret relevant documents and legal requirements.
3. **CO3 (Apply)** – Demonstrate application of the principles and functions of management in practical contexts.
4. **CO4 (Analyze)** – Analyze organizational structures and assess HR practices for organizational effectiveness.
5. **CO5 (Evaluate)** – Evaluate the impact of contemporary issues and develop ethical and socially responsible business solutions.

Course Modules

Module 1: Introduction to Business Organisation (15 hours)

Meaning, nature, and objectives of business, Essentials of a successful business, Classification of business activities: Industry, Commerce, Trade, Forms of business organization: Sole proprietorship, Partnership, Joint Hindu Family, Joint Stock Company, Co-operative society, Choice of suitable form of organization, Business risks and insurance

Module 2: Formation and Promotion of a Company (10 hours)

Stages in formation of a company, Promotion – meaning and functions of a promoter, Incorporation, capital subscription, and commencement of business, Documents: Memorandum of Association (MOA), Articles of Association (AOA), Prospectus, Types of companies: Private, Public, One-person, Government, MNCs

Module 3: Principles of Management (15 hours)

Management: Definition, nature, and scope, Evolution of management thought: Taylor, Fayol, Mayo, Functions of management: Planning, Organizing, Staffing, Directing, Controlling, Levels of management and managerial roles, Coordination and decision-making.

Module 4: Organization Structure and Human Resource Management (10 hours)

Organizational structure: Functional, Divisional, Matrix, Delegation, Decentralization, and Span of control, Human resource planning, recruitment, selection, training, and development, Performance appraisal and motivation, Leadership styles and communication.

Module 5: Contemporary Issues and Business Environment (10 hours)

Corporate Social Responsibility (CSR) and ethics in business, Globalization and its impact on business, Startups and entrepreneurship, Digital transformation and e-commerce, Role of Government in business regulation

Suggested Readings

1. **Y.K. Bhushan** – *Fundamentals of Business Organization and Management*, Sultan Chand
2. **Koontz & Weihrich** – *Essentials of Management*, McGraw Hill
3. **P.C. Tulsian & Vishal Pandey** – *Business Organisation and Management*, Pearson
4. **L.M. Prasad** – *Principles and Practice of Management*, Sultan Chand
5. **C.B. Gupta** – *Business Organisation and Management*, Sultan Chand
6. **Harold Koontz & Heinz Weihrich** – *Management: A Global Perspective*, McGraw Hill
7. **Online Resources:**
 - Ministry of Corporate Affairs: <https://www.mca.gov.in>
 - NPTEL Video Lectures on Management
 - Harvard Business Review Articles on Contemporary Management

Mapping of Cos to syllabus

COs	M1	M2	M3	M4	M5
CO2	H	M	M	M	M
CO3	M	H	H	H	M
CO4	M	H	H	H	H
CO5	L	L	M	M	H

Course Code.....: Mathematics – I**(3 Credits-45 hours) (L-T-P: 3-0-0)****Course Objectives:**

1. To provide foundational knowledge of matrices, calculus, and financial mathematics relevant to business.
2. To enable students to apply mathematical techniques in analyzing and solving business problems.
3. To develop critical thinking through quantitative methods in decision-making.
4. To demonstrate how mathematical concepts are applied in business domains such as finance, production, pricing, and inventory control.

Course Outcomes

CO1: Recall and describe basic concepts of matrices, determinants, and methods of solving systems of linear equations, including the Leontief Input-Output Model. (Remembering)

CO2: Solve systems of linear equations using matrices and apply Leontief Input-Output Model to economic problems.

CO3: Apply the principles of differentiation in analyzing marginal functions, elasticity, and optimization of revenue, cost, and profit.

CO3: Use multivariable calculus for production and demand analysis and compute consumer and producer surplus using integration.

CO4: Analyze financial decisions using mathematics of interest, annuities, depreciation, and present/future value calculations.

Module 1: Matrices and Determinants (10 hours)

Overview of Matrices: Types, operations (addition, multiplication), transpose, inverse.

Solution of a system of linear equations (up to 3 variables) using

- Matrix Inversion Method

- Cramer's Rule

Leontief Input-Output Model (Open Model only)

Business Applications:

Use of matrices to solve pricing, budgeting, and resource allocation problems.

Economic modeling using Leontief input-output to study inter-industry relationships.

Module 2: Calculus I Differential Calculus and Optimization (10 hours)

Concepts and rules of differentiation. Concept of Marginal Analysis: Marginal Revenue, Marginal Cost. Concept of Elasticity of demand and supply. Application of Maxima and Minima problems: Revenue, Cost, Profit, Economic Order Quantity, Optimal trade in time.

Business Applications:

Determine output levels that maximize profit or minimize cost.

Analyze demand sensitivity to pricing for marketing strategy.

Compute optimal inventory and replacement timing in logistics and operations.

Module 3: Calculus II – Multivariable Calculus and Integration (10 hours)

Partial Differentiation: Partial derivatives up to second order. Homogeneity of a function and Euler's theorem. Production Function: Returns to factor, Returns to scale. MRTS and Elasticity of Substitution. Application of Maxima and Minima problems involving two independent variables. Integration: Nature of commodities and partial elasticity of demand, Applications of marginal analysis, Consumer Surplus and Producer

Surplus.

Business Applications:

Optimization in production with two inputs (labor and capital).

Decision-making in pricing strategies using surplus analysis.

Estimation of economic returns under changing input proportions.

Module 4: Mathematics of Finance (15 hours)

Rates of interest: nominal, effective and their inter-relationships in different compounding situations. Compounding a sum using different types of rates. Applications relating to Depreciation of assets and average due date. Types of annuities: ordinary, due, and deferred - Discrete and continuous. Perpetuity. Determination of future and present values using different types of rates of interest. Applications relating to Capital Expenditure and Leasing.

Business Applications:

Time value of money in capital budgeting and investment appraisal.

Estimation of loan amortization schedules.

Lease vs. Buy decision using present value comparisons.

Suggested readings:

1. Allen, B.G.D, Basic Mathematics, Mcmillan, New Delhi.
2. Volra, N. D., Quantitative Techniques in Management, Tata McGraw Hill, New Delhi.
3. Kapoor, V.K., Business Mathematics, Sultan chand and sons, Delhi.
4. Hoffman, L., Bradley, G.L., & Sobecki, D. (2020). *Calculus for Business, Economics, and the Social and Life Sciences*. McGraw Hill Education.
5. Sydsaeter, K., & Hammond, P. (2012). *Essential Mathematics for Economic Analysis*. Pearson Education.
6. Bose, D. (2002). *An Introduction to Mathematical Economics*. Himalaya Publishing House.

Mapping of Cos to syllabus

	M1	M2	M3	M4
CO1	M	L	M	L
CO2	H	H	H	M
CO3	M	H	H	H
CO4	L	L	L	H

AECH100T/AECH200T: COMMUNICATIVE HINDI I

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course outcomes

On completion of this course successfully, students will be able to:

CO 1: Grasp the basic script of Devnagari for communicative usage (remembering)

CO 2: Learn the vocabulary, grammar and sentence formation for day to day communication in Hindi (understanding)

CO 3: Use the vocabulary, idiom and proverbs in communicative Hindi writing (applying)

CO 4: Understand Hindi used in common public places & offices as National Language (applying)

Module I: Introduction to Hindi language and pronunciation

a. Introduction to evolution of Hindi as National language of connectivity

b. Introduction to Hindi alphabet (Devanagari script) - vowels and consonants with their pronunciation

c. Basic greetings and expressions

- ☐ हहोदी भाषा का राष्ट्रीय भाषा के रूढ में उत्थान: नररचयात्मक विश्लेषण
- ☐ हहोदी बारह खड़ी (देिनागरी लखन) का ांन- स्िर , व्योजन णि उनका उच्चारण
- ☐ सामान्य सम्बोधन णि उद्बोधन ांन

Module II: Vocabulary building and basic sentence formation

a. Vocabulary building for daily use;

b. Basic sentence formation using simple verbs and nouns

c. Introduction to daily inter personal communications / asking questions/ daily use conversations

- ☐ दैनक प्रयोग की शब्दारी णि शब्दकोष का ांन
- ☐ सोा णि क्रिया के उनयोग से सामान्य िाक्यों की सोरचना
- ☐ दैनक उनयोगी सम्बोधन , स्ि-सम्बोधन , प्रश्न इत्याहद नूछना णि सामान्य बोश्चार सम्बन्धी ांन

Module III: Basic level conversational practice and grammar

- Introduction to Hindi grammar: noun, pronoun, adjective, verb, adverb
- Sentence formation using different tenses: present, past, future
- Use of prepositions and conjunctions in sentences
- Role-play exercises for different situations: shopping, ordering food, asking for directions, etc.
- Group discussion and conversation practice for grammar, sentence formation and effective communication in Hindi

- हहोदी व्याकरण -सोी, सिवनाम, विशेषण, क्रिया, क्रिया-विशेषण इत्याहद
- विलभन्न कार सन्दभव में िाक्य सोरचना, -र्विमान, भविष्य णि भूर कार
- सोबोध सूचक अव्यय/नूविसगव शब्द णि समुच्चयबोधक/सोयोजक शब्द - िाक्य सोरचना में उनका उन्नयोग
- अलभनय- नाटक /िावराण गनर्विध / नाट्य रचना के माध्यम से विलभन्न दैननक नररस्थनर्यों के िावराण का ान - दैननक खान-नान सम्बन्धी, खरीददारी सम्बन्धी, नर्ा-हिकाना /हदशा सम्बन्धी इत्याहद
- सामूहक नररचचाव णि िावराण के माध्यम से व्याकरण के उन्नयोग, िाक्य सोरचना णि प्रभािी िावराण का ान र्था अभ्यास

Module IV: Intermediate level vocabulary and grammar

- Vocabulary building for intermediate level topics: travel, health, environment, etc.
 - Intermediate level sentence formation: complex sentences, conditional sentences, etc.
 - Idioms & proverbs and their usage in communication
- माध्यलमक सर के िावराण हेरु शब्दािरी ननमावण जैसे यात्रा, सिसूय, िाारिण इत्याहद ेत्रों में उन्नयोगी शब्दािरी का ान
 - माध्यलमक सर के िावराण हेरु िाक्य सोरचना का ान : सोयुक् िाक्य, उन्नबोध िाची िाक्य इत्याहद
 - दैननक िावराण र्था उन्नयोग में आने िाी कहािरीं णि मुहािरीं का ान

Module V: Advanced level conversation and writing practice

- Advanced conversation practice on different professional topics;
 - Writing practice: Paragraph writing, message writing, letter writing, essay writing, etc.
- विलभन्न कायवकारी ेत्रों से सम्बोधर उच्च सररीय िावराण का ान णि अभ्यास
 - रेखन अभ्यास : नात्र रेखन, सन्देश, ननबोध, अनुच्छेद / िाक्यखण्ड रेखन इत्याहद

Suggested Readings

- Richard Delacy, Sudha Joshi (2009), Elementary Hindi: Learn to Communicate in Everyday Situations -Tuttle Publishing (a work book -e-book with MP4 video)
- Sunita Narain Mathur, Madhumita Mehrotra (2017), Hindi for Beginners: A Guide to Conversational Hindi (Audio Disc Included), Tuttle Publishing
- Surendra Kumar Gambhir (2003), Communicative Hindi for Beginners: Cultural Appropriateness, Vocabulary, Grammatical Accuracy Google book
- DRISHTI IAS BLOG(2023), Hindi Language: Its Journey So Far, <https://www.drishtiiias.com/blog/hindi-language-its-journey-so-far>
- Britannica blog(nd), Hindi language- history, variety, grammar and vocabulary, <https://www.britannica.com/topic/Hindi-language>

Mapping of COs

COs		Module 1	Module 2	Module 3	Module 4	Module 5
CO1		H	M			
CO2		L	M	H		
CO3					H	M
CO4				M	M	H

AECA100T/AECA200T: COMMUNICATIVE ASSAMESE I**(L-T-P: 2-0-0) (2 Credits: 30 hours)****Course Objectives**

To give basic idea about the Assamese Language alphabets, wordings and also to make them learn about sentence formation, tense and writing skills of Assamese

Course Outcomes

CO 1: Understand the basic concept of Assamese language.

CO 2: Remembering the conversational language.

CO 3: Analyse the reading skills of Assamese

CO 4: Apply the writing skills in daily life activities

Module I: Introduction to Assamese language and pronunciation (8 Hours)

- a. History and geography of Assam
- b. Introduction to Assamese alphabet and pronunciation of vowels and consonants
- c. Basic greetings and expressions
- d. Module II: Vocabulary building and basic sentence formation (8 Hours)
- e. Vocabulary building for daily use
- f. Basic sentence formation using simple verbs and nouns
- g. Introducing oneself and asking questions

Module III: Grammar Basics and Conversational Practice (6 Hours)

- a. Introduction to Assamese grammar: noun, pronoun, adjective, verb, adverb
- b. Sentence formation using different tenses: present, past, future
- c. Use of prepositions and conjunctions
- d. Role-play exercises for different situations: shopping, ordering food, asking for directions, etc.
- e. Group discussion and conversation practice

Module IV: Intermediate level vocabulary and basic writing practice (8 Hours)

- a. Vocabulary building for intermediate level topics: travel, health, environment, etc.
- b. Intermediate level sentence formation: complex sentences, conditional sentences, etc.
- c. Use of idioms and proverbs,
- d. Advanced conversation practice on different topics
- e. Writing practice: letter writing, essay writing, etc.
- f. Project Phase-I : Group discussion, project identification
- g. Case study along with group discussion.

Suggested Readings:

- ১) অসমীয়া ভাষাৰ উৎপত্তি আৰু অৱস্থিতি – ই. গিৰিচাৰ।
- ২) যোগাযোগমূলক অসমীয়া ভাষা – লেখক ড° হেম শৰ্মা।
- ৩) অসমীয়া বৰ্ণমালা আৰু যুক্তাক্ষৰ।
- ৪) অসমীয়া ব্যাকৰণ লিখক সত্যানন্দ বৰা।
- ৫) অসমীয়া কুৱিতা – কুবৰৰ পৰিচয়।
- ৬) অৰণ্যৰ হাহি – কুবৰৰ পৰিচয়, শ্ৰী বাবুল শৰ্মা।

AEFR100T/AEFR200T: FRENCH BEGINNER LEVEL I

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course objective

French Beginner level I is a course of 30 learning hours designed to help learners to acquire basic speaking, listening, writing and reading skills in French. The course introduces pronunciation, common vocabulary and basic grammar to learners with no previous knowledge of French language. This knowledge prepares students to effectively communicate in French on topics related to everyday situations. Students practice listening and speaking in real-life situations, learn to read short and practical texts in French, and gain an insight into francophone cultures. By the end of the session, learners are expected to be able to engage in some general, everyday types of conversation.

Course Outcomes

On completion of this course, students will be able to:

CO1: Recall, name and identify the vocabulary and phrases related to who, when, where and other key question words, explain and interpret their meanings and select appropriate response. (Remembering, analyzing, evaluating)

CO2: Use the vocabulary and sentence structures learned to converse and discuss on a range of topics related to everyday situations. (Understanding, applying)

CO3: Demonstrate a basic understanding of francophone countries' cultures, describe and summarize basic cultural values. (Applying, understanding, evaluating)

CO4: Analyse cultural differences and choose appropriate ways to interact with speakers from Francophone countries. (Analysing, evaluating)

CO5: Design and compose meaningful situational dialogues and perform them; invent skits by using the language skills learned. (Creating)

Module I: Introduction to French phonetics and pronunciation drills (8 hours)

- a) Phonetic alphabet
- b) Vowels, semi-vowels and consonnants
- c) Silent letters
- d) Pronunciation rules

Module II: Everyday common phrases and basic sentence structures (16 hours)

- a) Greeting
- b) Self-introduction (nationality, profession, age, family)
- c) Making request
- d) Talking about one's likes and dislikes
- e) Making invitation
- f) Describing a personnel

Module III: Introduction to Francophone cultures (6 hours)

- a) French and its speakers
- b) Pop culture: music, movies, TV, dramas
- c) Lifestyles

Suggested Readings

1. *Amical A1*, CLE International, Paris, 2011

Mapping of COs

Course Outcome	Module 1	Module 2	Module 3
CO1	M	H	
CO2		H	
CO3			H
CO4			H
CO5		H	

AEGR100T/AEGR200T: Introduction to German Language I

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objectives:

The course aims at covering the basics of German language. It also covers a few basic grammar topics and an application of grammar in day-to-day life that is in reading, writing, listening, and speaking. On the completion of the first semester, one can understand and use familiar, everyday expressions and very simple sentences, can introduce him/her and others as well as ask others about themselves – e.g., where they live, who they know and what they own – and can respond to questions of this nature.

Course Outcomes

Students will be able to acquire a working knowledge in basic German

Course Contents:

	Topic	Grammar
1	Greetings	Personal pronouns and verbs in the present tense
2	Introduce yourself/countries/occupations/Family	Artikel: der/die/das
3	The alphabet and the numbers	Verbs
4	Languages and countries	The negation
5	People and hobbies	Expression of time (am, um, von...bis)
6	In the city	Possessive Artikel
7	Food and drink and in the restaurant	Nominative and Accusative sentences, verbs and prepositions
8	Time and season	

Suggested Reading

Netzwerk Deutsch als Fremdsprache A1, Textbook + Workbook by Stephanie Dengler

Word Processing and Spreadsheet Course Code.....

(3 Credits-45 hours) (L-T-P: 2-0-1)

Course Objectives:

1. To understand and navigate basic spreadsheet and word processing interfaces for business documentation.
2. To apply formatting, functions, and formulas in spreadsheets for data entry, calculation, and presentation.
3. To manage and analyze business data using charts, pivot tables, and dashboards.
4. To automate routine business tasks using macros and integrate data across applications.
5. To create and format professional business documents using word processing tools.
6. To enhance business communication and reporting through structured and secure documents.

Course outcomes:

CO1: Identify components of spreadsheet and word processing interfaces and their business applications. (Remembering)

CO2: Understand formulas, functions, sorting/filtering, and conditional formatting to solve business problems. (Understanding)

CO3: Demonstrate data entry, formatting, and worksheet management skills for budgeting and inventory tracking. (Applying)

CO4: Analyze business data using pivot tables, pivot charts, and visual dashboards. (Analyzing)

CO5: Create automated reports and documents by applying macros and data integration techniques. (Creating)

CO5: Develop structured and styled business documents using advanced word processing features. (Creating)

Module I: Spreadsheet Essentials (5 hours)

Introduction to spreadsheets, Managing workbooks and worksheets, Navigating the interface, Creating, saving, and organizing files, Data entry and formatting, Inserting, deleting, and naming worksheets

Lab Work: Lab: Creation of a basic personal finance tracker, Preparation of a product inventory sheet for a retail business

Business Topics to be Covered: Budget planning and Inventory management

Module II: Data Management and Formatting (10 hours)

Cell referencing (absolute, relative, mixed), Formulas and functions (text, logical, lookup, date & time, mathematical, statistical), Sorting and filtering, Conditional formatting, Worksheet security and protection

Lab Work: Designing an employee attendance sheet using date & time functions, Developing a sales commission calculator using logical formulas and Designing a customer database with sorting and filtering features.

Business Topics to be Covered: Payroll processing, Sales forecasting and CRM (Customer Relationship Management) basics

Module III: Business Data Analysis (10 hours)

Pivot tables and pivot charts, Data summarization, Grouping, filtering, and slicing, Chart types and selection, Business data visualization and interpretation

Lab Work: Analyzing monthly sales data using pivot tables, Creating dashboards showing regional sales performance, Visualizing profit trends using different chart types.

Business Topics Covered: Sales analytics, Regional performance evaluation, Dashboard reporting for managers

Module IV: Automation and Integration (10 hours)

Introduction to Macros, Recording and running macros, Object linking and embedding, Data import/export, Creating professional reports, Printing, page setup, and PDF conversion

Lab Work: Automate invoice generation using macros, Import sales data from external sources and format it, Create automated business reports in printable formats

Business Topics to be Covered: Report generation for stakeholders and Data integration across departments

Module V: Word processing for business documentation and Reporting (10 hours)

Introduction to Word Processing, Creating and Formatting Business Documents, Using Styles, Templates, and Themes, Inserting and Formatting Tables and Charts, Mail Merge for Bulk Communication, Reviewing and Collaborating on Documents, Creating Table of Contents and Indexes, Document Security and Sharing Options

Lab Work: Drafting a professional business letter using templates, Creating a company profile using styles and formatting tools, Designing a product brochure with images and charts, Performing a mail merge for customer communication, Preparing a multi-section annual report with table of contents, references, and protection features

Business Topics to be Covered: Business communication, Corporate reporting, Marketing documentation and Client relationship management

Mapping of Cos

Course Outcomes	M1	M2	M3	M4	M5
CO1	H	M	L	M	M
CO2	M	H	M	M	M
CO3	L	H	H	L	H
CO4	L	M	M	M	L
CO5	M	M	H	H	H

Common Value Based**CBES101T: ENVIRONMENTAL STUDIES**

(1 credit: 15 hours)

Course Outcomes:

CO 1: Recall the multidisciplinary nature of environmental studies. (Remembering)

CO 2: Explain ecological processes of natural resources. (Understanding)

CO 3: Categorize different types of natural resources. (Analysing)

CO 4: Evaluate the global scale of environmental pollution. (Evaluating)

Module I: The Multidisciplinary Nature of Environmental Studies (1 lectures)

Definition, scope and importance, need for public awareness.

Module II: Natural Resources (2 lectures)

a. Different types of natural resources and associated problems - forest resources, water resources, mineral resources, food resources, energy resources and land resources.

b. Conservation of natural resources.

Module III: Ecosystems (2 lectures)

a. Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, food chains, food webs.

b. Structure of following ecosystems - forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems.

Module IV: Biodiversity and Its Conservation (2 lectures)

Types of biodiversity – genetic, species and ecosystem, value of biodiversity, global biodiversity, India as a mega-diversity nation, threats to biodiversity, conservation of biodiversity - in-situ and ex-situ conservation.

Module V: Environmental Pollution (3 lectures)

a. Definition, causes, effects and control measures of - air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards and e-pollution.

b. Solid waste management.

c. Disaster management.

Module VI: Social Issues and the Environment (3 lectures)

a. From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, climate change, global warming, acid rain, ozone layer depletion.

b. Environment protection act.

c. Introduction to environmental impact assessment.

Module VII: Human Population and the Environment (2 lectures)

Population growth and sex ratio; Population explosion - family welfare programme; Environment and human health; HIV/AIDS; Role of information technology in environment and human health.

Suggested Readings

1. Textbook for Environmental Studies, E. Bharucha, UGC, New Delhi.

2. Fundamentals of Environmental Studies, S. Somvanshi and R. Dhupper, S.K. Kataria and Sons Publisher.
3. Environmental Chemistry, A. K. De, New age publishers.
4. Environmental Studies, Third edition, J. P. Sharma, University Science Press.
5. Comprehensive Environmental Studies, K. G. Bhattacharyya and A. Sarma, Narosa Publishing House Pvt, Ltd.

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H				H		H
CO 2		M	H				
CO 3				M		H	
CO 4							H

CBHY102T: HEALTH AND WELLNESS, YOGA EDUCATION, AND SPORTS AND FITNESS

(1 Credit: 15 hours)

Course Outcomes

CO 1: Explain the importance of healthy lifestyle (Understanding)

CO 2: Make use of Yoga, sports for health and fitness (Applying)

Module I: Health and Wellness (4 hours)

Meaning and importance of health and Wellness, components/dimensions of health and Wellness; Nutrition for health and wellness

Module II: Yoga (6 hours) :

Introduction to Yoga, Asanas and Pranyamas

Module II: Sports and Fitness (5 hours)

Concept of Sports and fitness; Fitness activities for strength, Flexibility and Endurance; Indoor and Outdoor sports

Suggested Readings

1. Claude Bouchard, Steven N. Blair, William L. Haskell, 'Physical Activity and Health', Human Kinetics, 2007
2. Emily Oddo, 'Yoga: For Beginners', , White Flower Publishing, 2018
3. Marzia Fernandez, Emily Attached, Gino Mackesy, 'Mental Health Workbook', 2020.
4. Dr. A. K. Uppal , Dr. P. P. Ranganathan, ' Fitness, Wellness and Nutrition', Friends Publications India. 2020
5. Fred Coalter, ' Sport for Development: What game are we playing?', Routledge. 2013

Mapping of COs

Course Outcomes	Module I	Module II	Module III
CO 1	H		M
CO 2		H	M

MTCE110T: SERVICE LEARNING

(Credit: 2 Hours: 30)

Objective: Service Learning will aim to support the development of basic skills among the students namely, critical and creative thinking, reflection, communication, collaboration, information literacy, and social skills. The emphasis will be on active civic participation. As the students will actively involved in a wide range of experiences, which will benefit both the community at large and the students in particular and in the process the goals of the curriculum shall be achieved

COURSE/ LEARNING OUTCOMES

After learning this course, the students will be able to:

CO1: Define and explain the Service-Learning framework (Remembering)

CO2: Explain the nature and types of community engagement work (Understanding)

CO3: Identify the need and importance of social responsibility (Applying)

CO4 Analyse the need for social intervention through community partners (Analysing)

CO5: Evaluate the academic outcomes through Service Learning (Evaluating)

CO6: Elaborate upon the social understanding to the issues faced in the community (Creating)

Assessment Process:

The allotment of marks will be as follows:

Internal Assessment: 40 marks

(This will consist of one test to find out the knowledge acquired by students; attendance; discipline)

External Assessment: 60 marks

(This will consist of the field work, logbook diary, report submission of the field work, viva-voce and presentation)

The Assessment will go beyond evaluation of only the final outcome. All the steps must be completed successfully.

- i. Regular reporting and feedback - to allow continual adjustment and improvement.
- ii. Involving all stakeholders in the evaluation process is desirable.
- iii. Students will be given a log book diary which they will have to fill up on a regular basis. This comprehensive diary will have different sections which will effectively help the students to plan, document their activities and will act as a self-monitoring tool to measure the objectives, activities undertaken and the learning outcomes achieved.
- iv. Each faculty of the department will act as a supervisor for five or six students. The students will submit their logbook diary on a weekly basis. The logbook diary will have to be complete in all aspects along with supporting documents like photographs, etc.
- v. Once the assigned field activity is complete, all the students will prepare a project report on the basis of the prescribed structure.
- vi. Final presentation will be held wherein each student will present their report.

Module I: Concept of Service Learning (3 Hours)

Service Learning – meaning, concept, definition; value based framework of Service Learning; Understanding the core standards of Service Learning such as respect, reciprocity, relevance, and reflection; Elements of Service Learning; Understanding Service Learning – Its philosophy, historical background, purpose, value and theoretical framework; Locating Service Learning within the University context; Principles of Service Learning; Classification of Service Learning Models; Experiential Learning; Reflective Learning;; Journaling; Service Learning Pedagogy; Difference between Service Learning and other community experiences

Module II: Community Engagement and Community Partnerships (3 Hours)

Community Engagement – concept, meaning, definition and principles; benefits of community engagement, models of community engagement; Civic Engagement, University Community Engagement, Community partnerships – meaning, benefits, Reflection – meaning, definition and implications; Critical inquiry - meaning, definition and implications; Engaged Research - meaning, definition and implications;

Historical context of University Community Partnership; Understanding Community & Community Partnership; Ethical understanding of partnership; Understanding the agency of the Community – as co-educators; Community barriers

Module III: Social Responsibility and Communication Basics (3 Hours)

Social Responsibility – meaning, benefits, Socio-economic context – meaning, definition, Social issues – meaning, Understanding of society & social issues ; Conflict – meaning, types, Understanding various conflict resolution strategies; Community level partnerships – meaning, significance, types; Social Justice – meaning and implications; Communication – meaning, types, channels of communication, models of communication

Module IV: Identifying the Partners in the Community (3 Hours)

Partners in the community – meaning, types and functions of Community Partners namely, Corporate, Government and PSU Organizations, Panchayats, Community settings, Clinical settings, NGO's, Anganwadi Centres, Self Help Groups, Schools , Business Firms, Community Markets, Weekly Haats, Customer Relationship Management, etc

Module V: Basics of Professional Skills (3 Hours)

Aspects of Professional Skills Development: Factors affecting individual behaviour - personal, environmental and organizational, individual diversity –biographical and demographic characteristics, self-esteem, self-monitoring

Individual decision-making process, rational decision-making, decision-making styles, common biases and judgment errors in decision-making, individual v/s group decision-making.

Basics of Planning and Organising - Nature and purpose of planning, planning process, types of plans

Types of groups, stages of group development, characteristics of effective teams, how group status influences individual behavior, leaders and their role in teams, characteristics of an effective leader.

Module VI: Service Learning Projects (15 hours)

Service Learning Projects – stages, investigation, preparation, action, reflection, demonstration and documentation.

Areas of Study in Service Learning: Capacity building of youths, Single entry accounting system for small retailers, Preparation and benefits of maintain balance sheet, Financial Literacy, Financial Planning for Business Organisations, Basic Marketing Techniques, Selling Skills, Insurance, Human Resource Management, MSME schemes, Entrepreneurship ideas, start up ventures, Feasibility studies, Undertaking New Business Ventures, Venture Funding, Angel Investors, Partnership, Business Communication skills, Soft Skills Development, Poverty, livelihood, Health, Education, Water, Sanitation, Disability, Children, Women, NGO Management Practices, Environment, SDG's - technological solutions/suggestions for development, etc.

Note: Emphasis on Group Work, Projects, Case Studies, Assignments, Journaling, Report Preparation, Presentations, Workshops, Group Conferences Individual Conferences etc.

Suggested Readings

1. Kaye Cathryn Berger, the complete Guide to Service Learning: Proven Practical Ways to Engage Students in Civic Responsibility, Academic Curriculum and Social Action, Free Spirit Publishing
2. Barbara Jacoby, Service Learning in Higher Education: Concepts and Practices
3. Patty H. Clayton, Robert G. Bringle and Julie A. Hatcher, Research on Service Learning: Conceptual Frameworks and Assessment
4. Barbara Jacoby, Service-Learning Essentials: Questions, Answers and Lessons Learned
5. Julie A, Hatcher and Robert G. Bringle, Understanding Service Learning and Community Engagement
6. Farbar Katy, Change the World with Service Learning

Course code Indian Knowledge Systems and Ethical Foundations for Commerce (Credit 2 total hours = 30)

Course objective: The objective of this course is to introduce students to the rich heritage of the Indian Knowledge System (IKS) by exploring key philosophical, ethical, and socio-economic insights from the Vedas, the epics Ramayana and Mahabharata, and the teachings of Srimanta Shankardeva. It aims to help learners understand the relevance of ancient Indian wisdom in shaping values, leadership, ethical decision-making, and responsible commerce in today's world.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO1: Understand the core themes of Vedic knowledge and their relevance to life and sustainable living.
- CO2: Analyze ethical dilemmas and leadership models from the Ramayana and Mahabharata.
- CO3: Appreciate the teachings of Srimanta Shankardeva in the context of moral economy, social equality, and cultural integrity.
- CO4: Integrate Indian ethical and philosophical principles into personal and professional decision-making.
- CO5: Critically examine how ancient wisdom can contribute to responsible commerce and inclusive growth.

Module I: Introduction to Indian Knowledge System (IKS) (6 hours)

Concept and components of IKS; Oral and scriptural traditions; Importance in contemporary education and commerce.

Module II: Vedas and Commerce (6 hours)

Overview of Vedas; Concepts of Dharma, Artha, and Karma; Economic and ethical ideas in Vedic texts; Sustainability and business ethics.

Module III: Ramayana: Lessons in Leadership and Ethics (6 Hours)

Character study: Rama, Lakshmana, Bharata, Hanuman; Ethical dilemmas; Leadership, loyalty, governance, and decision-making.

Module IV: Mahabharata: Strategic Thinking and Conflict Resolution (6 Hours)

Dharma vs Adharma in business; Krishna's counsel in the Gita; Kautilya-like economic insights; Family business conflicts and resolutions.

Module V: Srimanta Shankardeva and Socio-Economic Ethics (6 Hours)

Life and teachings; Eka Sarana Dharma; Equality, non-discrimination, and moral commerce; Role of Bhakti in social transformation.

Suggested Readings and Resources:

1. Swami Ranganathananda – Universal Message of the Vedas
2. C. Rajagopalachari – Ramayana and Mahabharata (abridged)
3. Gita Press – Bhagavad Gita (with English translation)
4. Maheswar Neog – Srimanta Sankaradeva and His Times
5. Kapila Vatsyayan – The Indian Knowledge Systems
6. N.S.S. Raman – Indian Ethos and Values for Managers

Mapping of COs to Syllabus

Course Outcome	Module I	Module II	Module III	Module IV	Module V
CO1	H	L	L	M	M
CO2	H	M	H	H	M
CO3	L	H	H	M	H
CO4	L	H	H	H	H
CO5	M	H	M	H	H

Financial Management Theory and Application Code:

(4 Credits- 60 hours) (4-0-0: L:T:P)

Course Objectives:

1. To introduce students to the fundamental concepts and principles of financial management.
2. To enable students to analyze investment decisions using capital budgeting techniques.
3. To develop the ability to estimate cost of capital and understand capital structure theories.
4. To explore dividend and working capital decisions through practical business applications.
5. To build spreadsheet-based computational skills for financial decision-making.

Course Outcomes (COs):

- CO2: Describe the nature, scope, and basic principles of financial management, including time value of money and risk-return concepts.
- CO3: Apply capital budgeting techniques to evaluate investment projects and estimate cash flows.
- CO3: Calculate the cost of various sources of capital and evaluate financing decisions using capital structure theories.
- CO4: Evaluate different dividend policy models and analyze their impact on firm valuation.
- CO5: Estimate working capital requirements and analyze firm-level liquidity and operational efficiency

Unit 1: Financial Management – An Overview (5 Hours)

Nature, scope and objectives of financial management, Time value of money: concept and importance, Risk and return: overview and measurement basics, risk in the contemporary world, measurement of risks

Application in Business:

- Understanding the role of finance in strategic decision-making
- Comparing investment alternatives using risk-return analysis

Unit 2: Capital Budgeting Decision (10 Hours)

Capital budgeting process and importance in long-term investment planning, Cash flow estimation techniques, Evaluation methods: Payback Period, Discounted Payback Period, Accounting Rate of Return (ARR), Net Present Value (NPV), Internal Rate of Return (IRR), MIRR and Profitability Index (PI)

Application in Business:

- Evaluating new product launches, plant expansion, or merger decisions using capital budgeting
- Spreadsheet modelling for project appraisal

Unit 3: Cost of Capital and Financing Decision (10 Hours)

Estimating components of cost of capital: Cost of Equity, Cost of Retained Earnings, Cost of Debt, Cost of Preference Capital, Weighted Average Cost of Capital (WACC), Incremental/Marginal Cost of Capital

Capital Structure: Theories: Net Income, Net Operating Income, MM Hypothesis, Traditional Approach, Leverage Analysis: Operating, Financial, Combined, EBIT-EPS Analysis, Determinants of capital structure

Application in Business:

- Choosing between debt and equity funding for expansion
- Analysing capital structure of real companies to determine cost-effective financing

Unit 4: Dividend Decision (10 Hours)

Theories of dividend relevance and irrelevance: MM Approach, Walter's Model, Gordon's Model, Determinants of dividend policy. Application of dividend policy in the contemporary business world. Dividend vs Retained earnings, when should retain?

Application in Business:

- Comparing dividend payout practices of companies in different industries
- Evaluating how dividend decisions influence investor perception and firm value

Unit 5: Working Capital Decision (10 Hours)

Concepts of working capital: gross vs. net, Operating and cash cycles, Risk-return trade off in working capital management, Estimation of working capital requirements, Receivables management techniques

Application in Business:

- Estimating working capital needs based on real company data
- Designing policies to manage inventory and receivables efficiently

Practical Component (To Be Done Using Excel/Spreadsheet Tools)

1. Compute risk and return of investment alternatives.
2. Estimate project cash flows for a hypothetical startup and apply capital budgeting techniques.
3. Extract and analyze financial statements to compute cost of capital.
4. Evaluate dividend policies of firms from specific industries using historical data.
5. Compare working capital estimation between two companies from different sectors.

Note: Use of spreadsheet software (e.g., MS Excel or Google Sheets) is mandatory for assignments and internal assessment.

Mapping of Cos

COs	M1	M2	M3	M4	M5
CO2	H	M	M	M	M
CO3	M	H	H	H	M
CO4	M	H	H	H	H
CO5	L	L	M	M	H

Micro Economics Theory and Practice

(4 credits-60 hours) (4-0-0: L-T-P)

Course Objectives:

1. To impart knowledge of basic microeconomic concepts and theories.
2. To enable students to understand consumer and producer behavior in different market conditions.
3. To equip students with analytical tools for decision-making at the individual and firm level.
4. To link microeconomic theory with real-world business and policy issues.

Course Outcomes (COs):

- **CO1:** Define core concepts of microeconomics including scarcity, choice, opportunity cost, and utility. (*Remembering*)
- **CO2:** Explain consumer and producer decision-making using demand, supply, and elasticity concepts. (*Understanding*)
- **CO3:** Apply microeconomic tools to analyze optimal production and consumption. (*Applying*)
- **CO4:** Analyze pricing and output decisions in various market structures. (*Analyzing*)
- **CO5:** Evaluate real-world applications of microeconomic principles in business and policy contexts. (*Evaluating*)

Module 1: Introduction to Microeconomics (5 Hours)

Meaning, scope and limitations of microeconomics, Basic economic problems: scarcity, choice, opportunity cost, sunk cost, decision making with opportunity and sunk cost, Positive vs. normative economics Methodology of economic science: deductive and inductive

Application in Business:

- Decision-making under resource constraints
- Cost-benefit analysis in everyday business planning

Unit 2: Demand and Supply Analysis (10 Hours)

Law of demand and law of supply, Determinants of demand and supply, Market equilibrium and changes in equilibrium, Elasticity of demand: price, income, cross, decision making with the help of elasticity and Total Revenue, Elasticity of supply.

Application in Business:

- Pricing strategies based on demand elasticity
- Demand forecasting for product planning

Unit 3: Theory of Consumer Behavior (10 Hours)

Cardinal utility analysis: law of diminishing marginal utility, consumer equilibrium, Ordinal utility: indifference curve, budget line, consumer equilibrium, Income and substitution effects, Engel curve

Application in Business:

- Designing product bundles and pricing tiers
- Consumer behavior research for marketing insights

Unit 4: Theory of Production and Cost (10 Hours)

Production function: short-run and long-run, Law of variable proportions and returns to scale, Isoquants and isocost lines, Cost curves: short-run and long-run

Application in Business:

- Optimal input combinations for cost minimization
- Analyzing economies of scale for strategic expansion

Unit 5: Market Structures and Pricing (10 Hours)

Perfect competition: characteristics, price determination, Monopoly: price and output decisions, price discrimination, Monopolistic competition: product differentiation, selling cost, Oligopoly: features, kinked demand curve, cartels

Application in Business:

- Competitive analysis for pricing strategy

- Market entry decisions based on structure

Suggested Readings:

Principles of Microeconomics by N. Gregory Mankiw (Cengage Learning, 9th edition, 2020, ISBN: 9780357133484)

Microeconomics by Robert S. Pindyck, Daniel L. Rubinfeld, and P.L. Mehta (Pearson Education, 9th edition, 2018, ISBN: 9789332585531)

Intermediate Microeconomics: A Modern Approach by Hal R. Varian (W.W. Norton & Company, 9th edition, 2014, ISBN: 9780393920772)

Microeconomics I and Statistics by Anindya Das and Arup K. Sengupta (Oxford University Press, 2021, ISBN: 9780199494089)

Micro Economics by P.K. Mehta and M. Singh (Taxmann Publications, ISBN: 9789392211989)

Mapping Of COs

	M1	M2	M3	M4	M5
CO1	H	L	L	L	L
CO2	H	H	M	M	M
CO3	M	H	H	H	H
CO4	L	M	H	M	M
CO5	L	L	L	M	H

BUSINESS STATISTICS AND DECISIONS

(3 credits-45 hours) (3-0-0: L-T-P)

Objective: The objective of this course is to familiarize students with the applications of statistical techniques in business decisions. This purpose of this course is to provide students with statistical tools needed by managers. The course emphasizes understanding the process associated with statistical decisions, defining and formulating problems, Analysing the data, and using the results in decision making.

COURSE/LEARNING OUTCOMES

After learning this course, the students will be able to:

CO 1: Find the techniques for decision-making under uncertainty. (Remembering)

CO 2: Demonstrate understanding of statistical thinking and data analysis. (Understanding)

CO 3: Apply methods of Correlation, Regression and also use Time based data. (Applying)

CO 4: Analyse from theoretical and practical perspectives, decision making concepts and processes in business settings. (Analysing)

CO 5: Estimate different kinds of Statistical methods like Mean, Median, Mode, Standard Deviation, Index Number. (Evaluating)

CO6: Combine research concepts and methods in a business setting. (Creating)

Part A: BUSINESS STATISTICS**Module I: Uni-variate Analysis (10 hours)**

Measures of Central Tendency including Arithmetic mean, Geometric mean and Harmonic mean: properties and applications; Mode and Median. Partition values - quartiles, deciles, and percentiles. Measures of Variation: absolute and relative. Range, quartile deviation and mean deviation; Variance and Standard deviation: calculation and properties.

Module II: Bi-variate Analysis (10 hours)

Simple Linear Correlation Analysis: Meaning, and measurement. Karl Pearson's coefficient and Spearman's rank correlation. Simple Linear Regression Analysis: Regression equations and estimation. Relationship between correlation and regression coefficients.

Module III: Time-based Data: Index Numbers and Time Series Analysis (10 hours)

Meaning and uses of index numbers; Construction of index numbers: Aggregative and average of relatives – simple and weighted, Tests of adequacy of index numbers, Construction of consumer price indices.

Components of time series; additive and multiplicative models; Trend analysis: Finding trend by moving average method and Fitting of linear trend line using principle of least squares.

Part B: BUSINESS DECISION**Module IV (7 hours)**

Course introduction. Introduction to Evidence Based Management. Introduction to measurement theory and statistical inference. Simple decision tools; Rational choice, limited rationality and biases; Modern test theory. Rapid evidence assessment. Academic Survey design and testing.

Module V (8 hours)

Multiple-person decision making. Exploratory data analysis; Forecasting; roadmaps Optimisation; Big data, inference and dimension reduction. Forecasting, roadmaps.

Suggested Readings

1. Sharma J. K., Business Statistics, Pearson Education.
2. Gupta S.C., Fundamentals of Statistics, Himalaya Publishing House.
3. Gupta S.P. and Gupta A, Elementary Statistics, Sultan Chand and Sons, New Delhi.
4. Levin R and Rubin David S, Statistics for Management, Prentice Hall of India, New Delhi.
5. Spiegel M.R., Theory and Problems of Statistics, Schaum's Outlines Series, McGraw Hill Publishing

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L	M			
CO 2	M	H	M		
CO 3			M	H	H

AECH101T/ AECH201T: COMMUNICATIVE HINDI II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Outcomes

On completion of this course successfully, students will be able to:

CO 1: Conceptualize vocabulary used in professional sectors (remembering)

CO 2: Apply advance level grammatical concepts in communicative usage (applying)

CO 3: Understand the cultural and regional influences on communicative Hindi (understanding)

CO 4: Effectively use Hindi in public, professional and social platforms

Module I: Advanced vocabulary building

a. Review of concepts: Review of basic level Hindi vocabulary ,pronunciation and sentence formation

b. Review of intermediate level vocabulary ,conversation and grammar

c. Vocabulary building for advanced topics: politics, economics, technology, etc.

d. Understanding and usage of synonyms, antonyms, and homonyms words

□ सामान्य हहोदी ान ँि अधारणा की समींा: शब्द कोष , उच्चारण , िाक्य सोरचना इत्याहद

□ माध्यलमक सूर के िावावशन हेरु शब्दािरी , िावावशन व्याकरण ँि इत्याहद की समींा

□ उच्च सूररीय िावावशन हेरु शब्दकोष ननमावण जैसे राजनीनर , अथवशास्त्र , वीानो िर् कनीकी आहद ंेत्रों में उनयोगी शब्दािरी

□ समानाथी, विरुद्धाथी ँि सामनाम शब्दों का ान ँि उनयोग

Module II: Advanced grammar concepts

a. Advanced sentence formation: passive voice, direct and indirect speech, etc.

b. Use of conjunctions, interjections, and transitional words

c. Figures of speech (Alankar) and their effective usage in communicative Hindi

□ उच्च सूररीय िाक्य सोरचना: कर्तवाच्य और कमवाच्य , प्रत्यं कथन और अप्रत्यं कथन इत्याहद

□ सोयोजक , विस्मयाहदबोधक, सोिामी शब्दों का उनयोग

□ असोकारों का ान ँि प्रभािशारी िावावशन में उनका प्रयोग

Module III: Conversational practice and Writing practice

a. Role-play exercises for advanced situations: negotiating, debating, expressing opinions, etc. Group discussion and conversation practice

b. Writing practice for advanced topics: newspaper articles, book/magazine articles ,reports, etc.; rhetorical usage in Hindi writing

□ अलभनय- नाटक /िावावशन गनर्विधध / नाट्य रचना के माध्यम से उच्च सूररीय नररस्थनयों के िावावशन का ान: िाद -विािाद , सामूहक नररचवाव, व्यस्क्रगर् अलभव्यस्क्र ँि िावावशन अभ्यास

□ रेखन अभ्यास: समाचार नत्र आरेख , नुस्कीय आरेख , प्रनर्िेदन इत्याहद, उच्च सूररीय रेखन कायव में आरोकाररक/ शब्दाडोबरनूणव भाषा का उनयोग

Module IV: Cultural and social influences on communication

a. Analytical understanding of Cultural and social aspects of communication in Hindi-speaking regions

b. Major communication styles : across generations , cultures and regions

c. Major Hindi Dialects of different regions of India

□ विलभन्न हहोदी भाषी ेत्र ऐि िावराण सोबवद्धर सामासुजक ऐि सोसुक्तनरु दसुष्टुकोण ऐि विशुशेषण

□ विलभन्न िावराण नद्धनरुयोः सोसुक्तनरु , ेत्रीय ऐि नीदी दर नीदी नररुवरुन के सनुदभुव में

□ विलभन्न भारुीय ेत्रों की प्रुमुख हहोदी उनुभाषाऐँ ऐि बोलरुयो

Module V: Professional communication and specialized communication

a. Communication in professional contexts :Vocabulary building for professional use ,Writing emails , letters and memos in Hindi

b. Communication used in core business sectors for specific purposes: tourism, healthcare, education, etc.

c. Vocabulary building and sentence formation for specialized professional communication

d. Role-play exercises for specialized communication scenarios viz. institutional, administrative, professional, legal, corporate and business communications etc.

□ वुासुनरुयक िावराण सनुदभुव : वुासुनरुयक िावराण हेरु शुदुदकोष का ान, इ-डेर/ वुनन, वुासुनरुयक नन, ानन आहद

□ प्रुमुख वुासुनरुयक ेत्रों जैसे भ्रुण , सुसुसु , लशु इतुाहद ेत्रों में उनुयोण में आने िारी शुदुदरुी का ान

□ वुासुनरुयक िावराण /सुननाओ के आदानप्रदान-में उनुयोणी शुदुदरुी , िकु सुरुनना ऐि शुदुदकोष का ान

□ अलभनरु- नादक /िावराण गनुवुध / नादु रनना के माधुड से वलशसुटु/वुशेषीकतु नररुसुथनरु के िावराण का ान जैसे वुासुनरुयक, प्रुबोधकीय, सोसुथगरु, वुानाररुक, सोगहुरु / ननगलड' वुानार सडुडुनी ऐि कानुनी िावराण

Module VI: Use of Hindi in digital communication

a. Opportunities and Usage of Hindi language in social media and digital communication

b. Writing online content, public contents and professional contents in Hindi through in class activities.

□ सामासुजक सोनार माधुड/ सोशर डीडडु, ओकीय माधुड/ डडसुजतर लडडडु में हहोदी भाषा का प्रुयोण ऐि सोभाुनारु

□ सीधा सोनार सोनकव/ आन राइन के सनुदभुव में प्रारुन रेखन/कोटु राइहटुग ,सुवुजननक रेखन, वुासुनरुयक रेखन इतुाहद का ान ऐि अभुास

Suggested Readings

1. Soorya prasad Dicit (2012) ,Sanchar Bhasha –Hindi, Lokbharti Prakashan
2. Hindi-B- Rachna Sagar(2019), Rachna Sagar publication
3. Omkar N.Koul (2008),Modern Hindi Grammar, Donwoody Press
4. Richard Delacy, Sudha Joshi (2009), Elementary Hindi: Learn to Communicate in Everyday Situations -Tuttle Publishing (a work book -e-book with MP4 video)
5. Sunita Narain Mathur, Madhumita Mehrotra (2017) ,Hindi for Beginners: A Guide to Conversational Hindi (Audio Disc Included), Tuttle Publishing
6. Surendra Kumar Gambhir (2003), Communicative Hindi for Beginners: Cultural Appropriateness, Vocabulary, Grammatical Accuracy Google book
7. DRISHTI IAS BLOG (2023), Hindi Language: Its Journey So Far, <https://www.drishtias.com/blog/hindi-language-its-journey-so-far>
8. Britannica blog (nd), Hindi language- history, variety, grammar and vocabulary, <https://www.britannica.com/topic/Hindi-language>

Mapping of Cos

COs	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	L	M	H		L	
CO 2	L	M	H			
CO 3				H	L	
CO 4			M		H	H

AECA101T/AECA201T: COMMUNICATIVE ASSAMESE II
(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objectives

The objectives of this course is to provide Advance Writing Skill in Assamese Language, knowledge of Assamese grammar, Conversational practice, Cultural and Social Communication, Advance Grammar Concepts and finally to provide professional communication in Assamese.

Course Outcomes

CO 1: Understand the Advanced vocabulary buildings.

CO 2: Explain the Advance sentence formation in Assamese language.

CO 3: Evaluate the importance of Assamese culture professional communication.

Module I: Advanced vocabulary building (6 Hours)

- Review of basic Assamese pronunciation and sentence formation
- Review of intermediate level vocabulary and grammar
- Vocabulary building for advanced topics: politics, economics, technology. etc.
- Use of synonyms, antonyms, and homony

Module II: Advanced grammar concepts (8 hours)

- Advanced sentence formation: passive voice, direct and indirect speech, etc.
- Use of conjunctions, interjections, and transitional words

Module III: Conversational practice and Writing practice (8 Hours)

- Role-play exercises for advanced situations: negotiating, debating, expressing opinions, etc.
- Group discussion and conversation practice
- Writing practice for advanced topics: newspaper articles, reports, etc.
- Use of rhetorical devices in writing

Module IV: Cultural and social communication (8 hours)

- Cultural and social aspects of communication in Assam
- Differences in communication styles across generations and regions
- Professional communication and specialized communication
- Communication in professional contexts
- Vocabulary building for professional use
- Writing emails and memos in Assamese
- Communication for specific purposes: tourism, healthcare, education, etc.
- Vocabulary building and sentence formation for specialized communication Role-play exercises for specialized communication scenarios

Suggested Readings

- ১) নতুন আই- অসমীয়া ব্যাকরণ আৰু বচনা ৫ ম, ৬ ম আৰু ৭ ম শ্ৰেণী, - দীনেশ্বৰ নাথ, ত্ৰিভুজন পাব্লিক প্ৰকাশন।
- ২) পাঠশালাৰ- ব্যাকৰণ আৰু বচনা তৃতীয় আৰু চতুৰ্থ শ্ৰেণীৰ বাবে অসম বুক- দিগেন

AEFR101T/AEFR201T: FRENCH BEGINNER LEVEL II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course objective

French Beginner level II is a course of 30 learning hours designed to help learners having completed French Beginner Level 1 to acquire more advanced language skills in French language. These skills prepare students to effectively communicate in French on topics related to various daily situations. Students enhance listening and speaking abilities in real-life situations, learn to read and write practical texts in French, and gain deeper understanding of francophone cultures. By the end of the session, learners are expected to be able to engage in a variety of simple daily conversations, read and write short paragraphs in French.

Course Outcomes

On completion of this course, students will be able to:

CO1: Recall, name and identify the vocabulary and phrases related to who, when, where and other key question words, explain and interpret their meanings and select appropriate response. (Remembering, analyzing, evaluating)

CO2: Use the vocabulary and sentence structures learned to converse and discuss on a range of topics related to everyday situations. (Understanding, applying)

CO3: Demonstrate a deeper understanding of francophone countries' cultures, describe and summarize basic cultural values. (Applying, understanding, evaluating)

CO4: Analyse cultural differences and choose appropriate ways to interact with speakers from Francophone countries. (Analysing, evaluating)

CO5: Design and compose meaningful situational dialogues and perform them; invent skits by using the language skills learned. (Creating)

Module I: Pronunciation drills (8 hours)

- a) Liaison and enchaînement
- b) Sound discrimination
- c) Distinction of grammatical gender
- d) Elision

Module II: Daily conversation and grammatical structures (16 hours)

- a) Shopping
- b) Expressing wishes and needs
- c) Asking and giving direction
- d) Telling time
- e) Describing intention in near-future tense
- f) Making an appointment

Module III: Introduction to Francophone cultures (6 hours)

- a) Tourism
- b) Arts and literature
- c) Lifestyles

Suggested Readings

1. *Amical A1*, CLE International, Paris, 2011

Mapping Of COS

Course Outcome	Module 1	Module 2	Module 3
CO1		H	
CO2		M	H
CO3			H
CO4			H
CO5		H	

**AEGR101T/AEGR201T: INTRODUCTION TO GERMAN LANGUAGE II
(2 credits – 30 hours) (L-T-P: 2-0-0)**

Course Objectives

The course aims at covering the basics of German language. It also covers a few basic grammar topics and an application of grammar in day-to-day life that is in reading, writing, listening, and speaking. On the completion of the first semester, one can understand and use familiar, everyday expressions and very simple sentences, can introduce him/her and others as well as ask others about themselves – e.g., where they live, who they know and what they own – and can respond to questions of this nature.

Course Outcomes

Students will be able to acquire a working knowledge in basic German

Course Contents

	Topic	Grammar
1	Daily schedule and arranging appointments	Dative sentences, verbs, prepositions
2	In the office, different jobs, and leisure activity	Sentence connectives: conjunctions (und, oder, aber)
3	On the computer and emails	The group of nouns
4	Living and the home furnishings	Pronouns
5	Clothes and the shopping	Adjectives
6	Health and body parts	Modal Verbs
7	Holiday, travel, and city tour	Past Tense

Suggested Reading

Netzwerk Deutsch als Fremdsprache A1, Textbook + Workbook by Stephanie Dengler

**Introduction to Data analytics using Python-I
(3 Credits- 45 Hours) (3-0-0: L-T-P)**

Course objectives:

1. To understand Python syntax and write clean, functional, and readable code.

2. To apply programming logic and control structures to solve real-world business problems.
3. To use Python for basic data analysis tasks, including data cleaning and manipulation.
4. To leverage Python libraries such as NumPy and Pandas for efficient data handling.
5. To build foundational programming and analytical skills relevant to careers in data science and business analytics.

Course Outcomes:

CO1: Demonstrate remembering of fundamental programming constructs in Python, including input/output operations, variables, expressions, data types, string operations, and basic arithmetic.

CO2: Understand how to organise and manage data using built-in Python data structures, including lists, tuples, dictionaries, and strings, and utilize modules to structure programs effectively.

CO2: Understand modular code using user-defined functions and demonstrate good programming practices, such as commenting, using docstrings, debugging with error messages, and adhering to Python style.

CO3: To apply control structures such as conditionals and loops to solve basic computational and business problems, including if-else logic, Boolean operations, and iteration using for and while loops.

CO4: To analyze, manipulate, and visualize real-world data using Python libraries such as NumPy and Pandas, applying core data science skills like exploratory data analysis (EDA) and basic visualization techniques.

Module I: Fundamentals of Python Programming (10)

Introduction to Python and its background, Input/output operations, Variables, strings, numbers, and basic error handling, Writing and understanding Python expressions, Type conversion and mixed data types, Floating-point arithmetic and math module, Working with basic objects: strings, formatted strings, variables, lists, and tuples

Lab Topics: Writing your first Python program (Hello World, input/output), Creating and using variables (int, float, string), String concatenation, length, and formatting, Performing arithmetic operations and evaluating expressions, Type conversion and mixed-type operations and Handling and understanding error messages (syntax, name, indentation)

Module II: Control Flow and Modularity (10)

Decision-making and boolean logic - If-else conditions, nested and chained decisions, Looping constructs (while, for, nested loops), Loop control: break, continue, else, Writing functions: definition, scope, parameters, return values, Working with modules and import mechanisms

Lab Topics: Writing decision-making programs using if-else statements, Creating loops (for and while) for repetitive tasks, Using break and continue in loops, Defining and calling functions with parameters and return values and Organizing code using Python modules

Module III: Data Structures and Object-Oriented Programming (10)

Advanced string operations and formatting, List operations, sorting, reversing, comprehensions, Dictionaries: creation, operations, nested dictionaries, Object-oriented programming: classes, instances, methods, operator overloading, Recursion and inheritance (basic to advanced)

Lab Topics: Manipulating strings, lists, and dictionaries, Sorting, slicing, and list comprehensions, Creating simple classes and objects, Implementing methods and using constructors, Writing basic programs using recursion and inheritance

Module IV: Working with Files and Introduction to Data Science (15)

File handling: reading, writing, working with CSVs, Handling exceptions and raising errors, Introduction to Data Science, Working with NumPy and Pandas, Exploratory Data Analysis (EDA), Data Visualization techniques using Python

Lab Work: Analyzing datasets using Pandas, Creating basic visualizations (bar, pie, histograms), Mini Project (e.g., analyzing business sales or customer data)

Suggested Readings:

Matthes, E. (2019). *Python crash course* (2nd ed.). No Starch Press.

Sweigart, A. (2019). *Automate the boring stuff with Python: Practical programming for total beginners* (2nd ed.). No Starch Press.

Downey, A. B. (2015). *Think Python: How to think like a computer scientist* (2nd ed.). O'Reilly Media.

Mapping of COs

	M1	M2	M3	M4
CO1	H	M	M	M
CO2	H	H	H	M
CO3	L	H	H	H
CO4	L	L	M	H

COMMON Value Based**CBDT103T: DIGITAL AND TECHNOLOGICAL SOLUTIONS****(1 credit: 15 hours)****Module 1: Computer Fundamentals and Office automation (8 Hours)**

Evolution of Computers and its applications, latest IT gadgets, basics of hardware and software, Operating Systems: types and functions, Office tools – Word Processor, Spreadsheets, Power Presentation, Introduction to graphic editing tools.

Module 2: Communication Systems and Digital Solutions (4 Hours)

Types of Communication Systems model and principles, Types of transmission media, Internet concepts, Web browsers, search engines, Email, Social networking and Netiquettes.

Introduction & Evolution of Digital Systems, Role and Significance of Digital Technology, Overview of e-governance, E-commerce & Digital Marketing: Basic Concepts, Benefits & Challenges, Digital India & e-Governance: Initiatives, Infrastructure, Services and Empowerment, Digital Financial Tools: Unified Payment Interface (UPI), Unstructured Supplementary Service Data (USSD), Aadhaar Enabled Payment System (AEPS), Banking Cards, e-Wallets, Internet Banking, 5G Technology.

Module 3: Cyber Security and Emerging Technologies (4 Hours)

Concepts of cyber security, Issues and challenges of cyber security, Classification of cyber-crimes, Introduction to IT Act 2000 and its amendments, Needs and best practices for the use of Social media.

Introduction to emerging technologies, Internet of Things (IoT), Big Data Analytics, Cloud Computing, Virtual reality, Artificial Intelligence, Block Chain technology, 3D Printing, Robotic Process automation.

Suggested Readings

1. Rajaraman V., Fundamentals of Computers, PHI Publications
2. Anita Goel, Computer Fundamentals, Pearson Publication New Delhi
3. Suresh Basandra, Computers Today A. Shinde, *Introduction to Cyber Security: Guide to the World of Cyber Security*, Notion Press, 2021
4. U Sharma, P Nand, J Chatterjee, V Jain, N Z Jhanjhi, R. Sujatha, *Cyber-Physical Systems: Foundations and Techniques*, Wiley, 2022.
5. U Sharma, P Astya, A Baliyan, S Krit, V Jain, M Z Khan, *Advancing Computational Intelligence Techniques for Security Systems Design*, CRC Press, 2021
6. Rich & Knight, Artificial Intelligence, TMG, 3 e/d
7. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontline" Schroff/O'Reilly
8. Khan, Jamil Y., and Mehmet R. Yuce, eds. *Internet of Things (IoT): systems and applications*. CRC Press, 2019.
9. Redwood, Ben, Filemon Schöffer, and Brian Garret. *The 3D printing handbook: technologies, design and applications*. 3D
10. G. Nandi, R. K. Sharma, *Data Science Fundamentals and Practical Approaches*, BPB, 1st Edition, 2020

CBUI104T: UNDERSTANDING INDIA**Credit – 1 (0-0-1) – 15 Hours****Course Outcomes**

CO 1: At the end of this course, students will be able to explain the social, cultural and religious diversity of India and its impact on Indian psyche.

CO 2: At the end of this course, students will be able to evaluate the political and economic system of India.

Module 1: India and its Diversity (18 hours)

- Overview of India's geography, diversity, demographics and development indicators

- A brief survey of India's history, highlighting key events, personalities and movements that shaped its identity and destiny
- An exploration of India's rich and varied cultural heritage, including its languages, religions, arts, literature and philosophy
- An overview of India's social structure, institutions, norms and values, with a focus on issues such as caste, gender, class and ethnicity

Module 2: Indian Political System (12 hours)

- A study of India's political system, institutions, parties and ideologies
- India's role in regional and global affairs
- A review of India's economic performance; the challenges and opportunities for growth;
- An overview of sectors such as agriculture, industry, services, and trade.
- A discussion of India's environmental problems & the solutions for sustainable development
- A discussion on India's journey towards a developed nation.

Suggested Readings

1. Thapar, R. (2015). The Penguin History of Early India: From the Origins to AD 1300. India: Penguin Books Limited.
2. Kosambi, D. D. (2022). The Culture and Civilization of Ancient India in Historical Outline. United Kingdom: Taylor & Francis.
3. Zimmer, H. R. (2020). Philosophies of India. United States: Princeton University Press.
4. Mohanty, M. (2004). Class, Caste, Gender. India: SAGE Publications.
5. Mitra, S. K. (2017). Politics in India: Structure, Process and Policy. United Kingdom: Taylor & Francis.
6. Kothari, R. (1970). Politics in India. India: Orient Longman.
7. Balasubramanyam, V. N. (2019). The Economy of India. United Kingdom: Taylor & Francis.
8. Fisher, M. H. (2018). An Environmental History of India: From Earliest Times to the Twenty-First Century. United Kingdom: Cambridge University Press.

Marketing Management: Theory and Application

4 Credits (60 Hours) | L-T-P: 4-0-0

Course Objectives

The primary objectives of this course is to develop and understanding of the fundamental concepts, principles, and functions of marketing management, Enable students to analyze consumer behavior and identify market opportunities using segmentation, targeting, and positioning strategies, Equip learners with the ability to formulate and apply marketing mix strategies in real business scenarios, Foster the ability to evaluate contemporary marketing trends, digital marketing strategies, and socially responsible marketing practices, Build skills in strategic marketing decision-making and problem-solving applicable to competitive environments.

Course Outcomes (CO)

CO1: Define and explain core marketing concepts, functions, and philosophies in modern business.

CO2: Apply consumer behavior and marketing environment to identify opportunities and challenges.

CO3: Analyze STP strategies to design competitive market offerings.

CO4: Formulate effective marketing mix strategies (Product, Price, Place, Promotion) for products and services.

CO5: Create a model on digital marketing strategies, CRM approaches, and ethical marketing practices for sustainable competitive advantage

Course Structure – 4 Modules (60 Hours)

Module I: Introduction to Marketing Management (15 Hours):

Introduction: Definition, nature, scope, and importance of marketing; Evolution of marketing concepts: Production, Product, Selling, Marketing and Societal concepts, Marketing process and value creation; Marketing environment: Micro and Macro environment factors (PESTLE); SWOT analysis and its strategic application; Role of marketing in customer value, satisfaction, and relationship building.

Experience Learning

Case studies, field surveys, real-time industry examples

Module II: Market Analysis and Strategy (15 Hours):

Consumer Behavior: Nature, process of consumer buying decisions, influencing factors (cultural, social, personal, psychological); Market Segmentation; Targeting, Positioning (STP); Bases for segmenting consumer and industrial markets; Evaluation and selection of target markets; Positioning strategies and value proposition; Marketing Information Systems (MIS) and Marketing Research process.

Experience Learning Group presentations & product launch simulation)

Module III: Marketing Mix Decisions: 4Ps/7Ps – Theory & Application (15 Hours):

Product: Product levels and classifications; Product line and product mix strategies; Branding strategies; Brand Equity, Packaging & Labeling, Product Life Cycle (PLC) and strategies; New Product Development (NPD); Price: Objectives of pricing, Factors influencing pricing decisions, Pricing strategies, skimming, penetration, cost-based, competition-based, value-based; Place (Distribution): Channel design & decisions, Direct vs. indirect channels, Logistics, supply chain, wholesaling & retailing; Promotion: Communication mix, Advertising, Personal selling, Sales promotion, PR, Direct and online promotion.

Experience Learning Group presentations & product launch simulation)

Module IV: Contemporary and Emerging Marketing Trends (15 Hours)

Digital marketing: SEO, content marketing, influencer marketing, e-commerce strategies, Services Marketing: 7Ps, service characteristics & strategies, Customer Relationship Management (CRM) and loyalty strategies, Ethical marketing, social responsibility, green & sustainable marketing, Global & International Marketing – opportunities & challenges.

Experience Learning

Use of marketing analytics tools and digital campaign analysis

Suggested Reference Books

1. Philip Kotler & Kevin Lane Keller – *Marketing Management*
2. Ramaswamy & Namakumari – *Marketing Management*
3. William Stanton – *Fundamentals of Marketing*
4. David Jobber – *Principles & Practice of Marketing*
5. Stanton WJ: *Fundamental of Marketing*
6. *Marketing Management: A South Asian Perso*
7. *Marketing Management: Ramaswamy & Namakumari*, Tata McGraw Hill
8. *Marketing Planning and Strategy: Jain*, Cengage learning.
9. *Marketing Management: Gandhi IC*, Tata McGraw Hill

Mapping of Cos to the syllabus

Course Outcome	Module I	Module II	Module III	Module IV
CO1	H	M	L	M
CO2		H		
CO3	M		M	
CO4				M
CO5	L			

Course Code: COST AND MANAGEMENT ACCOUNTING

(4 Credit- 60 hours) (L-T-P: 4-0-0)

Objective

To acquaint the students with basic concepts used in cost accounting, various methods involved in cost ascertainment and cost accounting bookkeeping systems.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Define the concept and the role of cost accounting and Management Accounting in the modern economic environment. (Remembering)

CO 2: Describe the methods of calculating stock consumption and labour cost. (Understanding)
CO 3: Apply the tools and techniques of Management Accounting in managerial decision (Applying).

CO 4: Examine the methods of Allocation, apportionment and absorption of overheads. (Analysis)

CO 5: Interpret the impact of the selected costs method. (Evaluating)

Module: I Introduction to Cost and Management Accounting (10 Hours)

Meaning, objectives and advantages of cost accounting and Management Accounting; Difference between cost accounting, financial accounting and Management Accounting; Cost concepts and classifications; Elements of cost; Installation of a costing system; Role of a cost accountant in an organization, Preparation of Cost Sheet.

Activity 1: Students will visit a small manufacturing or service unit and prepare a *Cost Sheet* based on real data (materials, labour, overheads).

Module II: Management Accounting (10 Hours)

Tools and Techniques of Management Accounting; Budgeting and Budgetary Control, Standard Costing and Variance Analysis, Absorption versus Variable Costing, Role of Management Accountant in Decision Making.

Activity 2: Students will analyse financial statements of any organisation (public or private) and prepare: *A flexible budget*

And *A variance analysis* (material, labour, overhead variances)

Module: III Material Costing and Labour costing (15 Hours)

a. Materials: Material/inventory control techniques; Accounting and control of purchases, storage and issue of materials; Methods of pricing of materials issues — FIFO, LIFO, Simple Average, Weighted Average

b. Labour: Accounting and Control of labour cost; Time keeping and time booking; Concept and treatment of idle time, over time, labour turnover and fringe benefits; Methods of wage payment and the Incentive schemes-Halsey, Rowan, Taylor's Differential piece wage.

Activity 3: Students will conduct a *store-room simulation* (physical or virtual) to practise:

- Inventory control levels
- Re-order levels
- FIFO, LIFO, Simple & Weighted Average pricing

Module: IV Overhead Costing and Cost Records (15 Hours)

Definition; Importance; Classification; allocation, apportionment and absorption of overheads; Meaning of under- and over- absorption; Methods of absorption of manufacturing overheads, computation of Machine hour rate; Integrated and non-integrated accounting system; Reconciliation Cost and financial accounts.

Activity 4: Reconcile a *Costing Profit & Financial Profit* using real/simulated P&L data.

Module: V Costing Methods (10 Hours)

Module costing; Job costing; Contract costing; Process Costing (process losses, valuation of work in progress, joint and by-products), Service costing (only transport); Distinguish between job costing and process costing.

Activity 5: Students will prepare a *Process Account* showing normal loss, abnormal loss and valuation of WIP using numerical data from an industry case.

Suggested Readings

1. Charles T. Horngren, Srikant M. Datar, Madhav V. Rajan, Cost Accounting: A Managerial Emphasis, Pearson Education.
2. Drury, Colin. Management and Cost Accounting. Cengage Learning.
3. Jawahar Lal, Cost Accounting. McGraw Hill Education
4. Nigam, B.M. Lall and I.C. Jain. Cost Accounting: Principles and Practice. PHI Learning
5. Rajiv Goel, Cost Accounting. International Book House
6. Singh, Surender. Cost Accounting, Scholar Tech Press, New Delhi.
7. Jain, S.P. and Narang, K.L. Cost Accounting: Principles and Methods. Kalyani Publishers
8. Arora, M.N. Cost Accounting—Principles and Practice. Vikas Publishing House, New Delhi.
9. Maheshwari, S.N. and S.N. Mittal. Cost Accounting: Theory and Problems. Shri Mahavir Book Depot, New Delhi.
10. Iyengar, S.P. Cost Accounting. Sultan Chand & Sons
11. Jhamb H.V., Fundamentals of Cost Accounting, AneBooks Pvt. Ltd.

12. Introduction to Management Accounting Charles T. Horngren, Gary L. Sundem, Dave Burgstahler, Jeff O. Schatzberg, Pearson Education.
13. Management Accounting, Anthony A. Atkinson, Robert S. Kaplan, Ella Mae Matsumura, S. Mark Young. Dorling Kindersley (India) Pvt. Ltd

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M		L	
CO 2			H		
CO 3		H		H	
CO 4				L	H
CO 5					

Course Code: INDIAN FINANCIAL SYSTEM**(4 Credit - 60 Hours) (L-T-P: 4- 0-0)****Objective(s)**

This course aims at providing the basic knowledge of the Indian Financial system and its components, institutions and their functions. It also helps to understand the workings of the financial institutions and their role in economic development. This also helps to understand the operation of the financial market and capital market.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Understand the basic ideas and developments of the Indian financial system. (Understanding)

CO 2: Demonstrate the workings of the Indian financial institutions and Financial Market. (Applying)

CO 3: Analyze the basic operation of the financial market and financial institutions. (Analyzing)

CO 4: Evaluate various roles and functions played by the Indian financial system in economic development. (Evaluating)

Module I: Introduction of Financial System (10 hours)

Meaning and concept of the financial system; fundamental functions of a financial system; relationship between the financial system and economic development; components of the financial system; an overview of the Indian financial system.

Activity 1: Students will conduct a mini-survey of households or small businesses to study their awareness of the Indian Financial System and its components.

Module II: Money Market and Capital Market (15 hours)

Financial markets and their classification; the money market—its structure, key functions, institutions, and major instruments; the capital market—its components such as the primary and secondary markets, the functions and importance of the capital market, and the methods used for issuing securities in the primary market..

Activity 2: Students will do a real-time tracking of Money Market and Capital Market instruments for one week.

Module III: Financial Institution, Instruments and Services (20 hours)

Financial Institution; Banking and Non-Banking Financial Institution, Distinction between Banking and Non-Banking Financial Institutions; Structure of Banking in India; Commercial bank, Co-operative Bank, Rural Bank- their features, types of Non-Banking Financial Institution; Financial Instruments and Services- concepts and characteristics, features of various Financial Instruments, emerging Financial Service- leasing, hire-purchase, merchant banking, depository, credit rating, mutual funds; Insurance Companies and Pension Funds

Activity 3: Students will perform a **field visit** (physical or virtual) to any bank/NBFC or attend an online session by a bank official.

Module IV: Regulatory Institutions (15 hours)

Regulatory framework; Overview of Regulatory Framework of Financial System, functions of RBI, SEBI- objectives, scope of securities Contract (Regulation) Act 1956, relevant provision of India

Companies Act 1956 in regard to securities market; Insurance Regulatory and Development Authority of India; Pension Fund Regulatory and Development Authority; Small Industries Development Bank of India (SIDBI); Ministry of Corporate Affairs.

Activity 4: Students will study **recent regulatory actions** taken by RBI, SEBI, IRDAI, PFRDA, and MCA.

Suggested Readings

1. Indian Financial System, M.Y Khan, McGraw Hill Companies.
2. Financial Institution and Markets, Structure, Growth and Innovations, L.M. Bhole, The McGraw Hill Companies.
3. The Indian Financial System, Markets, Institutions and Service, Bharati V. Pathak, Pearson Education
4. Banking Theory and Practices, K.C Shekhar, Lakshmi Shekhar, Vikas Publishing House Pvt. Ltd
5. Indian Financial System- P.N Varshney& D.K. Mittal- Sultan Chand & Sons, New Delhi.

Mapping of COs

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		M	H	
CO3			H	
CO4	M		M	H

Course name: Macro Economics Theory and Analysis

Course code:

(3 Credits- 45 hours) (L-T-P: 1-0-0)

Objective: The course “Macroeconomic Theory and Analysis” aims to provide students with a comprehensive understanding of macroeconomic theory while developing their analytical and practical skills. Students will gain a thorough knowledge of key macroeconomic variables such as GDP, inflation, unemployment, interest rates, and balance of payments, and will learn to apply classical, Keynesian, IS-LM, AD-AS, Solow growth, and open economy models to real-world economic phenomena. The course emphasizes the analysis of fiscal, monetary, and trade policies, enabling students to evaluate their effects on output, employment, inflation, and growth.

Course /Learning Outcomes

At the end of this course students will be able to:

- CO 1: Describe key macroeconomic concepts, variables, and frameworks, including GDP, inflation, unemployment, interest rates, and balance of payments.
- CO 2: Identify growth models to analyse short-run and long-run macroeconomic outcomes.
- CO 3: Use fiscal, monetary, and trade policies to real-world examples.
- CO 4: Analyse the effects of fiscal, monetary, and trade policies on output, employment, inflation, and economic growth using real-world data.
- CO 5: Evaluate macroeconomic policy decisions in both domestic and international contexts, including open economy interactions, exchange rate regimes, and currency crises.

Module I: Introduction to Macro Economics (10 Hours)

Macro Economics – Concept and scope, Key macroeconomic issues: inflation, unemployment, growth, trade, Role of Government and Central Banks, Short-run vs long-run perspectives in macroeconomic analysis, Macroeconomic theories and models – classical, Keynesian, IS-LM, AD-AS model, Solow growth model.

Analytical Focus:

- a) Analyse India’s recent macroeconomic trends
- b) Identify key indicators affecting households, firms, and government decisions

Module: 2 National Income Accounting and Analysis (12 Hours)

Concepts and calculation of National Income - GDP, GNP, GDP per capita, Nominal vs. Real GDP, Limitations of GDP, Sustainable Development- Concept and Sustainable Development Goals (SDGs), Happiness Index.

Analytical Focus:

- a) Analyse sectoral contributions to India's GDP
- b) Compare real vs nominal GDP trends over time
- c) Compare sectoral contributions of Indian GDP with USA and China.

Module: 3 Macroeconomic Analysis of an Open Economy with Government Intervention (12 Hours)

Equilibrium national income in open economy, Inflation and Unemployment in an open economy, Fiscal policy: government expenditure, taxes and subsidies, Government budget deficits and their macroeconomic implications- consumption, investment, employment and inflation, Foreign Trade and Balance of Payment - Net exports, trade balance, and their effect on national income, Exchange rate determination and its impact on exports, imports, and GDP, Multiplier effect in an open economy.

Analytical Focus:

- a) Evaluate how fiscal policy influence income, consumption, and investment.
- b) See how exports, imports, and exchange rate changes influence GDP.
- c) Analyse trends in the Indian rupee against major currencies using real-time data.

Module: 4 Money, Banking, and Monetary Policy Analysis (11 Hours)

Money and Monetary aggregates – M0, M1, M2 and M3, Functions and types of money (commodity, fiat, digital), Demand for Money and Liquidity Preference- Transactions, precautionary, and speculative demand, Interest rate determination and money market equilibrium, Role of commercial banks in credit creation, Reserve requirements and their impact, Inflation & Monetary Policy: Concepts and Tools, Contemporary Issues in Money and Banking - Digital currencies and crypto-assets, Financial inclusion and fintech in India.

Analytical Focus:

- a) How monetary policy tools have been used over time to manage liquidity and stabilize the economy in India?
- b) Analyse credit growth trends of commercial banks in India.
- c) Analyse the growth trends of bitcoin price.

Suggested Readings:

1. Mankiw, N. G., & Taylor, M. P. (2014), *Macroeconomics*, European Edition, Chapters 1–5, published by Macmillan Learning, ISBN 978-1464141775.
2. Abel, A., Bernanke, B., & Croushore, D. (2014), *Macroeconomics*, 8th Edition, Chapters 1–2 and 5, published by Pearson Education, ISBN 978-9332518247.
3. Fischer, S., & Startz, R. (2018), *Macroeconomics*, 13th Edition, Chapter 9, published by McGraw-Hill Education, ISBN 978-1259290633.
4. Vanita Agarwal, *Macroeconomics: Theory and Policy*, published by- Pearson Education India, 2010, ISBN 978-8131731499.
5. Mihir Rakshit, *Macroeconomics of Post-Reform India*, published by- Oxford University Press India, 2010, ISBN 978-0198070092.
6. D. M. Mithani, *Macro Economics*, published by - Himalaya Publishing House, 2000

Mapping of COs to Syllabus

Course Outcome	Module I	Module II	Module III	Module IV
CO1	H	L	L	L
CO2	H	M	M	M
CO3	M	H	H	H
CO4	L	H	H	H
CO5	L	M	M	M

Introduction to Data analytics using Python-II (Skill Enhancement)

3 Credit -45 Hours (L-2-T0-P-1]

Course Objectives:

1. To handle advanced data manipulation tasks using Pandas and NumPy, including missing value treatment and time series operations.
2. To visualize and communicate data effectively using Matplotlib, Seaborn, and Plotly for static and interactive visualizations.
3. To apply descriptive and inferential statistical techniques for data analysis and hypothesis testing.
4. To introduce machine learning concepts and implement basic supervised and unsupervised learning algorithms.
5. To integrate data cleaning, analysis, visualization, and modeling for practical business insights.

Course Outcomes (CO):

1. CO2: Understand data cleaning, merging, and aggregation operations using Pandas and NumPy. (Applying)
2. CO5: Construct visualizations to analyze and present data trends using advanced plotting libraries. (Creating)
3. CO4: Analyze datasets using descriptive statistics, distributions, and hypothesis testing. (Analyzing)
4. CO3 Apply statistical significance using t-tests, chi-square tests, ANOVA, and correlation analysis. (Applying)
5. CO2: Differentiate between supervised and unsupervised learning models and their applications. (Understanding)

Module 1: Advanced Data Manipulation with Pandas and NumPy [7 Hours] [7 Hours lab]

Topics: Handling missing data and data imputation techniques, Merging, joining, and concatenating datasets, Group operations, aggregation, and pivot tables, Time series analysis basics using Pandas datetime

Lab Components: Load and clean messy datasets using `isnull()`, `fillna()`, `dropna()`, Merge multiple DataFrames with `merge()`, `concat()`, and `join()`, Group sales data by category/date and compute aggregates and Create and analyze time-indexed data (e.g., stock prices, weather data)

Module 2: Data Visualization Techniques [8 Hours] [8 Hours Lab]

Topics: Advanced plotting with Matplotlib and Seaborn, Interactive visualizations using Plotly, Creating basic dashboards using Plotly/Dash (intro level) and best practices in data storytelling and chart selection

Lab Components: Create bar, line, histogram, and heatmap visualizations, build interactive charts (hoverable, zoomable) with Plotly Express, compare chart styles and explain design choices

Mini project: Create a dashboard showing key metrics from a dataset

Module 3: Statistical Analysis and Hypothesis Testing [7 Hours] [7 Hours Lab]

Topics: Descriptive statistics (mean, median, std dev) and visual summaries, Probability distributions (normal, binomial, Poisson), Hypothesis testing (one-sample and two-sample t-tests, chi-square test) and ANOVA and correlation analysis (Pearson/Spearman)

Lab Components: Analyze a dataset using `.describe()` and visual tools (boxplots, histograms), Simulate distributions using `numpy.random` and plot them, Perform t-tests and chi-square tests using `scipy.stats`, Calculate correlation matrices and visualize them with heatmaps

- Case study: Conduct hypothesis testing on survey data

Module 4: Introduction to Machine Learning [8 Hours] [8 Hours Lab]

Topics: Supervised vs. Unsupervised learning overview, Regression analysis: Linear and Logistic, Classification: k-NN, Decision Trees, Clustering: k-Means, Hierarchical

Lab Components: Train a linear regression model on business/sales dataset (using scikit-learn), Apply logistic regression to predict binary outcomes (e.g., customer churn), Implement and evaluate a k-NN classifier on a labeled dataset, Perform clustering on customer data and visualize clusters

Final mini-project: End-to-end ML model (data cleaning, training, evaluation)

Suggested Readings:

1. Machine Learning Using Python by Manaranjan Pradhan and U. Dinesh Kumar is currently available in its first edition, published in 2019 by Wiley India.
2. Introduction to Machine Learning by Ethem Alpaydin is available in its fourth edition, published in 2020 by The MIT Press.
3. Machine Learning by Tom M. Mitchell remains in its original first edition, published in 1997 by McGraw-Hill Education.
4. Pattern Recognition and Machine Learning by Christopher M. Bishop is also still in its first edition, published in 2006 by Springer.
5. Machine Learning: A Probabilistic Perspective by Kevin P. Murphy has not had a new edition since its first release in 2012, but a follow-up titled Probabilistic Machine Learning: An Introduction was published in 2022 by The MIT Press.

Mapping of Cos

	M1	M2	M3	M4
CO1	M	L	L	L
CO2	H	H	M	H

(Course Code – HSCE221T) COMMUNICATIVE ENGLISH I [BCom/BBA/BCA/IMBA/IMCA – 3RD SEMESTER] AECE200T

(2 Credits – 30 hours)

Objective: The objective of this course is to equip the learners with the basic skills of effective communication in English language in all real life contexts, with a reasonable fluency and clarity. The course is intensely practice oriented and it specifically attempts to:

- Familiarize the students with the basic tools of oral communication.
- Teach the students to use grammar in meaningful contexts.
- To enable the students to communicate in English confidently.
- Develop negotiation and presentation skills

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: Classify the rules of Grammar & Phonetics for effective communication (Analyse)

CO2: Identify the key negotiation and presentation skills (Apply)

CO3: Develop critical appreciation of a literary text (Create)

Module I: Fundamentals of Communication: [ND] (5 hours)

Definition, types and process of communication; elements and flows of communication; barriers to communication and strategies to overcome them; interpersonal communication; importance of listening skills; non-verbal communication/ body language

Module II: Essential grammar of English: An Introduction [ND] (5 hours)

Parts of speech; Basic sentence structures; Articles; Prepositions; Person and number; Tenses and their uses; Subject –verb agreement; Vocabulary building; Common idioms and phrases

Module III: Basic tools of oral communication in English [ND] (5 hours)

- a) Syllables, stress –pattern and intonation
- b) Consonants, vowels and diphthongs
- c) Differences between spoken and written English

Module IV: Functional English: Structural Conversation Practice [SS] (5 hours)

Telephonic conversation; Agreement, disagreement; Hypothetical conditions, Interjection, exclamation, emotion emphasis; Expressions of hope, disappointment, surprise, concern, worry; Willingness, wish, intention; Commands, requests, advice, promise, threat; Greetings, small talk, congratulations, condolences, offers, invitations

Module V: Select Literary Texts: Reading and cComprehension (5 hours)

1. "The Gift of the Magi" - O Henry [SS]
2. "Night of the Scorpion" – Nissim Ezekiel [SS]
3. "The Road Not Taken" – Robert Frost [ND]
4. "The Lake Isle of Innisfree" – William Butler Yeats [ND]
5. "The Doll's House" – Katherine Mansfield [SS]

Module VI: Negotiation and Presentation Skills [SS] (5 hours)

Negotiation techniques, collaborative vs. competitive negotiation, persuasive communication strategies, communication skills for resolving conflicts; public speaking skills, overcoming stage fright, structuring and delivering impactful speeches, presentation skills – designing professional slides using tools like PowerPoint, visual aids –charts, graphs and images; techniques to express effectively in group discussions, how to face an interview – tips and strategies

Suggested Readings:

1. Leech, Geoffrey and Jan Svartvik, *A Communicative Grammar of English*, Third edition, Pearson Education, 2002.
2. Sasikumar,V and Dhamija, P.V, *Spoken English*, Tata McGraw Hill, New Delhi.
3. Taylor, Grant, *English Conversation Practice*, Tata McGraw Hill, 1975.
4. Dixon, Robert J., *Everyday Dialogues in English*, Prentice Hall India, 2006.
5. Apte, Madhabi, *A Course in English Communication*, Prentice Hall India, 2007.
6. Seely, John, *The Oxford Guide to Writing and Speaking*, Oxford.
7. Plathottam, George, *Public Speaking: Resource Book for Effective Communication*, Don Bosco Publications, Guwahati, 2007.
8. An Anthology of Short Stories, prepared by Department of Humanities and Social Sciences, Assam Don Bosco University, for private circulation, 2014.

Mapping of COs to Modules

COs	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	M	H	L	H	H	M
CO2	H	M	M	M	M	H
CO3	M	M	L	M	H	H

Human Resource Management Theory & Application**(5 Credit-75 Hours) (L-T-P: 5-0-0)****Objectives:**

- To provide students with a strong understanding of the concepts, functions, and evolving role of Human Resource Management in modern organizations..
- To develop student competence in key HR practices, including recruitment, selection, training, performance management, compensation, and HR policy implementation.
- To introduce students to basic HR analytics, HRIS, and data-supported decision-making in recruitment, training, and performance evaluation.
- To familiarise students with emerging trends in HRM, such as diversity and inclusion, hybrid work models, people analytics, globalization, and evidence-based HR practices.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Remembering of different terms associated with HRM. (Remembering)

CO 2: Understanding about HR policies, diversity initiatives, and HRIS/HR analytics . (Understanding)

CO 3: Applying basic HR techniques, including designing recruitment processes, preparing job descriptions, evaluating training needs, and using simple performance appraisal methods. (Application)

CO 4: Analysing HR problems and emerging trends, such as globalization, hybrid work, people analytics, stress monitoring, and evidence-based HR interventions. (Analysing)

CO5: Evaluating HR practices through mini-projects, simulations, and case studies, including recruitment exercises, appraisal system analysis, and intervention monitoring (Evaluating)

Module I: Introduction to HRM (15 Hours)

Concept and scope of HRM, Evolution and growth of HRM in India, Significance, Functions and challenges of HRM; status and qualities of HR Managers; objectives of Human Resource policies; Personnel Management vs. HRM; HRM vs. HRD; HR Planning and forecasting; Kaizen, Total Quality Management (TQM), and Six Sigma in HR; introduction to HR Analytics and its relevance in modern HRM; HR Metrics and HR Analytics: concept, purpose, and applications; HR Information Systems; Intuition vs. analytical thinking in HR decision-making.

Mini-project: Students analyse HR policies and HRIS features of two organizations (one traditional, one digital) and compare how data is used in HR decision-making.

Module II: Recruitment, Selection and Workforce Diversity (15 Hours)

Concept of recruitment, process of recruitment, sources of recruitment, Advantages and disadvantages of internal and external sources; selection procedure, difference between selection and recruitment, Types of tests and interviews, Job Analysis: job description and job specification; Job Evaluation; Workforce segmentation and identification of critical job roles; Understanding equality, diversity, and inclusion (EDI).

Activity: Conduct a mock recruitment and selection exercise using a structured interview and evaluation rubric.

Module III: Training, Development & Performance Improvement (15 Hours)

Concept and Importance; Identifying Training and Development Needs; Training vs. Development; Designing Training Programmes; Role-Specific and Competency-Based Training; Evaluating Training Effectiveness; training requirements analysis; predicting employee performance for training needs; Management Development and Career Development; Training Process Outsourcing.

Hands-on Task: Students design a training module for a specific job role and create an evaluation plan for its effectiveness.

Module IV: Performance Management and Compensation (15 Hours)

Nature, objectives and importance; Modern techniques of performance appraisal; potential appraisal and employee counselling; job changes - transfers and promotions; Compensation: concept and policies; Predicting employee performance and turnover (basic HR analytics concepts); Using performance data for decision-making; introduction to mediation, moderation and interaction effects in HR interventions

Case Study: Analyse an organisation's performance appraisal system and recommend improvements.

Module V: Emerging Horizons in HRM & HR Applications (15 hours)

Impact of Globalization on HRM, Future trends of HRM (Hybrid Work Model, Human Leadership, People Analytics, transition from Employee Well-being to Healthy Organization), concept and types of virtual organization; Learning organisations; Distinction between Domestic and International HRM, Repatriation issues; Workforce diversity, Downsizing, Exit Interview; VRS; Human Resource Information System; Monitoring impact of HR interventions: stress evaluation, value change, evidence-based HR.

Simulation: Students analyse a dataset/sample case to monitor the impact of an HR intervention (e.g., training, wellness programme, diversity initiative).

Suggested Reading:

1. Armstrong, Michael, Human resource management & Practice, 10th Edition.
2. Graham, Ryan, Strategic Human Resource Management, Pearson Education.
3. C. B. Gupta, Human Resource Management, S Chand & Sons.
4. S.S. Khanka, Human Resource Management.
5. Edwards MartinR, Edwards Kirsten(2016), "Predictive HR Analytics: Mastering the HR Metric", Kogan Page Publishers.
6. Fitz-enz Jac (2010), "The new HR analytics: predicting the economic value of your company's human capital investments".

Mapping of Course Outcomes

Course Outcomes	MI	MII	MIII	MIV	MV
CO1	H	M	M	L	L
CO2	H	H	M	M	H
CO3	M	H	H	H	M
CO4	M	M	L	H	H
CO5	M	M	M	H	H

Course Code: Advanced Accounting
(5 Credits- 75 hours) (L-T-P: 4-1-0)

Objectives:

- To provide learners with an in-depth understanding of advanced corporate accounting practices and statutory reporting requirements.
- To develop proficiency in handling complex accounting procedures, including buyback, internal reconstruction, amalgamation, and consolidation.
- To equip students with the ability to interpret, prepare and analyse corporate financial statements in compliance with Ind AS.

Course /Learning Outcomes

At the end of this course, students will be able to:

CO 1: Recall and outline the statutory provisions, formats, and key concepts related to corporate financial statements, buyback, internal reconstruction, amalgamation, and consolidation as per the Companies Act and Ind AS.

CO 2: Explain the principles, procedures, and accounting treatments involved in cash flow statements, share buyback, internal reconstruction, amalgamation, and sustainable reporting frameworks.

CO 3: Apply relevant Ind AS standards to prepare cash flow statements, record journal entries for buyback and reconstruction, compute amalgamation consideration, and prepare consolidated financial statements.

CO 4: Analyse financial restructuring situations, evaluate the effects of capital reorganisation, compare merger vs purchase methods, and interpret financial statements using advanced corporate accounting techniques.

CO 5: Develop comprehensive corporate financial reports by integrating advanced accounting treatments across reconstruction, amalgamation, and consolidation, while incorporating sustainable and ethical reporting components.

Module I: Preparation and Presentation of Financial Statements (20 Hours)

- Financial Statements- As Per Schedule III of Companies Act, 2013;
- Cash Flow Statement as per Ind AS 7

Module 2: Buyback of Securities and Internal Reconstruction (15 Hours)

- Buy back of shares: Legal Position, Conditions, sources of funds and duties after buy back of shares; Accounting Treatment.
- Internal Reconstruction: Situations, Different forms, Alteration & Reduction of Share Capital, Reorganisation through surrender of shares, Accounting Treatment.

Module 3: Amalgamation of Companies (15 Hours)

Provisions as per Companies Act and Ind AS, Amalgamation in the nature of Merger and Purchase, Consideration for Amalgamation, Accounting Treatment and Preparation of Balance Sheet after Amalgamation.

Module 4: Consolidated Financial Statements (15 Hours)

Preparation of Consolidated Financial Statements as per Ind AS 110.

Module 5: Sustainable and Ethical Reporting: (10 Hours)

Human Resource Accounting; Natural Resource Accounting; Carbon Credits; Triple Bottom Line Approach; Environmental, Social, Governance (ESG).

Suggested Readings:

- Advanced Accountancy, R.L. Gupta & M. Radhaswamy, Sultan Chand & Sons
- Corporate Accounting, S.N. Maheshwari & S.K. Maheshwari, Vikas Publishing House
- Modern Accountancy – Volume II, A. Mukherjee & M. Hanif, Tata McGraw Hill Education (TMH)
- Advanced Accounts, M.C. Shukla & T.S. Grewal, S. Chand Publishing.
- Corporate Accounting, P.C. Tulsian & Bharat Tulsian, Pearson

Mapping of COs to Syllabus

CO's	M 1	M 2	M 3	M 4	M 5
CO 1	H				H
CO 2	H			H	H
CO 3	H			H	

CO 4			H		H
CO 5	H				H

Data Visualisation and Communication using Tableau (Major)

4 credits: 75 Hours (L-3-T-0-P-1)

Course Objective:

1. To clean, organize, and prepare data for visual analysis.
2. To design effective charts, dashboards, and interactive visualizations in Tableau.
3. To apply storytelling and design best practices for communicating insights.
4. To use Tableau's advanced features (calculations, maps, interactivity) to analyze complex datasets.

Course Outcome:

CO1: Recall key concepts of data visualization, Tableau interface elements, chart types, and data ethics principles. (Remembering)

CO2: Explain the importance of visual design principles, dashboard components, and storytelling techniques in business analytics. (Understanding)

CO3: Organize and prepare raw datasets for visual analysis using Tableau's data cleaning and transformation features. (Applying)

CO3: Apply interactive tools like filters, actions, and parameters to enhance the analytical value of dashboards. (Applying)

CO5: Construct effective visualizations (e.g., bar, line, pie, dual-axis) and design dashboards using Tableau best practices. (Creating)

Module 1: Foundations of Data Visualization and Tableau [10 Hours] [7 Hours Lab]

Topics: Importance of data visualization in analytics, Overview of Tableau: interface, file types, connecting to data, Data types, fields, hierarchies, and metadata, Cleaning and preparing data in Tableau, Building basic charts: bar, line, pie, stacked charts, Design principles: color, labels, clarity, chart selection

Lab Activities: Load sample datasets and build basic visuals, Explore Tableau interface and worksheet setup, Practice cleaning and renaming fields, Create bar and line charts with tooltips and formatting

Module 2: Interactive Dashboards and Filters [12 Hours] [8 hours Lab]

Topics: Designing dashboards: layout, containers, spacing, Adding interactivity: filters, actions (highlight, filter, URL), Using parameters to control views, Key Performance Indicator visualizations (e.g., bullet charts, indicators)

- Story points: sequencing views for storytelling

Lab Activities: Design a dashboard with 2–3 visualizations, Add interactive filters and highlight actions, Use parameters to change metrics or categories and Build a story point presentation on a case dataset

Module 3: Advanced Charts, Calculations, and Maps [11 Hours] [7 Hours Lab]

Topics: Dual-axis charts, combined graphs, Calculated fields and table calculations, Level of Detail (LOD) expressions, Using dates and time series analysis, Creating and customizing maps (symbol, filled), Geospatial analysis with coordinates and layers

Lab Activities: Create charts with multiple measures (e.g., sales vs. profit), Write calculated fields (e.g., profit ratio, ranking), Build a geographic map with tooltips and filters and Analyze time series trends (e.g., sales over months)

Module 4: Communication, Ethics, and Capstone Project [12 Hours] [8 hours Lab]

Topics: Principles of effective data storytelling, Choosing the right chart for the right audience, Data ethics, privacy, and misrepresentation risks, Capstone project development: data selection, goals, user needs, Presenting dashboards with narrative context

Lab Activities: Evaluate and critique poorly designed dashboards, Develop a dashboard using a real-world dataset, Prepare a written or video explanation of your insights and Present your capstone project to the class or instructor panel

Mapping of COs

	M1	M2	M3	M4
CO1	H	L	L	L
CO2	H	L	L	H
CO3	L	M	H	M
CO5	L	H	M	M

Suggested readings:

Learning Tableau 2020: Create Effective Data Visualizations, Build Interactive Visual Analytics, and Transform Your Organization by Joshua N. Milligan is the 4th edition, published in 2020 by Packt Publishing Ltd.

Communicating Data with Tableau: Designing, Developing, and Delivering Data Visualizations by Ben Jones was published in 2014 by O'Reilly Media, Inc.

Visual Analytics with Tableau by Alexander Loth was published in 2019 by John Wiley & Sons, Inc.

LEGAL ASPECTS IN BUSINESS

4 Credit- 60 Hours (L+T+P: 3+0+1)

OBJECTIVE:

The objective of this course is to equip learners with a strong understanding of major business laws and to develop their ability to apply, analyse, and evaluate legal principles for effective decision-making in business, taxation, consumer protection, cyber law, and intellectual property rights.

COURSE/LEARNING OUTCOMES (COs)

CO 1: Explain key concepts, principles, and provisions under major business laws such as Contract Act, Sale of Goods Act, Negotiable Instruments Act, Company Law, Industrial Laws, Tax Laws, Consumer Protection, Cyber Law, and IPR.

CO 2: Apply legal rules and statutory provisions to business scenarios involving contracts, agency, sale of goods, negotiable instruments, and company operations.

CO3: Analyze legal issues related to commercial transactions, corporate governance, industrial relations, taxation, and consumer disputes to identify rights, liabilities, and compliance requirements.

CO 4: Evaluate corporate practices, tax structures, unfair trade practices, and cyber-related risks using relevant legal frameworks and judicial interpretations.

CO 5: Develop legally compliant solutions, documentation, and strategies in areas such as GST computation, corporate decision-making, cyber law enforcement, and intellectual property protection.

MODULE I - COMMERCIAL LAW

(15 hours)

THE INDIAN CONTRACT ACT 1872: Definition of contract, essentials elements and types of a contract, Formation of a contract, performance of contracts, breach of contract and its remedies, Quasi contracts - Contract Of Agency: Nature of agency, Creation and types of agents, Authority and liability of Agent and principal: Rights and duties of principal and agents, termination of agency.

THE SALE OF GOODS ACT 1930: Nature of Sales contract, Documents of title, risk of loss, Guarantees and Warranties, performance of sales contracts, conditional sales and rights of an unpaid seller.

Negotiable Instruments Act 1881: Nature and requisites of negotiable instruments. Types of negotiable instruments, liability of parties, holder in due course, special rules for Cheque and drafts, discharge of negotiable instruments.

MODULE II - COMPANY LAW AND COMPETITION ACT

(12 hours)

COMPANY ACT 1956&2013: Major principles – Nature and types of companies, Formation, Memorandum and Articles of Association, Prospectus, Power, duties and liabilities of Directors, winding up of companies, Corporate Governance.

Competition Act 2002: Introduction, Definitions, Enquiry into Certain Agreements and Dominant Position of Enterprise and Combinations.

MODULE III - INDUSTRIAL LAW**(10 hours)**

An Overview of Factories Act - Payment of Wages Act - Payment of Bonus Act - Industrial Disputes Act

MODULE IV - CORPORATE TAX & GST**(10 hours)**

Corporate Tax Planning, Corporate Taxes and Overview of Latest Developments in Indirect tax Laws relating to GST: An introduction including constitutional aspects, Levy and collection of CGST & IGST, Basic concept of time and value of supply, Input tax credit, Computation of GST Liability, Registration, Tax Invoice, credit & Debit Notes, Electronic Way bill, Returns, Payment of taxes including Reverse Charge.

MODULE V - CONSUMER PROTECTION ACT AND INTRODUCTION OF CYBER LAWS**(13 hours)**

Consumer Protection Act – Consumer rights, Procedures for Consumer grievances Redressal, Types of consumer Redressal Machineries and Forums-- Cybercrimes, IT Act 2000 and 2002, Cyber Laws,

Introduction of IPR Intellectual Property Laws-Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement.– Copy rights, Trade marks, Patent Act. Introduction, Right to Information Act, 2005.

REFERENCES:

1. N. D. Kapoor, Elements of mercantile Law, Sultan Chand and Company, India, 2017.
2. P. K. Goel, Business Law for Managers, Biztantatara Publishers, India, 2017.
3. Akhileshwar Pathack, Legal Aspects of Business, 4th Edition, Tata McGraw Hill, 2018.
4. Kumar, Ravinder (2016). Legal Aspects of Business, 4/e; New Delhi: Cengage Learning
5. Text Book of Indirect Tax – Sinha P.K Dr. Vinod Singhania, Taxman Publication, New Delhi
6. GST Manual with GST Law Guide & GST Practice Referencer (Set of 2 Volumes) (10th Edition, October 2018) Paperback – 2018 by Taxmann (Author)
7. P. P. S. Gogna, Mercantile Law, S. Chand & Co. Ltd., India, Fourth Edition, 2010.
8. Dr. Vinod, K. Singhania, Direct Taxes Planning and Management, 2008.
9. Richard Stim, Intellectual Property- Copy Rights, Trade Marks, and Patents, Cengage Learning, 2008.
10. Daniel Albuquerque, Legal Aspect of Business, Oxford, 2012
11. Ravinder Kumar– Legal Aspect of Business.– Cengage Learning, 2nd Edition- 2011.
12. GST Ready Reckoner-As amended by CGST (Amdt.) Act 2018/IGST (Amdt.) Act 2018/UT-GST (Amdt.) Act 2018/GST (Compensation to States) Amdt. Act 2018

Mapping of Cos to syllabus

Course Outcome	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	H	M	H		
CO 3			M	H	
CO 4				H	
CO 5					M

(Course Code – HSCE222T) COMMUNICATIVE ENGLISH II [BCom/BBA/BCA/i-MBA/i-MCA – 4th Semester] AECE201T

(2 Credits – 30 hours)

The objective of this course is to:

- To develop an awareness in the students about writing as an exact and formal skill
- To equip them with the components of different forms of writing
- To enable the students to familiarize with the emerging trends in business communication
- To develop strategies for effective cross-cultural collaborations

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: Utilize the different formats of business and digital communication **(Apply)**

CO2: Examine the different strategies of cross-cultural communication (**Analyze**)

CO3: Develop reading comprehension skills of students (**Create**)

Module I: Digital and Technological Communication [SS] (6 hours)

Leadership communication- building trust and credibility through communication; crisis communication- handling media and public relations during crisis; emerging trends in business communication – different digital communication platforms; leveraging AI in communication; social media management and professionalism

Module II: Business Letters [ND] (4 hours)

- a) Introduction—layout, structure, categories of business letter
- b) Rules of good writing
- c) Recruitment correspondence—application, CV, interview, offer, acceptance, etc.
- d) Technical report writing

Module III: Telecommunication [SS] (3 hours)

- a) Fax and email
- b) Internet, intranet, extranet

Module IV: Internal communication [ND] (3 hours)

- a) Memos - structure, tone; b) Reports - formal, informal; c) Proposals; d) Meetings, minutes, agenda

Module V: Persuasive communication [ND] (3 hours)

- a) Circulars, sales letters
- b) Publicity materials - Public relations, news release, newsletters
- c) Notice, advertisements, leaflets

Module VI: Global and Cross-Cultural Communication [SS] (6 hours)

Cultural Sensitivity and Adaptability; understanding cultural differences in communication styles; strategies for effective cross-cultural collaboration; Global business etiquette; cross-cultural negotiations; multilingual and multimodal communication; leveraging translation tools for global communication; effective use of digital communication platforms for diverse audiences

Module VII: Select Literary Texts: Reading and cComprehension (5 hours)

1. "Haflong Hills" - Kallol Choudhury [ND]
- 2) "The Solitary Reaper" – William Wordsworth [SS]
3. "Fire and Ice" – Robert Frost [ND]
4. "Death, Be Not Proud" – John Donne [ND]
5. "Cat in the Rain" – Ernest Hemingway [SS]

Suggested Readings:

1. Taylor Shirely, *Communication for Business: A Practical Approach*, Fourth edition, Pearson Education, 2005.
2. Rutherford, Andrea J., *Basic Communication Skills for Technology*, Pearson Education, 2001.
3. Mitra, Barun K, *Effective Technical Communication*, OUP, 2006.
4. Sen, Leena, *Communication Skills*, Prentice Hall India, 2007.
5. Brian, M.H. Robinson, et al, *Communicative Competence in Business English*, Orient Longman, 1988.
6. Kaul, Asha, *Effective Technical Communication*, Prentice Hall, 2006.
7. *The Oxford Anthology of Writings from North -East India* (Fiction) edited by Tilottoma Misra, OUP, 2011.

Mapping of COs to Modules

COs	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5	Mod 6	Mod 7
CO1	H	H	H	H	H	M	M
CO2	M	L	L	L	L	H	H
CO3	H	M	M	M	M	H	H

International Business (5 Credit-75 Hours) (L-T-P: 5-0-0)

Objectives:

- To introduce students to the fundamental concepts, scope, and environment of international business, including globalization, culture, trade theories, and foreign trade structure.
- To develop understanding of global financial markets, exchange rate dynamics, and economic integration, with basic analytical interpretation using simple datasets.
- To familiarise students with the global business environment, including international laws, risks, multinational corporations, and foreign direct investment.
- To enable students to understand international finance mechanisms, global financial institutions, and export–import financing.
- To build awareness of ethical issues and governance practices in international business, including global standards on ethics, sustainability, and responsible cross-border operations.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO 1: Remembering the basic concepts related to international business, globalization, trade theories, and foreign trade structure. (*Remembering*)

CO 2: Understanding the functioning of global financial markets, exchange rate systems, international laws, and global business environment. (*Understanding*)

CO 3: Applying trade concepts, export–import procedures, foreign market entry strategies, and simple data analysis to international business decisions. (*Application*)

CO 4: Analysing global business risks, multinational operations, financial integration, and ethical challenges in international business. (*Analysing*)

CO 5: Evaluating ethical dilemmas, governance practices, and strategic choices of firms operating in international markets. (*Evaluating*)

Module I: Introduction to Global Business (15 hours)

International Business: Meaning and scope; role of globalization and digital linkages; Culture Factors and Global Business: Elements of culture, Training Challenge; Global Trade Theories: Mercantilism, Classical Trade Theory, Factor Proportion Theory, International Trade and Product cycle theory; Structure of Indian Foreign Trade: Composition & direction; EXIM Bank; Policy supporting foreign trade; Export–Import procedures; Government initiatives promoting Indian foreign trade.

Activity: Pick one country and prepare a short report on its culture, trade policies, and major export–import trends and present how these factors influence business entry strategies.

Module II: Global Financial Markets (15 hours)

Foreign exchange markets; Exchange rate movements; Exchange rates: Fixed and Floating Foreign exchange rates; Impact of exchange rates on business decisions; Economic integration: EU, ASEAN, SAARC; Government Trade Policies, Introduction to using data (simple datasets/graphs) to study exchange rates, inflation, and interest trends.

Activity: Track the exchange rate of INR versus USD/EUR for one week and create a small chart showing fluctuations and explain how these changes affect import/export businesses.

Module III: Global Business Environment (15 hours)

International Business Environment; Private International Law; Public International Law; Risk to Global Business; Theoretical foundations of International Business; Balance of Payments; International Liquidity and Reserves; International Economic; Accounting and Tax differences; Multinational Corporations; Foreign Direct Investment.

Activity: Examine a current global business event (e.g., a trade war, a regulatory change) and identify legal, economic, and political risks faced by multinational companies.

Module IV: International Finance (15 hours)

Financing exports and imports; International Capital and Cash Management; International Capital Structure; Global Capital Markets: Eurocurrency Markets, Global Bonds and Equity; International Banking and Security Markets; Major global institutions in business IMF; World Bank; IFC; ITA; ADB; WTO.

Activity: Role-play as exporters/importers and choose appropriate financing options (e.g., letter of credit, advance payment). They justify why that method is suitable based on case details.

Module V: Ethics and Governance in International Business (15 hours)

Business Ethics: Meaning and importance in international business; Corporate Governance: Concepts and Principles; Role of Board of Directors and stakeholders; Ethical Challenges in International Operations; Bribery and corruption, Unfair labour practices, Environmental concerns in global operations, Data privacy and cross-border data protection, Role of Analytics in Ethics & Governance.

Activity: Evaluate a short ethical case (e.g., bribery risk or data privacy issue faced by an MNC) and decide the best ethical response. They provide recommendations based on global governance standards.

Suggested Readings:

1. Rakesh Mohan Joshi: International Business, Oxford University Press.
2. FRANCIS CHERUNILAM: International Business: Text and Cases, PHI Learning.
3. Charles W. L. Hill – International Business: Competing in the Global Marketplace (McGraw-Hill).
4. Justin Paul – International Business.

Mapping of Course Outcomes

Course Outcomes	MI	MII	MIII	MIV	MV
CO1	H	M	M	L	L
CO2	H	H	M	M	H
CO3	M	H	H	H	M
CO4	M	M	L	H	H
CO5	M	M	M	H	H

Financial Analytics

5 Credit: 90 Hours (L-4-T-0-P-1)

Course Objectives:

- To Understand core financial concepts, statements, and decision-making tools.
- To Apply financial analytics models for project evaluation, firm valuation, and market forecasting.
- To Develop predictive models for credit risk and financial derivatives.
- To Explore the role of fintech innovations such as blockchain and cryptocurrency in modern finance.
- To Enhance decision-making with hands-on exercises using Excel, R, and Python.

Course Outcomes

CO2 Understand financial concepts and fintech applications in finance.

CO3 Build financial models for project appraisal and firm valuation.

CO3 Forecast financial markets using time-series models.

CO4 Analyse Price and hedge derivatives using quantitative techniques.

CO5 Interpret financial statements and detect patterns using analytics.

CO5 Perform credit risk assessment and digital lending analytics.

Module 1: Foundations of Financial Analytics and Fintech [12 Hours] [6 Hours Lab]

Topics: Introduction to Financial Analytics, Financial Statements: Balance Sheet, Income Statement, Cash Flow Statement, Ratio Analysis and Pattern Detection, Altman's Z-Score for Bankruptcy Prediction, Evolution of Fintech and Regulatory & Ethical Issues in Fintech

Analytics: Excel-based Ratio Analysis, Trend Charts, Logistic Regression for Bankruptcy Prediction in R and Python.

Module 2: Project Evaluation, Valuation, and Risk-Return Analytics [12 Hours] [6 Hours Lab]

Topics: Time Value of Money (FV, PV, Annuity, Perpetuity), NPV, IRR, Payback Period, Discounted Payback Period, Firm Valuation: DCF, Dividend Discount Model, CAPM, Beta, WACC, Relative Valuation (P/E, EV/EBITDA, Discounted Free Cash Flow)

Analytcs: Project Feasibility Model in Excel, Risk-Return Scatter Plot, CAPM Estimation, Valuation Dashboards in Excel

Module 3: Financial Market Forecasting and Derivatives Analytics [12 Hours] [6 Hours Lab]

Topics: Introduction to Time-Series Analytics, AR, MA, AIRMA, GARCH, EGARCH Models, Option Pricing Models: Black-Scholes, Binomial, Futures and Forwards Pricing, Hedging Strategies, Option Greeks and strategies

Analytcs: Time-Series Forecasting in R/Python, Option Payoff and Pricing Models in Excel and Hedging Simulation Exercises

Module 4: Credit Risk Analytics and Digital Lending Models [12 Hours] [6 Hours Lab]

Topics: Credit Risk Concepts: Credit Scoring, Probability of Default, Credit VaR Estimation Techniques, Digital Lending: P2P Lending, Marketplace Lending Business Models, Credit Risk in Digital Lending

Analytcs: Credit Scoring Model using Logistic Regression (R), VaR Simulation in Excel

Module 5: Blockchain, Digital Currency, and Cryptocurrency Analytics [12 Hours] [6 Hours Lab]

Topics: Blockchain Technology Basics and Applications in Finance, Crypto Primitives and Smart Contracts, Bitcoin and Cryptocurrency Portfolio Analysis, Risks and Returns in Crypto Markets, Blockchain-Based Financial Innovations

Analytcs: Cryptocurrency Portfolio Risk-Return Calculation in Excel, Blockchain Use Case Evaluation and Cryptocurrency Risk Analysis

Suggested Readings:

Graham, B. (2006). *The intelligent investor* (Rev. ed., with commentary by J. Zweig). Harper-Business. (Original work published 1949)

Financial Intelligence, Revised Edition: A Manager's Guide to Knowing What the Numbers Really Mean (Harvard Business Review Press, Feb 19, 2013) by Karen Berman and Joseph Knight

Financial Statement Analysis and Security Valuation by [Stephen H. Penman](#), McGraw-Hill Companies, Incorporated, 2007

Mohanty, Pitabas. *Financial Analytics*. New Delhi: Wiley India, 2023. ISBN: 9789354644177. Print.

Mapping of Cos

	M1	M2	M3	M4	M5
CO2	H	M	M	M	H
CO3	M	H	M	M	L
CO4	M	H	H	H	H
CO5	L	L	H	H	L

Course Code: Course Name: Mathematics II

(4 Credits- 60hours) (L-T-P: 4-0-0)

Objective: The objectives of the course are-

- Understand foundational mathematical and statistical tools relevant to business and analytics
- Apply descriptive and analytical mathematical techniques for summarizing and interpreting business data
- Use mathematical models such as ratios, inequalities, logarithms and sequences for analytical decision-making
- Develop the ability to formulate and solve linear programming problems for optimization in business
- Evaluate business decisions using probability-based models and risk analysis

Course /Learning Outcomes

At the end of this course students will be able to:

- CO 1: Demonstrate basic knowledge of essential business mathematics.
 CO 2: Explain mathematical concepts useful in business analytics
 CO 3: Apply mathematical tools to solve business and analytical problems.
 CO 4: Analyze business situations using linear programming and inequalities
 CO 5: Evaluate business decisions using probability-based models.

Module I: Business Mathematics Essentials (15 hours)

Ratio, proportion and variation including ratio and types of proportion, direct, inverse and joint variation, percentage change using ratios, business applications such as market share, financial ratios (concept) and productivity ratios, quadratic equations in business including standard form, nature of roots, quadratic formula and forming quadratic equations, applications such as cost–revenue–profit functions, price–demand relationships, optimum pricing and quadratic break-even models, inequalities including linear inequalities, quadratic inequalities and interval solutions, applications such as budget constraints, feasible region boundaries and minimum profit conditions

Activity at module completion: Students will analyse a real or hypothetical business case to compute ratios, form quadratic cost–revenue functions and determine feasible solutions using inequalities.

Module II: Mathematical Tools for Data Analytics (18 Hours)

Set theory including sets, operations and Venn diagrams, counting principles including permutations and combinations, logarithms and exponential functions, log transformations, exponential growth and decay, break-even analysis, return–risk modeling, sequences and series (AP and GP) with business applications

Activity at module completion: Students will perform a data-based task involving set operations, apply permutations and combinations to decision scenarios, use logarithmic transformations on small datasets and calculate break-even points with interpretation

Module III: Linear Programming for Business Decisions (12 Hours)

Formulation of linear programming problems, graphical method, feasible region and corner point method, optimal solution, applications including product mix, resource allocation, transportation problems, cost minimization and profit maximization

Activity at module completion: Students will formulate and solve a linear programming problem for a business case involving product mix or resource allocation using the graphical method and interpret the optimal solution

Module IV: Probability for Business Analytics (15 Hours)

Classical, empirical and subjective probability, addition and multiplication theorems, conditional probability, Bayes' Theorem, applications including demand forecasting, risk analysis and decision-making under uncertainty

Activity at module completion: Students will work with a dataset to compute probabilities, apply conditional probability and Bayes' Theorem, and prepare a short analysis on probabilistic decision-making for a business scenario.

Suggested Readings:

1. **S.C. Gupta & V.K. Kapoor** – *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
2. **D.C. Sancheti & V.K. Kapoor** – *Business Mathematics*, Sultan Chand & Sons.
3. **S.P. Gupta** – *Statistical Methods*, Sultan Chand & Sons.
4. **J.K. Sharma** – *Business Mathematics*, Ane Books Pvt. Ltd.
5. **Taha, Hamdy A.** – *Operations Research: An Introduction*, Pearson.
6. **Sundaresan & Jayaseelan** – *An Introduction to Business Mathematics*, S. Chand Publications.
7. **Berenson, Levine & Szabat** – *Basic Business Statistics*, Pearson.
8. **Richard I. Levin & David S. Rubin** – *Statistics for Management*, Pearson Education.
9. **Anderson, Sweeney & Williams** – *Statistics for Business and Economics*, Cengage Learning.
10. **J.K. Sharma** – *Operations Research: Theory and Applications*, Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	L
CO2	H	H	M	L

CO3	M	H	H	M
CO4	H	M	H	M
CO5	L	L	M	H

Course: Entrepreneurship Development**(4 Credits: 60 Hours) (L:T:P- 3--1)****Course Objectives:****This course aims to enable students to:**

- To understand entrepreneurial mindset and competencies.
- To identify and evaluate viable business opportunities.
- To develop entrepreneurial ideas through research and feasibility analysis.
- To formulate a comprehensive business plan.

Course /Learning Outcome

After learning this course, the students will be able to

CO1: Define and explain fundamental concepts and types of research (Remembering)

CO2: Formulate research problems, hypotheses and develop basic research design (Understanding)

CO3: Construct valid and reliable research instruments and collect data (Applying)

CO4: Analyse collected data using basic analytical tools (Analysing)

CO5: Prepare a structured research report or seminar paper using correct referencing styles (Evaluating/ creating)

Module 1: Foundations of Entrepreneurship (15 Hours)

Concept & evolution; types of entrepreneurs, Entrepreneurial mindset, competencies & design thinking, Creativity, leadership, problem-solving, teamwork, Legal framework, compliances & startup ecosystem basics.

Module 2: Opportunity Identification & Feasibility (12 Hours)

Sources of opportunity; PESTLE & SWOT analysis, Feasibility analysis (market, technical, financial), Risk identification & mitigation, Environmental scanning & opportunity mapping.

Module 3: Business Idea, Business Model & Business Plan (13 Hours)

Idea generation frameworks, Business Model Canvas, Components of a business plan, financial projections: revenue models, cash flow, BEP, Sources of finance: Angel, VC, Govt schemes.

Module 4: Markets, Customers, Branding & GTM Strategy (10 Hours)

Market research: STP, customer persona, Branding & value proposition, Digital marketing fundamentals, Pricing & customer acquisition strategies.

Module 5: Enterprise Launch, Growth & Ecosystem (10 Hours)

Business registration steps, Indian and NE-region startup ecosystem, Growth & scaling strategies, Ethics, sustainability & CSR, Pitch deck creation and investor expectations.

Suggested Readings:

- Desai, V. (2019). *Dynamics of entrepreneurial development & management* (6th ed.). Himalaya Publishing House.
- Gupta, C. B., & Srinivasan, N. P. (2017). *Entrepreneurship development in India* (5th ed.). Sultan Chand & Sons.
- Khanka, S. S. (2015). *Entrepreneurial development* (8th ed.). S. Chand & Company Ltd.
- Hisrich, R. D., Peters, M. P., & Shepherd, D. A. (2020). *Entrepreneurship* (11th ed.). McGraw-Hill Education.
- Mukherjee, A. K., & Roy, S. (2023). *Introduction to entrepreneurship development*. Oxford University Press.
- Sharma, S. (2023). *Entrepreneurship development* (2nd ed.). PHI Learning.
- Khandelwal, R., Kapoor, D., Gupta, N., & Gupta, N. (Eds.). (2026). *Entrepreneurship and sustainable business development*. Apple Academic Press.
- Ries, E. (2011). *The Lean Startup: How today's entrepreneurs use continuous innovation to create radically successful businesses*. Crown Business.
- Sarasvathy, S. D. (2008). *Effectuation: Elements of entrepreneurial expertise*. Edward Elgar Publishing.

Mapping of Course Outcomes

Course Outcomes	MI	MII	MIII	MIV	MV
CO1	H	M	M	L	L
CO2	H	H	M	M	H
CO3	M	H	H	H	M
CO4	M	M	L	H	H
CO5	M	M	M	H	H

INTERNSHIP

Course CREDIT-30 HOURS (L+T+P: 0+0+2)

Objectives: The students are required to undergo an internship in work related to Commerce and Management during the semester break at the end of fourth Semester or fifth Semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation. After the internship the students have to present their experiences in the form of reports and seminar presentations at a specified date towards the end of the sixth semester. Students will be evaluated on the basis of the report, seminar presentation and viva-voce examination.

LEARNING OUTCOMES

At the end of the internship students will be able to:

CO1: Relate with working in the corporate sector. (Remembering)

CO2: Interpret the situations and real life problems in business management and operations. (Understanding)

CO3: Organise and work on projects under a supervisor and deal with situations. (Applying)

CO4: Analyse and understand group cohesion. (Analysing)

CO5: Justify any action on the part of management for greater efficiency (Evaluating)

CO6: Develop a corporate personality with improved communication skills, presentation and other soft skills. (Creating)

INTRODUCTION

The field of Commerce and Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the Three/Four-Year Degree Course of Commerce (B.Com Analytics), the students are made acquainted with the various facets of Accounting, Management and Finance. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

- The internship should be for a minimum duration of 80 hours which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.
- The students have to undergo the internship during the Summer Break at the end of 4th Semester Examination or Winter Break at the end of 5th Semester Examination. Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student.
- Students can undergo internship at any organisation which is recognised registered of their choice but the work must be related to commerce and management.
- After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department.
- There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

- I. The Internship Report must comprise of the following:
 - a) Recommendation Letter from the Department.
 - b) Completion Certificate from the Organisation where the student has worked as intern.
 - c) Internship Diary as per the prescribed format.
 - d) Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.
- II. The Contents of the Report must include:
 - a) Introduction.
 - b) Objectives of the Internship.
 - c) About the Organisation (Sector, Activities, Operations).
 - d) Description of the work.
 - e) Vi. Learning Outcomes.
- III. The Assessment for the internship must have the following components:
 - a) Internship Report: 20 marks
 - b) Internship Diary: 20 marks
 - c) Seminar Presentation: 30 marks
 - d) Viva-Voce Examination: 30 marks

Course name: Minor Project- Phase 1

Course code:

Objective: This phase aims to equip students with the foundational skills required to identify business problems, understand their context through literature review, and gather appropriate datasets. Students will learn systematic data collection, data quality assessment, and preprocessing techniques essential for conducting business analytics projects.

At the end of this course students will be able to:

CO 1: Describe relevant business problems and design a minor project using real-world datasets.

CO 2: Identify a real-world business problem using secondary data and contextual analysis.

CO2: Identify appropriate tools to Collect, clean, and process data effectively.

CO 3: Apply appropriate preprocessing techniques to clean, validate, and prepare datasets for analysis.

CO 6: Develop and submit a structured project proposal and a fully cleaned dataset with documentation.CO

Course Design:

Module 1: Problem Identification & Definition (5 hours)

- a) Identify a real-world business problem or dataset.
- b) Conduct a literature review or secondary research to understand the context.
- c) Define objectives, scope, and expected outcomes of the project.
- d) Identify data sources: internal datasets, open-source datasets
- e) Prepare a project proposal including: problem statement, objectives, methodology outline, and expected deliverables.

Deliverable: Approved project proposal.

Module 2: Data Collection and Preprocessing (15 hours)

- a) Collect data from secondary sources.
- b) Validate data quality: check for missing values, outliers, duplicates, and inconsistencies.
- c) Apply data cleaning techniques: imputation, normalization, transformation, coding categorical variables.
- d) Create a final cleaned dataset ready for analysis.

Tools: Excel, Python (Pandas / NumPy), R.

Deliverable: Cleaned and validated dataset with documentation.

Module 3: Report Writing & Presentation (10 hours)

Prepare a structured project proposal by including:

- a) Abstract / Executive Summary
- b) Introduction and problem statement
- c) Objectives and methodology
- d) Data sources and preprocessing
- e) Exploratory analysis and visualizations

Tools: MS Word, Google Docs, PowerPoint, Tableau / Power BI.

Deliverable: Submission of proposal and presentation.

Assessment Rubrics:

Total Marks: 100

Assessment Component	Description	Weightage (%)
1. Problem Identification & Literature Review	Clarity of problem statement, relevance, justification through literature review	20
2. Project Proposal	Objectives, scope, methodology, feasibility, structure, and documentation quality	20
3. Data Collection	Appropriateness of data sources, completeness of datasets, documentation of data characteristics	20
4. Data Preprocessing & Cleaning	Handling missing values, outliers, transformations, encoding, quality of final cleaned dataset	20
5. Phase 1 Report / Documentation	Organization, clarity, explanation of steps, references, formatting	20

Mapping of COs to Syllabus

Course outcome	Module I	Module II	Module III
CO1	H	M	M
CO2	H	H	H
CO3	M	M	H
CO4	L	L	L
CO6	L	L	M

Advertising and Brand Management: Theory and Practices

4 Credit 60 Hours/ L.T.P : 4.0.0

Total Hours: 60

Course Objectives

The course aims to:

1. Provide foundational knowledge of advertising, IMC, media planning, and brand management.
2. Develop practical skills in planning advertising strategies and media selection.
3. Enable students to understand brand positioning, brand equity, and brand-building processes.
4. Analyze the role of branding in competitive advantage and long-term business sustainability.
5. Apply advertising and branding concepts to real-world marketing problems.

Course Outcomes (COs)

On successful completion of the course, students will be able to:

CO Code Course Outcomes

CO1 Explain the concepts, scope, and functions of advertising and IMC.

CO2 Apply advertising planning, budgeting, and creative strategy tools in campaign development.

CO3 Evaluate media alternatives and advertising effectiveness using appropriate techniques.

CO4 Analyze branding concepts including brand identity, brand personality, and brand equity.

CO5 Develop strategic brand management plans including positioning, brand extension, and portfolio management.

Module I: Introduction to Advertising and Marketing Communication (12 Hours)

Advertising: Definition, nature, scope, objectives, functions, types; Social, ethical and economic aspects of advertising; Integrated Marketing Communication (IMC): Role, process and models (AIDA, Hierarchy of Effects, and DAGMAR); Advertising Industry: Advertisers, Media and Advertising Agencies: structure, functions, selection and compensation.

Experience learning

Case studies, real advertisement analysis, role-play, branding workshops.

Industry-based projects & digital ad campaign assignments.

Module II: Advertising Planning and Strategy (12 Hours)

Consumer behavior and advertising: segmentation, targeting, motivation; Advertising objectives and budgeting approaches (Objective & Task, Competitive parity); Creative Strategy: Message design, appeals, copywriting, tones; layout and visual design.

Experience learning

Case studies, real advertisement analysis, role-play, branding workshops.

Industry-based projects & digital ad campaign assignments.

Module III: Media Planning and Evaluation (10 Hours)

Media types: print, electronic, outdoor, digital; direct marketing: merits & demerits; Media planning process; media mix; media scheduling (continuous, fighting, pulsing); Measuring advertising effectiveness: Pre-testing and post-testing techniques.

Experience learning

Case studies, real advertisement analysis, role-play, branding workshops.

Industry-based projects & digital ad campaign assignments.

Module IV: Introduction to Brand Management (12 Hours)

Branding Fundamentals: Meaning of brand, branding, and brand management; brands versus products; importance of branding to consumers and firms; Brand Identity and Personality: Core and extended identity, brand image, brand personality (models and factors) and the benefits of a strong brand; Brand Equity: The concept of brand equity, sources of brand equity, and customer-based brand equity (CBBE) models.

Experience learning

Case studies, real advertisement analysis, role-play, branding workshops.

Industry-based projects & digital ad campaign assignments.

Module V: Strategic Brand Management (14 Hours)

Brand positioning and repositioning strategies; Brand building and sustaining programs; brand elements & secondary associations; Brand extensions (line & category); brand reinforcement; brand portfolio and architecture; Global branding & brand performance evaluation.

Experience learning

Case studies, real advertisement analysis, role-play, branding workshops.

Industry-based projects & digital ad campaign assignments.

Reference Books

1. **Kevin Lane Keller** – *Strategic Brand Management*, Pearson Education.

2. **George E. Belch & Michael Belch** – *Advertising & Promotion: An Integrated Marketing Communications Perspective*, McGraw Hill.
3. **Sengupta Subroto** – *Brand Positioning: Strategies for Competitive Advantage*, Tata McGraw Hill.
4. **Chunawala & Sethia** – *Foundations of Advertising Theory and Practice*, Himalaya Publishing.
5. **Aaker David** – *Managing Brand Equity*, Free Press

Mapping of Cos to Syllabus

Course Code	Module I	Module II	Module III	Module IV	Module V
CO1	M			M	
CO2		H			
CO3			H		
CO4					M
CO5					H

Course Code: Course Name: Business Analytics using R and Tableau

4 Credits- 105 hours (L-T-P: 1-0-3)

Objective: The objectives of the courses are-

- To understand the basics of data analytics, R programming, and Tableau.
- To Perform data import, cleaning, and manipulation in R.
- To apply descriptive and inferential statistical techniques using R.
- To build dashboards and data visualizations using Tableau.
- To interpret analytical results for business decision-making.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall fundamental concepts of business analytics, R programming, and Tableau.

CO 2: Explain data handling, cleaning, manipulation, and visualization techniques in R and Tableau.

CO 3: Apply statistical methods and analytical tools in R and create visualizations in Tableau.

CO 4: Analyse business datasets using R and Tableau to generate meaningful insights.

CO 5: Evaluate analytical outputs and dashboards to support data-driven business decisions.

Module 1: Introduction to Business Analytics & R Programming (30 Hours)

Meaning of business analytics – Types of analytics (descriptive, predictive, prescriptive) – Role of analytics in business decision-making – Introduction to R software – R interface, scripts, packages – Basic R commands – Data types, variables, operators – Working with vectors, matrices, lists, data frames – Basic functions in R.

Activity: Students install R & RStudio, run basic commands, and create simple data objects (vectors, matrices).

Module 2: Data Handling & Statistical Analysis in R (35 Hours)

Importing data from CSV/Excel – Data cleaning, missing value handling – Data manipulation using dplyr – Sorting, filtering, grouping – Descriptive statistics: mean, median, mode, variance, correlation – Data visualization using ggplot2 (basic plots: bar, line, histogram, boxplot) – Introduction to inferential statistics: hypothesis testing (t-test, chi-square test), simple regression.

Mini Project: Students import a messy dataset, clean missing values, manipulate data using dplyr, and create a summary statistics table.

Module 3: Introduction to Tableau (30 Hours)

Overview of Tableau – Connecting to data sources – Dimensions & measures – Data types – Simple calculations – Creating basic charts (bar chart, line chart, pie chart, scatter plot) – Filters, groups, sets – Sorting, formatting, annotations – Dual axis charts – Working with dashboards – Story points.

Task: Students connect Tableau to a sample dataset and create 4 types of charts, then combine them into a simple dashboard.

Module 4: Business Applications Using R and Tableau (25 Hours)

Creating business reports with R : Creating interactive dashboards with Tableau: Sales analysis, customer segmentation, financial analysis using sample datasets: Combining R outputs with Tableau visualization : Basics of data-driven decision-making – Mini project/assignment in R or Tableau.

Mini Project: Students solve a real business problem (e.g., sales forecasting, customer segmentation) using either R or Tableau.

Suggested Readings:

- **Garrett Grolemond** – *Hands-On Programming with R*
- **Hadley Wickham** – *R for Data Science*
- **Joshua Milligan** – *Learning Tableau*
- **Daniel G. Murray** – *Tableau Your Data!*
- **Ken Black** – *Business Statistics for Contemporary Decision-Making*

Online Resources: RStudio (posit.co); Tableau Public learning modules; Coursera / edX courses on R and Tableau

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	L
CO2	M	H	L	M
CO3	L	H	M	M
CO4	L	L	H	H
CO5	L	M	M	H

AUDITING AND CORPORATE GOVERNANCE

(4 Credits-60 hours)

Objectives:

- To understand the various concepts related to Auditing, liabilities of statutory Auditors under the Companies Act 2013.
- To gain knowledge of special areas of Audit and computer-aided audit techniques and tools.
- To learn the procedures related to Corporate Governance theories and models, and various corporate scandals in India and abroad.

COURSE/LEARNING OUTCOMES:

After completing the course successfully, the student will be able to

CO1: Define the various concepts related to Auditing and types of Audits (Remembering)

CO2: Explain the concepts of audit of Limited companies, liabilities of statutory Auditors under the companies Act 2013 (Understanding)

CO3: Execute the Knowledge of special areas of Audit and computer-aided audit techniques and tools (Applying)

CO4: Examine the procedures related to Corporate Governance theories and models and various corporate scandals in India and abroad (Analysing)

CO5: Evaluate the requirements of different business ethics, corporate ethics in a business (Evaluating)

Module I: Introduction (12 hours)

Auditing: Introduction, Meaning, Objectives, Basic Principles and Techniques; Classification of Audit, Audit Planning, Internal Control – Internal Check and Internal Audit; Audit Procedure – Vouching and verification of Assets & Liabilities.

Experiential Learning Activities:

Practical Vouching Exercise: Students examine sample invoices, vouchers, cash memos, receipts, purchase orders, GRNs, etc.

Identify discrepancies, incomplete documentation, or fraud-prone areas.

Verification Lab: Learners verify assets & liabilities using mock balance sheets (e.g., fixed assets, cash-in-hand, inventory, creditors). Prepare verification checklists.

Module II: Audit of Companies (16 hours)

Audit of Limited Companies: Company Auditor- Qualifications and disqualifications, Appointment, Rotation, Removal, Remuneration, Rights and Duties Auditor's Report- Contents and Types. Liabilities of Statutory Auditors under the Companies Act 2013;

Secretarial Audit- Overview & introduction: Concept; advantages; legal provisions; risk of Secretarial Auditor; code of conduct.

Experiential Learning Activities:

Case Studies on Auditor Liabilities:

- Analyse real cases from the Companies Act 2013 (e.g., Satyam, IL&FS auditors, DHFL auditor failures).
- Identify negligence, fraud, and penalties.

Drafting an Engagement Letter: Students prepare an engagement letter that outlines the scope, responsibilities, and limitations.

Module III: Special Areas of Audit (12 hours)

Special Areas of Audit: Special features of Cost audit, Tax audit, and Management audit; Recent Trends in Auditing: Basic considerations of audit in EDP Environment; Computer-aided audit techniques and tools; Auditing Standards; Relevant Case Studies/Problems.

Experiential Learning Activities:

Cost Audit File Preparation:

- Students prepare a cost audit file for a manufacturing company (mock data).
- Includes cost sheets, variance analysis, and compliance.

Module IV: Corporate Governance (12 hours)

Conceptual framework of Corporate Governance: Theories & Models, Broad Committees; Corporate Governance Reforms. Major Corporate Scandals in India and Abroad: Common Governance Problems Noticed in Various Corporate Failures. Codes & Standards on Corporate Governance

Experiential Learning Activities:

Corporate Governance Scorecard Assessment: Students assess the corporate governance quality of real listed companies using governance scorecards.

Module V: Business Ethics (8 hours)

Morality and ethics, business values and ethics, approaches and practices of business ethics, corporate ethics, ethics program, codes of ethics, ethics committee; Ethical Behaviour: Concepts and advantages; Rating Agencies; Green Governance; Clause 49 and Listing Agreement

Experiential Learning Activities:

CSR Evaluation Activity:

- Review CSR initiatives of Indian corporates (Infosys, Tata, Reliance, Wipro).
- Compare with legal requirements under Companies Act

Suggested Readings

1. Ravinder Kumar and Virender Sharma, *Auditing Principles and Practice*, PHI Learning
2. . Aruna Jha, *Auditing*. Taxmann Publication.
3. A. K. Singh, and Gupta Lovleen. *Auditing Theory and Practice*. Galgotia Publishing Company.
4. Anil Kumar, *Corporate Governance: Theory and Practice*, Indian Book House, New Delhi
5. MC Kuchhal, *Modern Indian Company Law*, Shri Mahaveer Book Depot. (Publishers). (Relevant Chapters)
6. KV Bhanumurthy and Usha Krishna, *Politics, Ethics and Social Responsibility of Business*, Pearson Education
7. Erik Banks, *Corporate Governance: Financial Responsibility, Controls and Ethics*, Palgrave Macmillan
8. N Balasubramanian, *A Casebook on Corporate Governance and Stewardship*, McGraw Hill Education
9. B.N. Ghosh, *Business Ethics and Corporate Governance*, McGraw Hill Education

10. S K Mandal, *Ethics in Business and Corporate Governance*, McGraw Hill Education
11. Bob Tricker, *Corporate Governance-Principles, Policies, and Practice*(Indian Edition), Oxford University Press
12. Christine Mallin, *Corporate Governance (Indian Edition)*, Oxford University Press
13. Relevant Publications of ICAI on *Auditing (CARO)*
14. Sharma, J.P., *Corporate Governance, Business Ethics, and CSR*, Ane Books Pvt Ltd, New Delhi

Note: Latest edition of text books may be used

Mapping of COs to Syllabus

Out-come	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	
CO 5					H

SUPPLY CHAIN MANAGEMENT

(4 Credit- 60 hours) (L+T+P: 3+0+1)

Objectives

This course enables learners to understand core supply chain concepts such as supplier evaluation, scoring models, and sourcing strategies, while also developing the ability to analyse purchasing logistics, supplier assessment tools, and decision-making frameworks. It further equips students to evaluate coordination challenges and identify the root causes of the Bullwhip Effect, and to design strategies that enhance collaboration through trust building, VMI, CRP, and CPFR practices. Ultimately, learners will apply optimization and strategic alignment principles to create integrated, highly responsive supply chains.

COURSE/LEARNING OUTCOME

CO 1: Explain the role of supplier scoring, assessment methods, and sourcing performance metrics.

CO 2: Apply quantitative and qualitative techniques for supplier evaluation and purchasing logistics.

CO 3: Compare and differentiate obstacles that lead to lack of coordination in a supply chain.

CO 4: Evaluate the causes, impacts, and managerial remedies for the Bullwhip Effect.

CO 5: Design collaborative mechanisms such as VMI, CRP, and CPFR to improve supply chain performance.

Module I: Foundations of Supply Chain Management

Introduction to Supply Chain Management- Supply chain – objectives – importance – decision phases – process view – competitive and supply chain strategies – achieving strategic fit – supply chain drivers – obstacles – framework – facilities – inventory – transportation – information – sourcing – pricing.

Module II: Supply Chain Network and Distribution Design

Designing the Supply Chain Network- Designing the distribution network – role of distribution – factors influencing distribution – design options – e-business and its impact – distribution networks in practice – network design in the supply chain – role of network – factors affecting the network design decisions – modelling for supply chain.

Module III: Demand, Supply, and Inventory Planning

Planning Demand and Supply- Role of forecasting – demand forecasting – approaches – role of IT. Planning and Managing Inventories- Safety inventory and its appropriate level – impact of supply uncertainty, aggregation and replenishment policies.

Module IV: Transportation Systems and Sourcing Decisions

Transportation Networks and Sourcing- Role of transportation – modes and their performance – transportation infrastructure and policies - design options and their trade-offs – Tailored transportation. Sourcing – In-house or Outsource – 3rd and 4th PLs – supplier scoring and assessment.

Module V: Supply Chain Coordination and Collaboration

Coordination in a Supply Chain- Lack of supply chain coordination and the Bullwhip effect – obstacle to coordination – managerial levels – building partnerships and trust – continuous replenishment and vendor-managed inventories – collaborative planning, forecasting and replenishment.

REFERENCES

1. **Sunil Chopra & Peter Meindl (2021)** – *Supply Chain Management: Strategy, Planning, and Operation*, 7th Edition, Pearson Education. (Updated version of the 4th edition you listed)
2. **Wisner, Keah-Choon Tan & Keong Leong (2022)** – *Principles of Supply Chain Management: A Balanced Approach*, 6th Edition, Cengage Learning. (Latest edition of the 2005 text)
3. **Coyle, Novack, Gibson, & Bardi (2021)** – *Transportation: A Supply Chain Perspective*, 9th Edition, Cengage. (Updated version of “Management of Business Logistics” by Coyle, Bardi & Langley)
4. **Jeremy F. Shapiro (2007)** – *Modeling the Supply Chain*, 2nd Edition, Duxbury/Thomson. (Latest available edition for this title)

Additional Recommended References (Recent)

5. **Srinivasan G. (2020)** – *Quantitative Models in Operations and Supply Chain Management*, PHI.
6. **Simchi-Levi, Kaminsky & Simchi-Levi (2021)** – *Designing and Managing the Supply Chain*, 4th Edition, McGraw-Hill.
7. **Hugos, M. (2018)** – *Essentials of Supply Chain Management*, 4th Edition, Wiley.

Mapping of COs with syllabus

Course Outcome	MODULE I	MODULE II	MODULE III	MODULE IV	MODULE V
CO 1	M				
CO 2	H	M			
CO 3		H	H		
CO 4			H	H	H
CO 5					M

Course name: Minor Project -Phase -2

Course code:

(4 Credits- 60 hours) (L-T-P: 1-1-1)

Objective: This course provides hands-on experience in applying business analytics techniques to real-world business problems. Students learn to collect, clean, and analyze datasets using statistical and machine learning methods, interpret results, and present actionable insights. The course emphasizes analytical thinking, data-driven problem solving, and effective communication.

At the end of this course students will be able to:

CO 1: Describe relevant business problems and design a minor project using real-world datasets.

CO 2: Identify appropriate tools to Collect, clean, and process data effectively.

CO 3: Apply statistical, regression, or machine learning models to analyse business datasets.

CO 4: Analyse data and interpret results, evaluate findings, and provide actionable business recommendations.

CO 5: Present the project effectively through a structured report and oral presentation.

Course Design:

Module 1: Exploratory Data Analysis (EDA) & Visualization (15 hours)

- a) Perform descriptive statistics: mean, median, standard deviation, correlations.
- b) Visualize data using charts, histograms, scatter plots, and box plots.
- c) Identify trends, patterns, and anomalies.
- d) Formulate initial hypotheses for further analysis.

Tools: Python (Matplotlib, Seaborn), R (ggplot2), Tableau, Power BI.

Deliverable: EDA report with visualizations and insights.

Module 2: Advanced Analysis / Modelling (25 hours)

- a) Identify appropriate models based on the problem type:

Regression analysis: Linear, Multiple, Logistic

Time series analysis: ARIMA, Exponential Smoothing

Classification / Clustering: K-Means, Decision Trees, Random Forest

Predictive analytics and forecasting

b) Perform model validation and evaluation: R^2 , RMSE, Accuracy, Confusion Matrix, etc.

c) Analyse the impact of key variables on the business problem.

d) Interpret results in business context, linking findings to real-world implications.

Deliverable: Analytical results with model interpretation and recommendations.

Step 5: Report Writing & Presentation (20 hours)

a) Prepare a structured report including:

Abstract / Executive Summary

Introduction and problem statement

Objectives and methodology

Data sources and preprocessing

Exploratory analysis and visualizations

Advanced analysis and model results

Discussion, findings, and actionable recommendations

Limitations and future scope

b) Prepare visual dashboards or charts to highlight insights.

c) Conduct oral presentation / viva with slides or interactive dashboards.

Tools: MS Word, Google Docs, PowerPoint, Tableau / Power BI.

Deliverable: Final report and presentation.

Suggested Tools / Software

- Data Handling: Excel, SQL, Google Sheets
- Analysis & Modelling: Python (Pandas, NumPy, Scikit-learn), R
- Visualization: Tableau, Power BI, Matplotlib, Seaborn
- Documentation: MS Word, Google Docs, LaTeX

Assessment Component	Detailed Criteria	Marks
Exploratory Data Analysis (EDA)	• Correct descriptive statistics (mean, median, SD, correlations) • Quality & correctness of visualizations (charts, histograms, scatter plots, box plots) • Identification of trends, patterns, anomalies • Formulation of relevant hypotheses	30
Advanced Modelling & Interpretation	• Appropriate model selection (regression, time series, ML, clustering) • Correct model building & execution (coding accuracy, parameter tuning) • Use of evaluation metrics (R^2, RMSE, Accuracy, Precision, Confusion Matrix, etc.) • Interpretation of model outputs in business context • Practical, logical and data-driven recommendations	40
Report Writing & Presentation	• Structured report: abstract, introduction, methodology, data, EDA, modelling, findings, limitations • Depth & clarity of explanation with supporting visuals • Dashboard/visual aid quality (Tableau / Power BI / PPT charts) • Presentation clarity, delivery & confidence • Q&A performance and conceptual understanding	30

Mapping of COs to Syllabus

Course outcome	Module I	Module II	Module III
CO1	M	M	L
CO2	M	H	M
CO3	H	H	H
CO4	H	H	L
CO6	L	L	M

Course Code: **Course Name:** **Predictive Analysis for Business using Python and R**
(5 Credits-150 hours) (L-T-P: 1-0-4)

Objective: The objectives of the course:

- To explain the fundamentals and applications of predictive analytics in business.
- To introduce Python and R for data import, cleaning, exploration, and visualization.
- To teach building and evaluating predictive models including regression and classification.
- To enable interpretation of model results for practical business decision-making.
- To apply predictive analytics in real-world business datasets through mini-projects.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall predictive analytics concepts, definitions, and applications across marketing, finance, HR, and supply chain.

CO 2: Comprehend data handling, cleaning, transformation, and exploratory data analysis techniques using Python and R.

CO 3: Apply supervised learning methods including regression and classification to business datasets using Python and R.

CO 4: Analyse model performance using evaluation metrics such as MAE, RMSE, accuracy, precision, recall, and confusion matrix, interpreting results for business decisions.

CO 5: Evaluate predictive analytics models and forecasts, compare techniques, and generate actionable insights through mini-projects and business reports.

Module 1: Introduction to Predictive Analytics, Python & R Basics (30 Hours)

Predictive analytics, scope and applications in marketing, finance, HR, supply chain, Python and R installation, working with interfaces, variables, data types, operators, loops, functions, basic data structures, Python libraries such as NumPy, pandas, matplotlib, R packages such as readr, dplyr, ggplot2.

Activity: Simple Python and R scripts to calculate total sales, profit margin, discounts, average customer rating, loops for daily sales calculations, outputs submitted as screenshots or lab report.

Module: 2 Data Import, Cleaning & Exploratory Data Analysis (35 Hours)

Importing CSV and Excel files in Python and R, handling missing values, removing duplicates, detecting and treating outliers, encoding categorical variables, normalization, scaling, data transformations, descriptive statistics, measures of central tendency, distribution analysis, correlation analysis, visualizations including histograms, scatter plots, boxplots, bar charts, heatmaps.

Activity: Cleaning a small business dataset, generating five visualizations, writing five observations from EDA, submitted as PDF or lab record.

Module 3: Predictive Modelling Using Python & R (40 Hours)

Supervised learning, simple and multiple linear regression, logistic regression, decision trees, K-Nearest Neighbour (k-NN), training and testing data split, model building using Python (scikit-learn) and R (caret), evaluation using mean absolute error (MAE), root mean square error (RMSE), accuracy, precision, recall, confusion matrix, application to business scenarios and interpretation of outputs.

Activity: Building one regression model (sales prediction) and one classification model (customer churn or loan default), submitting code, accuracy scores, confusion matrix, and interpretation in five points.

Module 4: Time Series Forecasting & Advanced Predictive Tools (20 Hours)

Time series analysis, components of trend and seasonality, simple forecasting techniques including moving average and exponential smoothing, time series visualization in Python and R, conceptual understanding of ARIMA, application to business forecasting for demand, sales, and revenue.

Activity: Performing simple forecasting on monthly sales data using moving average or exponential smoothing, submitting graph with explanation.

Module 5: Business Applications & Mini Project (25 Hours)

Application of predictive models to business datasets in domains such as retail, banking, HR, and telecom, model comparison, evaluation, interpretation of results, preparation of predictive reports and dashboards for decision-making.

Activity: Completing a mini-project using a dataset, cleaning and exploring data, building a predictive model, evaluating model performance, submitting a business interpretation report, presentation and viva

Suggested Readings:

Wes McKinney – *Python for Data Analysis*; Hadley Wickham – *R for Data Science*; Müller & Guido – *Introduction to Machine Learning with Python*; James Evans – *Business Analytics*; Online resources: Kaggle, RStudio, Scikit-learn documentation.

Mapping of COs to Syllabus

CO / Module	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	M	L	L	M
CO2	M	H	M	L	M
CO3	L	M	H	M	H
CO4	L	M	H	H	M
CO5	L	L	M	M	H

Course code: Investment Analytics (5 credits-60 Hours) (L-T-P: 4-1-0)

Objective:

- To give knowledge and insights into the functioning of the Indian Stock market
- To develop tools and skills for security analysis-fundamental and technical
- To develop trading and investment skills in the securities market

Course /Learning Outcomes

At the end of this course, students will be able to:

CO1: Recall and list key concepts related to investment basics, Indian security markets, financial instruments, market participants, trading mechanisms, and fundamental and technical indicators.
CO2: Explain the functioning of primary and secondary markets, risk–return relationships, financial instruments, valuation ratios, macroeconomic indicators, industry dynamics, and charting principles used in investment analysis.

CO3: Apply quantitative and qualitative analytical tools to compute risk and return, interpret stock indices, perform basic valuation ratios (P/E, PEG, P/BV), evaluate financial statements, and use technical indicators such as SMA, EMA, MACD, and trading rules for investment decision-making.

CO4: Analyse IPO pricing and listing performance, compare industries and companies using financial, economic, and qualitative parameters, interpret complex price-volume data, evaluate market sentiment through breadth indicators, and assess investor behaviour using technical and fundamental analytics.

CO5: Formulate data-driven investment strategies by integrating fundamental analysis, technical charts, risk–return metrics, market sentiment indicators, and economic trends to construct evidence-based trading and investment decisions.

Module I: Basics of Investing (20 hours)

Basics of Investment & Investment Environment; Risk and Return, Instruments of Investment-Equity shares, Preference shares, Bonds and Debentures. Indian Security Markets: Primary Markets (IPO, FPO, Private placement, Offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE,

NSE, MSEI. Security Market Indices: Nifty & Sensex, Sources of financial information; Trading in securities: types of orders, using brokerage and analyst recommendations.

Analytical Focus:

- a. Analyse risk–return characteristics of investment instruments using quantitative methods.
- b. Interpret price movements of Nifty, Sensex based on macroeconomic data.

Module II: Indian Security Markets (15 hours)

Primary Markets (IPO, FPO, Private placement, Offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE, NSE, MSEI. Security Market Indices: Nifty & Sensex; Sources of financial information; Trading in securities: types of orders, using brokerage and analyst recommendations.

Analytical Focus:

- a. Analyse IPO pricing, subscription, and listing performance using real-time market data.
- b. Interpret security market indices to understand market sentiment and index analytics.

Module III: Fundamental Analysis (20 hours)

Top down and bottom-up approaches, Analysis of international & domestic economic scenario, Industry analysis, Company analysis (Quality of management, financial analysis :Both Annual and Quarterly, Income statement analysis, position statement analysis including key financial ratios, Cash flow statement analysis, Industry market ratios: PE, PEG, Price over sales, Price over book value, EVA), Understanding Shareholding pattern of the company.

Analytical Focus:

- a. Evaluate macroeconomic indicators to forecast market trends.
- b. Conduct industry analytics using growth rates, cyclicity, and competitive forces.
- c. Analyse company performance using:
 - Ratio analytics (liquidity, leverage, profitability, valuation)
 - Cash flow and earnings quality analytics
- d. Compute and interpret intrinsic value using valuation ratios (P/E, PEG, P/BV).

Module IV: Technical Analysis (20 hours)

Trading rules (credit balance theory, confidence index, filter rules, market breadth, advances vs declines and charting (use of historic prices, simple moving average and MACD) basic and advanced interactive charts. Do's & Don'ts of investing in markets.

Analytical Focus:

- a. Analyse historical price trends using SMA, EMA, MACD, Price-volume charts.
- b. Interpret candlestick charts and advanced chart types analytically.
- c. Evaluate market sentiment using AD (Advances/Declines) ratio and breadth indicators.

Suggested Readings:

1. Security analysis and portfolio management (third edition), S. Kevin, PHI.
2. Security Analysis, Benjamin Graham & David Dodd
3. Securities Market foundation, NISM
4. Financial services and capital markets, ICAI
5. Finance and securities market in India, M.A. Shakila Banu, Abhijeet Publications; 1st edition (1 January 2012).

Mapping of COs to Syllabus

CO's	M 1	M 2	M 3	M 4
CO 1	H	H		

CO 2		H	H	H
CO 3			H	H
CO 4			H	H
CO 5				H

Course Name: Cyber Law

Course Code:

Credits: 3 (3L-0T-0P)

Total Hours: 45

Course Description

This course introduces the learners to the legal aspects of the digital world, focusing on the Indian Cyber Law framework. It covers key concepts of cybercrimes, e-contracts, digital signatures, intellectual property, data privacy, and ethical issues in cyberspace. Learners will gain knowledge of essential legal provisions of the IT Act 2000 and study relevant case laws to understand practical compliance in online activities and digital commerce.

Course Objectives

1. To introduce the fundamental concepts, scope, and importance of Cyber Law and cyberspace.
2. To familiarize learners with major types of cybercrimes and the legal provisions of the IT Act 2000.
3. To develop understanding of e-contracts, digital signatures, and electronic governance in online transactions.
4. To explain intellectual property, privacy, and ethical issues in the digital environment.
5. To create awareness of emerging trends, cyber forensics, and compliance practices through case studies and practical assignments.

Course Outcomes (COs)

CO1: Explain key concepts, terminology, and evolution of Cyber Law. (Understand)

CO2: Identify and classify various types of cybercrimes and legal implications. (Remember / Understand)

CO3: Apply IT Act provisions and rules to practical digital commerce scenarios. (Apply)

CO4: Analyze case laws related to cyber fraud, privacy, and data breaches. (Analyze)

CO5: Evaluate legal compliance measures and suggest improvements for secure digital business operations. (Evaluate)

Course Contents:

Module 1: Introduction to Cyber Law (CO1, CO2) [12 hours]

Definition, scope, and importance of Cyber Law; History and evolution of Cyber Law in India; Basic terminology: cyberspace, cybercrime, cyber jurisprudence; Legal issues in cyberspace - overview and importance; E-contracts and legal enforceability of online transactions; Digital signatures and electronic governance; Case studies: Fundamental e-commerce legal disputes.

Digital Footprint Mapping Exercise: Students investigate their online footprints using OSINT tools (e.g., Google dorking, WHOIS). Reflection report on privacy risks and legal implications

Module 2: Cybercrimes & Legal Provisions (CO3, CO4) [15 hours]

Types of cybercrimes: hacking, phishing, identity theft, cyber bullying, cyber terrorism, data breaches, financial fraud; Regulatory framework: Information Technology Act 2000 - key sections and amendments; Legal provisions under the IT Act related to cybercrimes; Cyber forensics and digital evidence; Case studies: analysis of recent Indian cybercrime judgments.

Cyber Threat Simulation Activity: Demonstration of phishing emails, fake websites, ransomware behaviour using safe toolkits (e.g., PhishSim). Students identify suspicious indicators and document risk mitigation.

Module 3: Intellectual Property, Privacy & Ethical Issues (CO3, CO4, CO5) [18 hours]

Copyright, patent, and trademark protection in digital environment; Digital piracy and copyright infringement; Data protection and privacy: National and international standards (GDPR, Indian PDP Bill); Ethical issues in cyberspace and corporate digital responsibility; Emerging trends: Data localization, AI regulation, intermediaries' liability; Developing a compliance framework and ethical guidelines for digital commerce; Project/Assignment: Drafting e-contracts, case presentation on cyber law issues; Best practices for secure digital commerce operations.

Mock E-Governance Process Flow: Students simulate online document authentication using, digital signatures, e-records, verification workflows. Helps them understand legal recognition of electronic records.

Recommended Books:

1. "Textbook on Cyber Law" by Pavan Duggal; 2nd Edition; Universal Law Publishing Co. Pvt. Ltd.
2. "A Handbook of Cyber Laws and Information Technology in India" by Dr. Kasturi Bora & Upasana Borah; 1st edition; Notion Press.
3. "Cyber Security and Cyber Laws" by Nilakshi Jain and Ramesh Menon; Wiley India Pvt Ltd.
4. *The Information Technology Act, 2000*, Bare Act, Professional Book Publishers, New Delhi.

RESEARCH METHODOLOGY (Same syllabus will be applicable for BCOM in Business

Analytics with Research

(2 Credits: 30 hours) (L:T:P- 2-0-0)

Course Objectives

This course aims to enable students to:

- Understand fundamental concepts, types, and approaches of research.
- Identify, define and develop a research problem appropriate for academic studies.
- Design basic research instruments and collect data ethically and systematically.
- Analyse quantitative and qualitative data using introductory analytical tools.
- Prepare research papers, seminar papers, and project reports following academic standards.

Course /Learning Outcome

After learning this course, the students will be able to

CO1: Define and explain fundamental concepts and types of research (Remembering)

CO2: Formulate research problems, hypotheses and develop basic research design (Understanding)

CO3: Construct valid and reliable research instruments and collect data (Applying)

CO4: Analyse collected data using basic analytical tools (Analysing)

CO5: Prepare a structured research report or seminar paper using correct referencing styles (Evaluating/ creating)

Module I: Foundations of Research (6 Hours)

Meaning, nature, scope and objectives of research, Types of research: Qualitative, Quantitative, Mixed methods; Applied, Basic, Exploratory, Descriptive, Experimental research, Concept of Research Design vs. Research Methodology, Ethics in research (Plagiarism, academic integrity). Investigation vs. Research, Ethical use of AI, concept of business research, Scientific Research and Social Science Research.

Activity: Write a short note on research and its types (for seminar paper introduction), Conduct a plagiarism check demonstration (using free tools)

Module II: Research Problem & Research Design (6 Hours)

Identifying and formulating a research problem; **review of literature**, Research gap identification through literature; Types of research designs: Analytical, Descriptive, Cross-sectional, Longitudinal; Variables and hypotheses formulation.

Practical Component: Students choose a research topic and develop a problem statement and prepare a hypothesis sheet for seminar-based research

Module III: Survey Design, Measurements & Sampling (8 Hours)

Principles of survey research; Questionnaire construction: scale, items, sequencing; Validity (content, construct), reliability (Cronbach Alpha basics); Levels of Measurement: Nominal, Ordinal, Interval, Ratio; Sampling: Probability and non-probability sampling, sample size basics.

Practical Component: Students prepare a 10–12 item questionnaire based on their chosen topic and do a mini-validation activity (peer review of questionnaires)

Module IV: Data Analysis & Research Analytics (6 Hours)

Date- Sources, primary and secondary data, Data entry, **Data processing**, coding & cleaning using MS Excel; Descriptive statistics: mean, median, mode, variance, SD; Hypothesis testing

basics (t-test, chi-square—conceptual); Correlation and simple regression overview; Introduction to SPSS/R for basic analysis.

Practical Component: Students analyse sample dataset using Excel and create tables & graphs for research paper results section

Module V: Research Report, Seminar Paper & Referencing (4 Hours)

Structure of research paper, seminar paper, dissertation; Writing literature review & conceptual framework; Referencing styles: APA (latest edition), MLA, Chicago (overview); Bibliography and citation tools (Zotero, Google Scholar)

Practical Component: Students prepare one-page research synopsis and practice APA referencing with 10 sources

Practical/Experiential Learning Activities (Any 2–3)

1. Literature review assignment based on 5–7 published papers
2. Preparation of research questionnaire and field data collection
3. Basic analysis in Excel/SPSS and reporting
4. Preparation of research paper with APA referencing
5. Seminar presentation on research topic chosen

Suggested Readings (Updated & APA style)

1. Kothari, C. R. (2014). *Research methodology: Methods and techniques* (3rd ed.). New Age International.
2. Saunders, M., Lewis, P., & Thornhill, A. (2019). *Research methods for business students* (8th ed.). Pearson.
3. Srivastava, S. C. (1990). *Foundations of social research and economics techniques*. Himalaya Publishing House.
4. Sharma, H. D., & Mukherji, S. P. (1992). *Research methods in economics and business*. Macmillan.
5. Michael, V. P. (2001). *Research methodology in management*. Himalaya Publishing House.

Mapping of Course Outcomes

Course Outcomes	MI	MII	MIII	MIV	MV
CO1	H	M	M	L	L
CO2	H	H	M	M	H
CO3	M	H	H	H	M
CO4	M	M	L	H	H
CO5	M	M	M	H	H

DISSERTATION–Phase-I

(6 Credits – 90 Hours) (L–T–P: 4–0–2)

Course Objective

The course aims to equip undergraduate students with fundamental knowledge of research methodology and to develop practical research skills required for academic research and project writing. Students will learn:

- i. How to identify a research problem,
- ii. How to write a synopsis,
- iii. How to review existing literature,
- iv. How to design a research methodology,
- v. How to follow APA referencing style, and
- vi. How to use statistical tools using SPSS for basic data analysis.

This first phase builds the foundation for Dissertation-II, where students conduct fieldwork, data analysis, and full report submission.

Module 1: Synopsis Development (10 Hours)

Topics Covered:

- Meaning and purpose of synopsis

- Identification of the broad area of study
- Techniques for narrowing down a research topic
- Formulation of research problem
- Developing research questions
- Writing aims and objectives
- Drafting the rationale/significance of the study
- Structure of an academic synopsis as followed by major universities
- Common errors made in synopsis writing

Learning Outcomes:

- Students will be able to define a clear research topic and prepare a formal synopsis.

Deliverable:

- Submission of a written synopsis to the guide.

Module 2: Review of Literature (15 Hours)

Topics Covered:

- Meaning, purpose, and need for literature review
- Types of literature: empirical, theoretical, conceptual
- Sources: journals, books, theses, conference proceedings, databases
- Use of Google Scholar, JSTOR, Elsevier/Scopus (introduction only)
- Reading strategies and note-making for review
- Identifying themes and gaps in literature
- Writing a structured Review of Literature (ROL)
- Citation practices while reviewing
- Minimum number of reviews (as per departmental guidelines or faculty advice)

Learning Outcomes:

- Students will learn to critically analyze and summarize research papers and identify the existing research gap.

Deliverable:

- Submission of a structured review of literature to the guide.

Module 3: Research Methodology (10 Hours)

Topics Covered:

- Meaning and characteristics of research
- Types of research: Qualitative, Quantitative, Mixed Method
- Concept of variables: independent, dependent, moderating
- Hypothesis: types and formulation
- Research design: descriptive, exploratory, experimental

- Sampling techniques: probability & non-probability
- Tools of data collection: questionnaire, schedule, interview, observation
- Scale of measurement: nominal, ordinal, interval, ratio
- Data types: primary, secondary
- Ethics in research & plagiarism awareness

Learning Outcomes:

- Students will gain theoretical understanding of various research components essential for Phase-II.

Module 4: Referencing Style – APA (5 Hours)

Topics Covered:

- Need for referencing and avoiding plagiarism
- Difference between citations and references
- APA 7th Edition:
 - In-text citations (single author, multiple authors, organization, secondary citations)
 - Reference list entries for: books, journals, websites, edited volumes, reports
 - Formatting rules: indentation, order, punctuation
- Preparing the reference list for the progress report

Learning Outcomes:

- Students will be able to cite sources and prepare reference lists correctly using APA style.

Module 5: Training on Statistical Software (SPSS) (20 Hours)

Topics Covered:

- Introduction to SPSS interface
- Creating and defining variables
- Data entry and data cleaning
- Coding and recoding data
- Descriptive statistics: mean, median, mode, SD, variance
- Frequency distribution and cross-tabulations
- Graphical analysis: bar chart, histogram, pie chart
- Testing normality (introductory level)
- Exporting outputs and interpreting tables
- How to integrate SPSS outputs in the dissertation report

Learning Outcomes:

- Students acquire practical data-handling skills necessary for basic research analysis.

Module 6: Preparation and Submission of Progress Report (20 Hours)

The Progress Report must contain:

1. **Introduction**
2. **Statement of the Problem**
3. **Objectives of the Study**
4. **Significance/Rationale of the Study**
5. **Review of Literature**
6. **Research Gap Identification**
7. **Research Methodology**
8. **APA References**

Learning Outcomes:

- Students will learn to integrate all elements of preliminary research into a structured document.

EVALUATION (Phase-I)

Evaluation is internal and based on continual assessment by the guide.

A dissertation diary/logbook must be maintained by each student, recording details of meetings, suggestions, and progress.

Breakup of Marks (Total = 100):

Component	Marks
Synopsis	30
Review of Literature	30
Research Methodology	30
Referencing (APA Style)	10

Evaluation will consider:

- Timely submission of components
- Clarity and organization of writing
- Depth of analysis in literature review
- Correctness of methodology design
- Accuracy of APA referencing
- Regularity and engagement as reflected in the diary

HR Analytics (Based on IIMK)

(5 credit: 75 Hours) (L-4-T-P)

Course Objectives

1. To understand the basic concepts of Human Resource Analytics and its role in supporting HR decisions.
2. To learn how to collect, analyze, and use HR data for solving people-related problems.
3. To explore important HR metrics and how they are tracked throughout an employee's journey in an organization.
4. To apply analytics in workforce planning, talent sourcing, job analysis, and job evaluation.
5. To use data to improve talent acquisition, predict employee performance, and measure recruitment effectiveness.

Course outcome

CO1: Remember the basic concepts of Human Resource Management and understand the role of analytics in Human Resource Management.

CO 3: Apply the various metrics tracked across an employee's journey.

CO2: Understand the concepts of workforce planning, the steps involved and the metrics tracked.

CO4: Analyse the key factors that enable decision making during talent acquisition.

CO2: Explore the different types of organizational culture and the importance of value congruence.

CO4: Examine the importance of employee engagement and the key drivers that affect it

Module1: Introduction to HR Analytics [15 Hours]

Workforce Planning and Talent Sourcing Analytics: Fundamentals of HR- Strategic Role of HR- People Analytics - Basics- Basics of Statistics- Framework for Problem Solving - Define Problem, Collect Data, Build the Model, Evaluate and Critique the Model, Present Results and Benefits, Deploy Model- Critical Stages of Talent Life Cycle- Case Study - HR Decision Making: Issue Identification and Problem Solving

Module2: HR Practices and Benchmarking: [15 Hours]

Understanding Important HR Metrics tracked across the Overall Employee Journey- HR Valuations- Benchmarking- Dashboarding of Key Performance Indicators (KPI) in Tableau and Excel, Performance and Goal Setting- Providing Performance Feedback

Module 3: Workforce Planning and Talent Sourcing Analytics [15 Hours]

Workforce Planning and its Use- Steps to Workforce Planning- Supply, Demand, Gap and Solution Analysis (Markov Chain, Scatter Plot, Trend Analysis)- Job Analysis - Steps to come out with JD- Types of Job Evaluation - Concepts and Metrics- Types of Job Redesign - Concepts and Metrics

Module 4: Talent Acquisition & Development Analytics: [15 Hours]

Key Factors in Selection that Determine Quality of Hire- Predicting Performance- Measures to Track - Predictive Analysis- Acquisition effectiveness- Employee Training and Development Analytics

Module 5 Induction and Culture Fit & Talent Engagement Analytics: [15 Hours]

Understanding Organizational Culture; Types of Cultures- Socialization Process; Stages of Onboarding- Create an Onboarding Predictive Model- Value Congruence, Importance of Employee Engagement- Major Drivers of Employee Engagement- Employee Engagement Surveys- Variations in Employee Engagement across Days- Employee Engagement Levels in Team

Mapping of Cos

	M1	M2	M3	M4	M5
CO1	M	M	L	L	L
CO2	H	H	M	M	M
CO3	L	H	H	H	H
CO4	L	L	H	H	H

Suggested Readings:

Ulrich, David; Younger, Jon; Brockbank, Wayne; and Ulrich, Mike. *HR from the Outside In: Six Competencies for the Future of Human Resources*. 1st ed., McGraw-Hill Professional, July 2012. ISBN-10: 0071802665; ISBN-13: 978-0071802666.

Becker, Brian E., Huselid, Mark A., and Ulrich, David. *The HR Scorecard: Linking People, Strategy, and Performance*. Boston, MA: Harvard Business School Press, 2001. ISBN-10: 1578511364; ISBN-13: 978-1578511365.

Chamorro-Premuzic, Tomas. *The Talent Delusion: Why Data, Not Intuition, Is the Key to Unlocking Human Potential*. London: Piatkus (Little, Brown Book Group), February 2, 2017. Paperback, xvii + 283 pp. ISBN-10: 0349412480; ISBN-13: 978-0349412481

Motwani, Bharti. *HR Analytics: Practical Approach Using Python*. New Delhi: Wiley India Pvt. Ltd., June 1 2021. Paperback, 652 pp. ISBN-10: 935424002X; ISBN-13: 978-9354240027.

Marketing Analytics

(5 credits: 75 hours) (L-T-P)

Course Objectives

- To introduce participants to core marketing concepts and how data-driven analytics supports marketing decisions.
- To familiarize students with qualitative and quantitative market data collection, preparation, and analysis techniques.
- To equip learners with analytics tools and methods for segmentation, targeting, positioning, and customer behavior analysis.
- To develop capabilities in applying analytics for product management, pricing decisions, and demand forecasting.
- To enable participants to measure promotional effectiveness, digital marketing performance, and customer engagement using analytical models.
- To provide hands-on experience with R, Python, Excel, and Tableau for marketing analytics applications.
- To build practical skills in predictive analytics, sentiment analysis, and customer lifetime value modeling.

Course Outcomes

CO1: Highlight the key marketing concepts and the role of analytics in strategic decision-making.

CO2 : Understand about the market segmentation, targeting, and positioning analytics to real-world marketing problems.

CO3: Apply the demand forecasting, product analytics, and price optimization models to support marketing decisions.

CO4: Effectively summarize, visualize, and analyze marketing data for decision support.

CO5: Create marketing dashboards and reports for data-driven insights using Tableau and Excel.

Module 1: Foundations of Marketing Analytics & Data Preparation

Introduction to Marketing Analytics, Types of Marketing Data: Qualitative vs. Quantitative, Data Collection, Cleaning, and Preparation, Summarizing and Visualizing Marketing Data, Role of Analytics in Marketing Decision Making.

Tools: MS Excel (Pivot Tables, Charts), R Basics

Module 2: Consumer and Market Analysis

Understanding Marketing Environment, Market Segmentation, Targeting, and Positioning (STP) Analytics, Consumer Demographics and Behavioral Analysis, Measuring Customer Attitudes and Preferences

Tools: T-Test, ANOVA, Chi-Square, Exploratory Factor Analysis, Cluster Analysis, Data Visualization (R/Excel)

Module 3: Product, Pricing, and Demand Forecasting Analytics

Product Analytics and New Product Testing, Test Marketing and Product Attribute Analysis, Pricing Strategies and Price Optimization, Demand Forecasting Techniques

Tools: Conjoint Analysis, Logistic Regression, Time Series Forecasting, Solver (Excel)

Module 4: Promotion, Distribution, and Digital Marketing Analytics

Promotion Effectiveness Measurement, Media Planning and Selection, Digital Marketing Metrics: Google Ads, Cost per Click (CPC), Click Through Rate (CTR), Cost Per Mille (CPM), Distribution Channel and Retail Analytics

Tools: Market Basket Analysis, RFM Analysis, Viral Marketing Models, Web Analytics

Module 5: Customer Engagement, Sentiment, and Predictive Analytics

Measuring Customer Satisfaction, Loyalty, and Value, Customer Lifetime Value (CLV) Modeling, Predictive Analytics for Customer Churn and Retention, Social Media Sentiment and Text Analytics

Tools: Regression, SEM, Text Mining, Sentiment Analysis (R/Python), Twitter Analytics, Tableau Dashboards

Suggested Readings:

Kotler, Philip. *Kotler on Marketing: How to Create, Win, and Dominate Markets*. New York: Free Press, 1999.

Kim, W. Chan, and Renée Mauborgne. *Blue Ocean Strategy*. Boston: Harvard Business Review Press, 2005

Heath, Chip, and Dan Heath. *Made to Stick: Why Some Ideas Survive and Others Die*. New York: Random House, 2007.

Cialdini, Robert B. *Influence: The Psychology of Persuasion*. Revised ed., New York: Harper Business, 2021.

Weintraub, Marty. *Killer Facebook Ads: Master Cutting-Edge Facebook Advertising Techniques*. Hoboken: Wiley, 2011.

Jain, Dipak C. *Marketing Analytics: Data-Driven Techniques with Microsoft Excel*. New York: Springer, 2016

Cutler, Dave, and Wayne L. Winston. *Marketing Analytics: Strategic Models and Metrics*. Wiley, 2022.

Wedel, Michel, and Wagner A. Kamakura. *Market Segmentation: Conceptual and Methodological Foundations*. 2nd ed., Boston: Springer, 2000.

Mapping of COs

	M1	M2	M3	M4	M5
CO2	H	M	M	M	M
CO3	M	H	H	M	H
CO4	M	H	H	H	H
CO5	L	M	L	H	L

Database Management for Business (3 Credits - 60 hours) (L-T-P: 2-0-1)

Course Objectives

To introduce fundamental concepts of databases from a business perspective. To enable students to design, manage, and query business databases. To apply database concepts to business functions: marketing, finance, HR, operations, supply chain, customer analytics, etc. To provide hands-on experience with SQL and business database tools. To prepare students for data-driven decision-making roles in business environments.

Course Outcomes

After completing this course, students will be able to:

CO1: Understand core DBMS concepts and apply ER modelling and normalization to design structured business databases. (Understanding)

CO2: Apply SQL commands to manage business data and analyze sales, HR, finance, and inventory information for decision-making. (Applying)

CO3: Analyze database applications in business, evaluate data security measures, and create simple business database solutions. (Analyzing, Evaluating, Creating)

Module I: Foundations of Databases in Business (Theory) [10 Hours]

Introduction to Business Databases: Role of data in modern business, Data-driven decision making, Databases vs spreadsheets in business, Applications in retail, banking, insurance, e-commerce, logistics, HR & finance.

Database Concepts: DBMS, RDBMS, Data Warehouse (concept only), Types of Databases: Operational, Analytical, Cloud, NoSQL (overview),

Data Models: Hierarchical, Network, Relational (focus), ER Models.

Database Design for Business: Entities, attributes, relationships, ER diagrams for business cases: Customer–Order, Employee–Payroll, Supplier–Inventory, Keys, constraints, referential integrity, Normalization (1NF–3NF) with business examples

Module II: Business SQL & Data Handling (Theory + Business Applications) [10 Hour] [15 Hours]

SQL for Business Operations: DDL (CREATE, ALTER, DROP), DML (INSERT, UPDATE, DELETE), DQL (SELECT).

SQL Queries for Business Insights: Filtering, sorting, functions, Joins with business scenarios, Customer segmentation, Sales–product analysis, Employee–department reports, Grouping and Aggregation, Sales summaries, Inventory levels, Profit calculations, HR analytics (attendance, payroll).

Module III: Business Applications, Data Security & Tutorials [10 Hour] [15 Hours]

Database Applications in Business: CRM databases (customers, leads, purchases), ERP modules (inventory, finance, HR, production), Supply Chain & Logistics databases, Banking, insurance & financial databases, E-commerce databases (carts, payments, products), Data analytics dashboards (concept level).

Data Security & Ethical Use in Business: Data privacy, data protection laws (Indian context: DPDP Act basics), Role-based access control in business systems, Backup, recovery & disaster management, Data audit trails in business transactions.

3. Tutorials / Practicals (1 Credit)

Hands-on SQL + Business Applications

- Creating tables for retail, finance, HR datasets

- Writing business-based SQL queries
- Case Study 1: Sales & Inventory analysis
- Case Study 2: HR payroll & attendance system
- Case Study 3: Customer database & CRM
- Basic reporting using SQL
- Mini Project: Business Database Design (any sector)

Suggested Readings

1. Database System Concepts – Korth, Silberschatz & Sudarshan
2. Fundamentals of Database Systems – Elmasri & Navathe
3. Modern Database Management – Jeffrey A. Hoffer
4. SQL for Data Analytics – Upom Malik
5. Data Management for Business – Harvard Business Publishing
6. Introduction to Big Data for Business – OUP

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H		
CO2	-	H	M
CO3	-	M	H

DISSERTATION- Phase II

(6 credits- 75 hours)

Learning Objective: The objective of the course would be to develop analytical skills among the students for solving any research queries. The students will also be taught about the preparation of a project report.

This phase of the Dissertation will comprise of the following:

1. **Field Work:** Collection of data and validation with the respective guide (30 hours)
2. **Analysis of Data:** Analysis and presentation of the data collected through application of various statistical tools through SPSS and other statistical software packages. **(10 hours)**
3. **Test of Plagiarism.**
4. **Submission of Project Report:** Submission of the complete report in continuation from Phase I.
5. **Presentation of work using PPT and Viva Voce Examination.**

EVALUATION:

Evaluation at Phase II will be done by a panel comprising of an external and internal expert along with the respective guide based on quality of work as follows:

Report (30 marks)

Publication in Journal/book/Presentation of research paper in seminar/conference etc.: 20 marks

Plagiarism: 10 marks (below 10 percentage of plagiarism carry 10 marks)

Presentation (20marks)

Viva-Voce (20marks)

BCOM in Business Analytics (Honours) with Research

Project-Dissertation-Phase-I

(18 Credits -540 Hours) (L-T-P: 0-0-36)

Project-Dissertation-Phase-II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

DISSERTATION GUIDELINES

Chapter I: INTRODUCTION

- a. Broad introduction to thesis topic and method. Page or two. Write after remainder of proposal is completed.
- b. Research problem. State broadly, in question form. Give sub-questions. Explain carefully. In one sense, usually the problem is to expand the body of knowledge examined in the literature review.
- c. Need for the research. Who will benefit? Discuss applied and scientific contributions.
- d. Nominal definitions. Define central terms.
- e. Context. Add further info to clarify the research problem.

Chapter II: THEORY: LITERATURE REVIEW

Organize by idea; avoid stringing together abstracts of articles

- a. Overview. Theoretical foundations.
- b. Literature. Group articles by ideas. For a given idea, first discuss common strands in the literature, then departures.
- c. Model. Of a process, usually. Based on the lit reviewed.
- d. Hypotheses (in broad sense of the term; also called Propositions). For each, give brief restatement of justification tied to earlier sections; explain derivation and implications. Include assumptions. Explicitly state plausible rival hypotheses (explanations of process) of a substantive nature
- e. Scope of the study. Theoretical assumptions; discuss limitations they impose.

Chapter III: METHODS

Outline in a few pages.

- a. Introduction. General description of method and design
- b. Design. Experiment, quasi-experiment, survey, and so forth.detailed description
- c. Sample. Universe, population, element, sample design, tolerance, probability.
- d. Measurement. Operational definitions, Include, as applicable, detailed discussion of indexes/scales. Specify methods used to assess validity and reliability.
- e. Analysis. Techniques to be used; justification. Nature of relationships expected (e.g., a symmetrical, symmetrical, reciprocal; linear, monotonic, other curvilinear; necessary, sufficient, necessary and sufficient). Include dummy tables and worked examples of statistics.
- f. Validity. Design: Internal and external, with relevant subtypes.
- g. Methodological assumptions. Discuss limitations they impose.

APPENDICES:

- a. Schedule. In Gantt Chart form.
- b. Facilities. Faculty and staff expertise, library and computer resources, other special facilities contributing to a successful study
- c. Budget.
- d. Bibliographic essay. Sources searched (indexes, abstracts, bibliographies, etc.). Strengths and weaknesses of literature.

Chapter IV: FINDINGS

- a. Brief overview.
- b. Results of application of method; any unusual situations encountered. Nature of sample.
- c. Descriptive analysis. One-way frequency distributions on central variables.
- d. Validity/reliability analysis.
- e. Tests of hypotheses. ANOVAs, cross tabulations, correlations, and such, depending on techniques used; give in same order as hypotheses.

Chapter V: DISCUSSION

When discussing implications, deal with both the theoretical and the practical. Present only interpretations of the findings, not opinion.

- a. Brief overview.
- b. Discussion of results of application of method. Implications.
- c. Discussion of descriptive analysis. Implications.
- d. Discussion of tests of hypothesis. Implications.
- e. Post-hoc analysis. Implications.

Chapter VI: CONCLUSION

May include writer's opinion

- a. Summary of entire thesis in a few pages.
- b. Conclusions. Refer to lit review.

- c. Implications. Speculate about broadest possible consequences, both theoretical and practical. Label speculation clearly.
 - d. Limitations. Theory, method
 - e. Suggestions for future research.
- APPENDICES, Bibliographic essay, Questionnaire and coding manual, if any. Raw data.
- BIBLIOGRAPHY, include all relevant sources examined, whether cited or not

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCE

DEPARTMENT OF CHEMISTRY

PROGRAMME: BACHELOR OF SCIENCE (BSC) in CHEMISTRY (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	CHFC100T	Fundamentals of Chemistry I (3-0-0)	4	301
		CHFC101L	Fundamentals of Chemistry I Lab (0-0-1)		303
2	Major Course 2	CHFC102T	Fundamentals of Chemistry II (3-0-0)	4	304
		CHFC103L	Fundamentals of Chemistry II Lab (0-0-1)		306
3	Major Course 3	CHOF200T	Organic Chemistry I: Oxygen containing functional group (30-0)	4	307
		CHOF201L	Organic Chemistry I: Oxygen containing functional group Lab (0-0-1)		308
3	Major Course 4	CHTH202T	Physical Chemistry I: Thermodynamics (3-0-0)	4	309
		CHTH203L	Physical Chemistry I: Thermodynamics Lab(0-0-1)		311
4	Major Course 5	CHHC204T	Organic Chemistry II: Heterocyclic chemistry (4-0-0)	5	311
		CHHC205L	Organic Chemistry II: Heterocyclic chemistry Lab (0-0-1)		313
4	Major Course 6	CHPC206T	Physical Chemistry II: Phase equilibria and chemical kinetics (4-0-0)	5	313
		CHPC207L	Physical Chemistry II: Phase equilibria and chemical kinetics Lab (0-0-1)		315
4	Major Course 7	CHSP208T	Inorganic Chemistry I: s and p block elements (3-0-0)	4	316
		CHSP209L	Inorganic Chemistry I: s and p block elements Lab (0-0-1)		317
5	Major Course 8	CHBI300T	Organic Chemistry III: Biomolecules (4-0-0)	5	318
		CHBI301L	Organic Chemistry III: Biomolecules Lab (0-0-1)		319
5	Major Course 9	CHCO303T	Inorganic Chemistry II: Coordination Chemistry (4-0-1)	5	320
		CHCO304L	Inorganic Chemistry II: Coordination Chemistry Lab (0-0-1)		321
5	Major Course 10	CHSQ305T	Physical Chemistry III: Spectroscopy and quantum Chemistry (3-0-0)	4	322
		CHSQ306L	Physical Chemistry III: Spectroscopy and quantum Chemistry (0-0-1)		323
6	Major Course 11	CHOS307T	Organic Chemistry IV: Organic Spectroscopy (3-0-0)	4	324
		CHOS308L	Organic Chemistry IV: Organic Spectroscopy Lab (0-0-1)		326

6	Major Course 12	CHBO309T	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (3-0-0)	4	326
		CHBO310L	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (0-0-1)		328
6	Major Course 13	CHEL311T	Physical Chemistry IV: Electrochemistry (3-0-0)	4	329
		CHEL312L	Physical Chemistry IV: Electrochemistry Lab (0-0-1)		330
6	Major Course 14	CHMP313P	Minor Project	4	
7	Major Course 15	CHAI400T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-00)	5	331
		CHAI401L	Inorganic Chemistry IV: Advanced Inorganic Chemistry Lab (0-0-1)		332
7	Major Course 16	CHQC402T	Quantum Chemistry and Group theory (5-0-0)	5	333
8	Major Course 17	CHAP403T	Physical Chemistry V: Advanced Physical Chemistry (5-0-0)	5	334
8	Major Course 18	CHRO404T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	5	336
		CHRO405L	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies Lab (0-0-1)		337

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	CHAS104T	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (3-0-1)	4	339
		CHAS105L	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab (0-0-1)		341
		CHGC106T	Green Chemistry (3-0-1)	4	342
		CHGC107L	Green Chemistry Lab (0-0-1)		343
2	Minor Course 2	CHSP108T	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (3-0-0)	4	344
		CHSP109L	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (0-0-1)		346
		CHIM110T	Inorganic materials and Industrial Importance (3-00)	4	347
		CHIM111L	Inorganic materials and Industrial Importance Lab (0-0-1)		348
3	Minor Course 3	CHFG210T	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I (3-0-0)	4	349
		CHFG211L	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I Lab (0-0-1)		351
		CHPC212T	Polymer Chemistry (3-0-0)	4	352
		CHPC213L	Polymer Chemistry Lab (0-0-1)		354
4	Minor Course 4	CHSP214T	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (3-0-1)	4	355
		CHSP215L	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (0-0-1)		357
		CHRO216T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	4	358
5	Minor Course 5	CHDQ314T	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (3-0-0)	4	359
		CHDQ315L	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (0-0-1)		360
		CHAC316T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	4	362

6	Minor Course 6	CHBC317T	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (3-0-0)	4	363
		CHBC318L	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (0-0-1)		365
		CHAP319T	Physical Chemistry V: Advanced Physical Chemistry (4-0-0)	4	366
7	Minor Course 7	CHAM406T	Analytical Methods in Chemistry (3-0-0)	3	367
7	Minor Course 8	CHRM407T	Research Methodology	2	368
8	Minor Course 9	CHML408T	Molecules of Life (3-0-0)	3	370

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	CHBC112L	Basic Analytical Chemistry (1-0-2)	3	372
2	S E Course 2	CHCH113L	Chemoinformatics (1-0-2)	3	373
3	S E Course 3	CHIP217L	Intellectual Property Rights (3-0-0)	3	374

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	CHIN114I	Internship	4	375
4	Internship	CHIN218I	Internship	4	375
5	Internship	CHIN320I	Internship	2	375

RESEARCH PROJECT /DISSERTATION

BSC CHEMISTRY (Honours)					
Semester	Category	Course Code	Course Name	Credits	Page No
7	Research Project/Dissertation	CHDI409P	Research Project Phase I	6	376
8	Research Project/Dissertation	CHDI410P	Research Project Phase II	6	376
BSC CHEMISTRY (Honours) with Research					
Semester	Category	Course Code	Course Name	Credits	Page No
7	Research Project/Dissertation	CHDI411P	Dissertation I	18	376
8	Research Project/Dissertation	CHDI412P	Dissertation II	20	377

INTRODUCTORY MULTI DISCIPLINARY COURSES**CHFN115T: FOOD AND NUTRITION (3-0-0)****(NHEQF:5)****Course Outcomes**

CO 1: Revisit the relationship between food, nutrition and health. (Remembering)

CO 2: Explain the importance of nutritional diets, deficiency and management during the life cycle.

(Understanding) CO 3: Apply the knowledge of food chemistry for career development. (Applying)

Module I: Food, nutrients and their needs (12 hours)

Basic idea of food, nutrition and health; functions of food, Nutritional Requirement during Infancy, maternal Childhood; Diet, Nutrition and Adolescence; Nutrition in the Elderly.

Module II: Nutritional constituents (10 hours)

Sources and functions of (a) Carbohydrates; (b) Amino acids and proteins; (c) Lipids (d) Mineral; (e) Vitamins: A, D, E, K.

Module III: Categories of food (10

hours) Study of the following categories of food:

(a) Cereals; (b) Pulses; (c) Fruits and vegetables; (d) Milk and milk products; (e) Egg, meat, poultry and fish; (f) Fats and oils.

Module IV: Management of deficiencies/ Dietary goals (11 hours)

Causes, symptoms, treatments of certain important nutrient deficiencies, Food Preservation & Food Additives & Colorants, Social Health Issues – Smoking, Alcoholism, Drug Addiction, AIDS and AIDS Control Programs.

Module V: Food perspectives (2 hours)

Career opportunity in food chemistry, food industry, Entrepreneur Development.

Suggested Readings

1. Essential of food chemistry, JAGAT BAHADUR K.C. and BASANTA KUMAR RAI, Electronic library, DMC/NAAST/CCT.
2. Food Chemistry, H.-D. Belitz · W. Grosch · P. Schieberle, 4th revised and extended ed., Springer.
3. Fundamentals of Foods, Nutrition and Diet Therapy, S. R. Mudambi and M. V. Rajagopal, New Age International.
4. Handbook of Food and Nutrition, M. Swaminathan, BAPPCO.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	H	H	
CO3			H		H

CHEE116T: ENERGY AND ENVIRONMENT (3-0-0)**(NHEQF:5)****Course Outcomes:**

1. Recall the concept of fuel petroleum chemistry as energy sources (Remembering)

2. Application of medicinal chemistry in daily life (Applying)
3. Analysis of the cause of pollution and their preventive measurements. (Analysing)

Module I: Importance of chemistry in energy and technology (15 Hours)

Renewable and non-renewable source of energy, origin, composition and importance of petroleum, distillation and fractional distillation, refining of petroleum, Cracking and Reforming process, Applications of various fractions of crude oil, Petrol, Diesel, Kerosene, LPG, CNG, LNG, clean fuels, Octane number, Flash point, calorific value, knocking and anti-knocking properties of oil, use of hydrogen as fuel, sustainable energy source and future scope.

Module II: Pharmaceutical Chemistry (15 Hours)

Definition of drug, Classification of drug, mechanism of drug action, mode of action of various types of drugs, natural and synthetic drug, importance of traditional herbs as medicine and their comparison with synthetic drug, lethal dose and toxicity of drug, preliminary concept of antibiotic, antiviral, anti-HIV, anti-cancer and antimalarial drugs.

Module III: Environmental pollution and management (15 Hours)

Concept of pollution, causes of environmental pollution and their adverse effects, definition of air pollution, major air pollutants, their sources and influences, acid rain, photochemical smog, effects on organisms and on materials, water pollution major sources and impacts, eutrophication, water treatment processes, soil pollution, causes of soil pollution, soil salinity, sources of soil pollutants, major influences and remedial measures, radioactive pollution, Pollution Monitoring and Control, importance of waste management system, concept of reusability or recyclability in practical life for minimizing waste.

Suggested Readings:

1. Drugs and Pharmaceutical Sciences Series, Marcel Dekker, Vol. II, INC, New York.
2. Introduction to Industrial Chemistry, B.K. Sharma: Goel Publishing, Meerut (1998)
3. Environmental Chemistry, Manahan, S. E. 9th edn. (CRC Press, Boca Raton, 2010).
4. Environmental Chemistry, J. W. Moore & E. A. Moore. Academic Press, London (1976).

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H		
CO 3		H	
CO4			H

COMMON VALUE BASED COURSES**CBES101T: ENVIRONMENTAL STUDIES**

(1 credit: 15 hours)

(NHEQF: 5)

Course Outcomes:

- CO 1: Recall the multidisciplinary nature of environmental studies. (Remembering)
 CO 2: Explain ecological processes of natural resources. (Understanding)
 CO 3: Categorize different types of natural resources. (Analysing)
 CO 4: Evaluate the global scale of environmental pollution. (Evaluating)

Module I: The Multidisciplinary Nature of Environmental Studies (1 lectures) Definition, scope and importance, need for public awareness.

Module II: Natural Resources (2 lectures)

- Different types of natural resources and associated problems - forest resources, water resources, mineral resources, food resources, energy resources and land resources.
- Conservation of natural resources.

Module III: Ecosystems (2 lectures)

- Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, food chains, food webs.
- Structure of following ecosystems - forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems.

Module IV: Biodiversity and Its Conservation (2 lectures)

Types of biodiversity – genetic, species and ecosystem, value of biodiversity, global biodiversity, India as a mega-diversity nation, threats to biodiversity, conservation of biodiversity - in-situ and ex-situ conservation.

Module V: Environmental Pollution (3 lectures)

- Definition, causes, effects and control measures of - air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards and e-pollution.
- Solid waste management.
- Disaster management.

Module VI: Social Issues and the Environment (3 lectures)

- From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, climate change, global warming, acid rain, ozone layer depletion.
- Environment protection act.
- Introduction to environmental impact assessment.

Module VII: Human Population and the Environment (2 lectures)

Population growth and sex ratio; Population explosion - family welfare programme; Environment and human health; HIV/AIDS; Role of information technology in environment and human health.

Suggested Readings

- Textbook for Environmental Studies, E. Bharucha, UGC, New Delhi.
- Fundamentals of Environmental Studies, S. Somvanshi and R. Dhupper, S.K. Kataria and Sons Publisher.
- Environmental Chemistry, A. K. De, New age publishers.
- Environmental Studies, Third edition, J. P. Sharma, University Science Press.
- Comprehensive Environmental Studies, K. G. Bhattacharyya and A. Sarma, Narosa Publishing House Pvt, Ltd.

E Resources

- <https://www.youtube.com/watch?v=zuSFs85kuJs&list=PLIC0i9IRboHb19v2dF0yuenG7xDOGJLeP>
- <https://www.youtube.com/watch?v=tMwFNMfjFuU&list=PL8dPuuaLjXtOikZljhKAe28AkupJXnS2u>

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	H				H		H
CO 2		M	H				
CO 3				M		H	

PROGRAMME: BACHELOR OF SCIENCE in CHEMISTRY (BSC)

DEGREE: BSC CHEMISTRY (HONOURS)/ BSC CHEMISTRY (HONOURS) WITH RESEARCH

PROGRAM OUTCOMES – UG PROGRAMME

- PO 1: **Disciplinary Knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study.
- PO 2: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. Critically evaluate practices, policies and theories by following scientific approach to knowledge development.
- PO 3: **Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully; and present complex information in a clear and concise manner to different groups.
- PO 4: **Social Interaction:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO 5: **Effective Citizenship:** Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO 6: **Moral and Ethical Awareness:** Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
- PO 7: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
- PO 8: **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio- technological changes. Critical sensibility to lived experiences, with self awareness and reflexivity of both and society.
- PO 9: **Information and Digital Literacy:** Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.
- PO 10: **Research related skills:** A sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause- and- effect relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Ability to apply one's learning to real life situations.

PROGRAM SPECIFIC OUTCOMES (BSC CHEMISTRY)

- PSO 1: **Scientific Problem-solving skill** Sound knowledge of fundamentals which can develop the problem-solving skills using chemical principles.
- PSO 2: **Analytical skills:** Develop analytical skills such as synthesizing, separating, characterizing chemical compounds and chemical reaction with the help of sophisticated instruments.
- PSO 3: **Skills related to employability:** Develop deep knowledge in some applied areas of chemistry such as pesticides chemistry, pharmaceutical chemistry etc. which helps in employability.

PSO 4: **Learning on life processes:** Develop basic understanding the role of chemistry in natural products as well as biological system.

SYLLABUS (BSC CHEMISTRY)

MAJOR COURSES			
Sl. No	Course Code	Course Name	Sl. No.
1	CHFC100T	Fundamentals of Chemistry I (3-0-0)	1.1
2	CHFC101L	Fundamentals of Chemistry I Lab (0-0-1)	1.2
3	CHFC102T	Fundamentals of Chemistry II (3-0-0)	2.1
4	CHFC103L	Fundamentals of Chemistry II Lab (0-0-1)	2.2
5	CHOF200T	Organic Chemistry I: Oxygen containing functional group (3-0-0)	3.1
6	CHOF201L	Organic Chemistry I: Oxygen containing functional group Lab (0-0-1)	3.2
7	CHTH202T	Physical Chemistry I: Thermodynamics (3-0-0)	3.3
8	CHTH203L	Physical Chemistry I: Thermodynamics Lab(0-0-1)	3.4
9	CHHC204T	Organic Chemistry II: Heterocyclic chemistry (3-0-0)	4.1
10	CHHC205L	Organic Chemistry II: Heterocyclic chemistry Lab (0-0-1)	4.2
11	CHPC206T	Physical Chemistry II: Phase equilibria and chemical kinetics (3-0-0)	4.3
12	CHPC207L	Physical Chemistry II: Phase equilibria and chemical kinetics Lab (0-0-1)	4.4
13	CHSP208T	Inorganic Chemistry I: s and p block elements (3-0-0)	4.5
14	CHSP209L	Inorganic Chemistry I: s and p block elements Lab (0-0-1)	4.6
15	CHBI300T	Organic Chemistry III: Biomolecules (3-0-0)	5.1
16	CHBI301L	Organic Chemistry III: Biomolecules Lab (0-0-1)	5.2
17	CHCO303T	Inorganic Chemistry II: Coordination Chemistry (3-0-0)	5.3
18	CHCO304L	Inorganic Chemistry II: Coordination Chemistry Lab (0-0-1)	5.4
19	CHSQ305T	Physical Chemistry III: Spectroscopy and quantum Chemistry (3-0-0)	5.5
20	CHSQ306L	Physical Chemistry III: Spectroscopy and quantum Chemistry (0-0-1)	5.6
21	CHOS307T	Organic Chemistry IV: Organic Spectroscopy (3-0-0)	6.1
22	CHOS308L	Organic Chemistry IV: Organic Spectroscopy Lab (0-0-1)	6.2
23	CHBO309T	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (3-0-0)	6.3
24	CHBO310L	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (0-0-1)	6.4
25	CHEL311T	Physical Chemistry IV: Electrochemistry (3-0-0)	6.5
26	CHEL312L	Physical Chemistry IV: Electrochemistry Lab (0-0-1)	6.6
27	CHMP313P	Minor Project	6.7
28	CHAI400T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	7.1
29	CHAI401L	Inorganic Chemistry IV: Advanced Inorganic Chemistry Lab (0-0-1)	7.2
30	CHQC402T	Quantum Chemistry and Group theory (5-0-0)	7.3
31	CHAI400T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	8.1
32	CHAI401L	Inorganic Chemistry IV: Advanced Inorganic Chemistry Lab (0-0-1)	8.2
33	CHQC402T	Quantum Chemistry and Group theory (5-0-0)	8.3
MINOR COURSES			

34	CHAS104T	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (3-0-1)	1.3
35	CHAS105L	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab (0-0-1)	1.4
36	CHGC106T	Green Chemistry (3-0-1)	1.5
37	CHGC107L	Green Chemistry Lab (0-0-1)	1.6
38	CHSP108T	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (3-0-0)	2.3
39	CHSP109L	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (0-0-1)	2.4
40	CHIM110T	Inorganic materials and Industrial Importance (3-0-0)	2.5
41	CHIM111L	Inorganic materials and Industrial Importance (0-0-1)	2.6
42	CHFG210T	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I (3-0-0)	3.5
43	CHFG211L	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I Lab (0-0-1)	3.6
44	CHPC212T	Polymer Chemistry (3-0-0)	3.7
45	CHPC213L	Polymer Chemistry Lab (0-0-1)	3.8
46	CHSP214T	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (3-0-1)	4.7
47	CHSP215L	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (0-0-1)	4.8
48	CHRO216T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	4.9
49	CHDQ314T	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (3-0-0)	5.7
50	CHDQ315L	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (0-0-1)	5.8
51	CHAC316T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	5.9
52	CHBC317T	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (3-0-0)	6.8
53	CHBC318L	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (0-0-1)	6.9
54	CHAP319T	Physical Chemistry V: Advanced Physical Chemistry (4-0-0)	6.10
55	CHAM406T	Analytical Methods in Chemistry (3-0-0)	7.4
56	CHRM407T	Research Methodology	7.5
57	CHML408T	Molecules of Life (3-0-0)	8.4
SKILL ENHANCEMENT COURSES			
58	CHBC112L	Basic Analytical Chemistry (1-0-2)	1.7
59	CHCH113L	Chemoinformatics (1-0-2)	2.7
60	CHIP217L	Intellectual Property Rights (3-0-0)	3.9

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
1.1	H	H	H					H	M		H	L		

1.2	H	H	H	M				M	M	L	H	M		
1.3	M	M								L		M		M
1.4	H	H	H	M				L	M		H	L		
1.5	H	H	H	M	L	L	M	M	M	M	H		M	
1.6	H	H	H	H	L	L	M	M	M	M	H	M	H	
1.7	H	H	H	H	M		M	M	M	M	H	H	H	
2.1	H	H	H	M				M	M	L	H	M		
2.2	H	H	H	M				M	M	L	H	M		
2.3	M	M					M			H	M	M	H	
2.4	H	H	H	M				L	M		H	L		
2.5	H	H	H		L			M	M	M	H		M	
2.6	H	H	H	M	L			M	M	M	H	M	H	
2.7	H	H	H	H	M			M	H	M	H	M	H	
3.1	H	H	H					H	M		H			
3.2	H	H	H	M				M	M	L	H	M		
3.3	H	H	H					H	M		H	L		
3.4	H	H	H	M				M	M	L	H	M		
3.5	H	H	H					L	M		H			
3.6	M		H	M		H		L			M	M		
3.7	H	H	H		L			M	M	L	H		M	
3.8	H	H	H	M	L			M	M	M	H	M	H	
3.9	H	H	H	H	M			M	M	M	H		H	
4.1	H	H	H					H	M		H			M
4.2	H	H	H	M				M	M	L	H	M		M
4.3	H	H	H	M				H	M	M	H			M
4.4	H	H	H	M			L	M	M	L	H	M	M	M
4.5	H	H	H					H	M		H			
4.6	H	H	H	M				M	M	L	H	M		
4.7	H	H	H	M				L	M		H	M		
4.8	M		H	M		H		L			M	M	L	
4.9	H	H	H	M				H	M	M	H		M	
5.1	H	H	H					H	M		H			H
5.2	H	H	H	M				M	M	L	H	M		H
5.3	H	H	H					H	M		H			
5.4	H	H	H	M				M	M	L	H	M		
5.5	H	H	H					H	H		H			
5.6	H	H	H	M				M	H	L	H	H		
5.7	H	H	M	L						L		M		M
5.8	M	M	H	M				L	M		H	L	M	
5.9	H	H	H	M		H		H			H		L	
6.1	H	H	H					H	M	M	H			
6.2	H	H	H	M				M	M	L	H	H		

6.3	H	H	H					H	M		H			
6.4	H	H	H	M				M	M	L	H	M		
6.5	H	H	H					H	M		H	L		
6.6	H	H	H	M			L	M	M	L	H	M		
6.7		M	H			M		H	H	H	H	M	M	M
6.8	H	H	M	L						L	H	M	L	
6.9	M	M	H	M				L	M	L	H	L	M	
6.10	H	H	H	M		H		H			H		L	
7.1	H	H	H	M		H		H			H		L	
7.2	H	H	H	M			L	M	M	L	H			
7.3	H	H	H			M		H	H	M	H			
7.4	H	H	H		L			M	M	M	H		M	
7.5	H	H	H	M	L			M	H	H	H	L		
8.1	H	H	H	M		H		H			H		L	
8.2	H	H	H	M			L	M	M	L	H			
8.3	H	H	H	M		H		H			H		L	
8.4	H	H	H					H	H	M	H		M	H

DETAILED SYLLABUS MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	CHFC100T	Fundamentals of Chemistry I (3-0-0)	4
		CHFC101L	Fundamentals of Chemistry I Lab (0-0-1)	
2	Major Course 2	CHFC102T	Fundamentals of Chemistry II (3-0-0)	4
		CHFC103L	Fundamentals of Chemistry II Lab (0-0-1)	
3	Major Course 3	CHOF200T	Organic Chemistry I: Oxygen containing functional group (3-0-0)	4
		CHOF201L	Organic Chemistry I: Oxygen containing functional group Lab (0-0-1)	
3	Major Course 4	CHTH202T	Physical Chemistry I: Thermodynamics (3-0-0)	4
		CHTH203L	Physical Chemistry I: Thermodynamics Lab(0-0-1)	
4	Major Course 5	CHHC204T	Organic Chemistry II: Heterocyclic chemistry (4-0-0)	5
		CHHC205L	Organic Chemistry II: Heterocyclic chemistry Lab (0-0-1)	
4	Major Course 6	CHPC206T	Physical Chemistry II: Phase equilibria and chemical kinetics (4-0-0)	5
		CHPC207L	Physical Chemistry II: Phase equilibria and chemical kinetics Lab (0-0-1)	
4	Major Course 7	CHSP208T	Inorganic Chemistry I: s and p block elements (3-0-0)	4
		CHSP209L	Inorganic Chemistry I: s and p block elements Lab (0-0-1)	
5	Major Course 8	CHBI300T	Organic Chemistry III: Biomolecules (4-0-0)	5
		CHBI301L	Organic Chemistry III: Biomolecules Lab (0-0-1)	
5		CHCO303T	Inorganic Chemistry II: Coordination Chemistry (4-0-1)	5

	Major Course 9	CHCO304L	Inorganic Chemistry II: Coordination Chemistry Lab (0-0-1)	
5	Major Course 10	CHSQ305T	Physical Chemistry III: Spectroscopy and quantum Chemistry (3-0-0)	4
		CHSQ306L	Physical Chemistry III: Spectroscopy and quantum Chemistry (0-0-1)	
6	Major Course 11	CHOS307T	Organic Chemistry IV: Organic Spectroscopy (3-0-0)	4
		CHOS308L	Organic Chemistry IV: Organic Spectroscopy Lab (0-0-1)	
6	Major Course 12	CHBO309T	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (30-0)	4
		CHBO310L	Inorganic Chemistry III: Bioinorganic and Organometallic Chemistry (00-1)	
6	Major Course 13	CHEL311T	Physical Chemistry IV: Electrochemistry (3-0-0)	4
		CHEL312L	Physical Chemistry IV: Electrochemistry Lab (0-0-1)	
6	Major Course 14	CHMP313P	Minor Project	4
7	Major Course 15	CHAI400T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	5
		CHAI401L	Inorganic Chemistry IV: Advanced Inorganic Chemistry Lab (0-0-1)	
7	Major Course 16	CHQC402T	Quantum Chemistry and Group theory (5-0-0)	5
8	Major Course 17	CHAP403T	Physical Chemistry V: Advanced Physical Chemistry (5-0-0)	5
8	Major Course 18	CHRO404T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	5
		CHRO405L	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies Lab (0-0-1)	

CHFC100T: FUNDAMENTALS OF CHEMISTRY I

(3 Credits-45 hours) (L-T-P: 3-0-0)

(NHEQF:5)**Objective***This course will discuss about the basic concepts of inorganic, organic and physical chemistry***Course/ Learning Outcomes**

At the end of this course students will be able to:

CO 1: Recall the basic concepts of organic chemistry like electronic displacements, nomenclature, hybridization etc. and chemical kinetics (Remembering)

CO 2: Predict the structure and properties of molecules and also the kinetics of the reactions. (Applying)

CO 3: Evaluate the optical activity, absolute and relative configuration using the concept of stereochemistry (Evaluating)

Module I: Inorganic Chemistry (15 lectures) a) Atomic Structure (8 lectures)

Review of: Bohr's theory and its limitations, Heisenberg uncertainty principle. Dual behaviour of matter and radiation, de-Broglie's relation. Hydrogen atom spectra. Need of a new approach to atomic structure.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s).

Rules for filling electrons in various orbitals, electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

b) Chemical Bonding and Molecular Structure (7 lectures)

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Landé equation for calculation of lattice energy (no derivation), Born-Haber cycle and its applications, Fajan's rules, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR (H_2O , NH_3 , PCl_5 , SF_6 , ClF_3 , SF_4) and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral complexes.

Concept of resonance and resonating structures in various inorganic and organic compounds. MO treatment of homonuclear diatomic molecules of 1st and 2nd periods and heteronuclear diatomic molecules such as CO , NO and NO^+ .

Module II: Organic Chemistry (15 lectures)

a) Basics of Organic Chemistry (6 lectures)

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.

Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophilicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes. Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

b) Stereochemistry (9 lectures)

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis-trans and, syn-anti isomerism E/Z notations with C.I.P rules.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centers, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

Module III: Physical Chemistry (15 lectures)

Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Suggested Readings

1. A new Concise Inorganic Chemistry, J. D. Lee, E L. B. S.
2. Basic Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley.
3. Concepts and Models in Inorganic Chemistry, McDaniel Douglas and J. Alexander, Wiley.
4. Inorganic Chemistry: Principles of Structure and Reactivity, J. Huheey, E. Keiter and R. Keiter, Pearson Publication. Organic Chemistry, T.W. G. Solomon, John Wiley and Sons.
5. A Guide Book to Mechanisms in Organic Chemistry, P. Sykes, Orient Longman.

6. Stereochemistry of Carbon Compounds, E. L. Eliel, Tata McGraw Hill.
7. Organic Chemistry (Vol I and II), I. L. Finar, E. L. B. S.
8. Organic Chemistry, R. T. Morrison, R. N. Boyd, Prentice Hall.
9. Shriver & Atkins' Inorganic Chemistry, P. Atkins, T. Overton, J. Rourke, F. Armstrong and M. Weller, Oxford University Press.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3		H	

CHFC101L: FUNDAMENTALS OF CHEMISTRY LAB

(1 Credits- 30 hours) (L-T-P: 0-0-1)

(NSQF:5)**Objective**

This course will help the students to learn about the basic laboratory experiments of Inorganic, Organic and Physical chemistry together.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concept of molarity, normality, molality etc. (Remembering)

CO 2: Illustrate the concept of solubility for purification of organic compounds via recrystallization (Understanding)

CO 3: Identify unknown organic molecule by determining the melting point of the compounds. (Creating) CO 4: Evaluate the activation energy of a given reaction. (Evaluating)

Module I: Organic Experiments

- a. Checking the calibration of the thermometer.
- b. Purification of organic compounds by crystallization using the following solvents:
 1. Water
 2. Alcohol
 3. Alcohol-Water
- c. Determination of the melting points of above compounds and unknown organic compounds (Kjeldahl method and electrically heated melting point apparatus).
- d. Effect of impurities on the melting point – mixed melting point of two unknown organic compounds.
- e. Determination of boiling point of liquid compounds (boiling point lower than and more than 100 °C by distillation and capillary method).
- f. Estimation of oxalic acid by titrating it with KMnO₄.
- g. Estimation of Cu (II) ions iodometrically using Na₂S₂O₃.
- h. Detection of elements in organic compounds.

Module II: Inorganic Experiments

- a. Estimation of oxalic acid by titrating it with KMnO₄.
- b. Estimation of Cu (II) ions iodometrically using Na₂S₂O₃.

Module III: Physical Experiments

Chemical Kinetics: Study the kinetics of the following reactions.

- a. Initial rate method: Iodide-persulphate reaction.

- b. Integrated rate method:
- Acid hydrolysis of methyl acetate with hydrochloric acid.
 - Saponification of ethyl acetate.
 - Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methyl acetate.

Suggested Readings

1. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.
2. Practical Organic Chemistry B. S. Furniss, A.J. Hannaford, P.W.G. Smith, and A. R. Tatchell, , Pearson.
3. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall
4. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall 5. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1		H	
CO 2	H		
CO3	H		
CO4			H

CHFC102T: FUNDAMENTALS OF CHEMISTRY II

(3 Credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF:5)

Objective

This course will discuss about the fundamental concepts of inorganic, organic and physical chemistry.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explain the periodicity of elements and thermodynamics of chemical reactions. (Understanding)
 CO 2: Calculate the change in free energy accompanying a chemical reaction. (Applying)
 CO 3: Explain the mechanism of different organic reactions. (Analysing)

Module I: Physical Chemistry (15 lectures)

a) Thermodynamics and Chemical Equilibrium (6 lectures) Review of thermodynamics and the Laws of Thermodynamics.

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between G and G° , Le Chatelier's principle. Relationships between K_p , K_c and K_x for reactions involving ideal gases.

b) Ionic Equilibria (9 lectures)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Module II: Organic Chemistry (15 lectures)

a) Chemistry of Aliphatic Hydrocarbons (10 lectures)

- **Carbon-Carbon sigma bonds:** Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.
- **Carbon-Carbon pi bonds:** Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/AntiMarkownikoff addition), mechanism of oxymercuration-demercuration, hydroboration oxidation, ozonolysis, reduction (catalytic and chemical), syn and antihydroxylation(oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethylbenzene.

Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

- **Cycloalkanes and Conformational Analysis:** Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

b) Aromatic Hydrocarbons (5 lectures)

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

Module III: Inorganic Chemistry (15 lectures)

a) Atomic Structure (6 lectures)

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de-Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2 . Quantum numbers and their significance.

Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals.

Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's principle and its limitations, Variation of orbital energy with atomic number.

b) Periodicity of Elements (6 lectures) *s*, *p*, *d*, *f* block elements, the long form of periodic table. Detailed discussion of the following properties of the elements, with reference to *s* & *p*-block.

- Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
- Atomic radii (van der Waals).
- Ionic and crystal radii.
- Covalent radii (octahedral and tetrahedral).
- Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

c) Oxidation-Reduction (3 lectures)

Redox equations, Standard Electrode Potential and its application to inorganic reactions. Principles involved in volumetric analysis to be carried out in class.

Suggested Readings

1. Organic Chemistry, T. W. G. Solomons, John Wiley and Sons.
2. A Guide Book to Mechanism in Organic Chemistry, P. Sykes, Orient Longman.
3. Organic Chemistry (Vol. I & II), I. L. Finar, E. L. B. S.
4. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice Hall.
5. Physical Chemistry, G. M. Barrow, Tata McGraw Hill.
6. Physical Chemistry, G. W. Castellan, Narosa.
7. General Chemistry Cengage Lening India Pvt. Ltd. J. C. Kotz, P. M. Treichel, and J. R. Townsend, New Delhi.

8. University Chemistry, B. H. Mahan, Narosa.
9. General Chemistry, R. H. Petrucci, Macmillan Publishing Co.: New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		H
CO 2	M		
CO 3		H	

CHFC103L: FUNDAMENTALS OF CHEMISTRY II LAB

(1Credits – 30 hours) (L-T-P: 0-0-1)

(NSQF:5)**Objective**

This course will help the students to learn about the laboratory experiments of Inorganic, Organic and Physical chemistry together.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Understand the chromatographic technique for separation and purification of mixture of organic compounds. (Understanding)
- CO 2: Apply the concept of acid-base titration for estimation. (Applying)
- CO 3: Apply principles of experiments related to pH meter and thermochemistry (Applying)

Module I: Organic Experiments

1. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography.
2. Separation of a mixture of two sugars by ascending paper chromatography.
3. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC).
4. Estimation of Sodium carbonate and Sodium hydroxide present together in mixture.
5. Estimation of Fe(II) and oxalic acid using standardized KMnO_4 solution.

Module II: Inorganic Experiments

1. Estimation of Sodium carbonate and Sodium hydroxide present together in mixture.
2. Estimation of Fe(II) and oxalic acid using standardized KMnO_4 solution.

Module III: Physical Experiments

1. Preparation of buffer solutions of different pH □ Sodium acetate-acetic acid.
 - Ammonium chloride-ammonium hydroxide.
2. pH metric titration of
 - strong acid vs. strong base.
 - weak acid vs. strong base.
 - Determination of dissociation constant of a weak acid.
3. Thermochemistry
 - Determination of heat capacity of calorimeter for different volumes.
 - Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

Suggested Readings

1. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.

2. Practical Organic Chemistry B. S. Furniss, A.J. Hannaford, P.W.G. Smith, and A. R. Tatchell, , Pearson.
3. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall
4. Vogel, A. I. Vogel's Qualitative Inorganic Analysis, Prentice Hall
5. Experiments in Physical Chemistry, C. W. Garland, J. W. Nibler and D. P. Shoemaker, McGraw-Hill, New York.
6. Experimental Physical Chemistry A. M. Halpern and G. C. McBane, W.H. Freeman & Co. New York.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1	H		
CO 2		H	
CO3			H

CHOF200T: ORGANIC CHEMISTRY-I: OXYGEN CONTAINING FUNCTIONAL GROUPS

(3 Credits – 45 hours) (L-T-P:3-0-0)

(NHEQF: 5.5)**Objective***This course is aimed at familiarizing students with the concepts of different functional groups.***Course / Learning Outcomes**

At the end of this course students will be able to:

CO 1: Recall concepts of chemical reactivity of different organic compounds.

(Remembering) CO 2: Explain the chemistry of halogenated hydrocarbons. (Understanding)

CO 3: Solve problems of transformation of functional groups using different reactions conditions. (Applying) CO 4: Differentiate alcohols, phenol, ethers, epoxides. (Analysing)

Module I: Chemistry of Halogenated Hydrocarbons (10 lectures)Alkyl halides: Methods of preparation and properties, nucleophilic substitution reactions – S_N1 , S_N2 and S_Ni mechanisms with stereo chemical aspects and effect of solvent etc.; nucleophilic substitution vs. elimination.Aryl halides: Preparation (including preparation from diazonium salts) and properties, nucleophilic aromatic substitution; S_NAr , Benzyne mechanism.

Relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution reactions. Organometallic compounds of Mg (Grignard reagent) – Use in synthesis of organic compounds.

Module II: Alcohols, Phenols, Ethers and Epoxides (10 lectures)

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Bouvaelt-Blanc Reduction; Oxidation of diols by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement.

Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's– Schmidt Reactions, Fries and Claisen rearrangements with mechanism.

Ethers and Epoxides: Preparation and reactions with acids. Reactions of epoxides with alcohols, ammonia derivatives and $LiAlH_4$.**Module III: Carbonyl Compounds and Carboxylic acids (25 lectures)**

Structure, reactivity, preparation and properties; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation,

Knoevenagel condensation, ClaisenSchmidt, Perkin, Cannizzaro and Wittig reaction, Beckmann and Benzil-Benzilic acid rearrangements, haloform reaction and Baeyer Villiger oxidation, α - substitution reactions, oxidations and reductions (Clemmensen, Wolff-Kishner, LiAlH_4 , NaBH_4 , Meerwein-Pondorf-Verley (MPV), PDC.

Addition reactions of α , β - unsaturated carbonyl compounds: Michael addition.

Active methylene compounds: Keto-enol tautomerism, preparation and synthetic applications of diethyl malonate and ethyl acetoacetate.

General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituents on acidic strength, typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids.

Preparation and reactions of acid chlorides, anhydrides, esters and amides; Comparative study of acyl group, mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions, Hofmann- bromamide degradation and Curtius rearrangement.

Suggested Readings

1. Organic Chemistry, R. T. Morrison and R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Organic Chemistry (Volume 1), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Organic Chemistry, T. W. G. Solomons and C. B. Fryhle, John Wiley & Sons, Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2		H	
CO 3	H	H	H
CO 4		H	

CHOF201L: ORGANIC CHEMISTRY-I: OXYGEN CONTAINING FUNCTIONAL GROUPS LAB

(1 Credits – 30 hours) (L-T-P: 0-0-1)

(NSQF:5)

Objective

This course helps the students to understand clearly about the synthesis of some organic compounds and detection of functional group.

Course /Learning Outcomes

At the end of this course students will be able to:

- CO 1: Recall principles and procedures involved in functional group detection of organic compounds and preparations. (Remembering)
- CO 2: Explain the chemistry behind the detection of functional groups. (Understanding)
- CO 3: Carry out reactions to transform functional groups. (Applying)
- CO 4: Assess optimal conditions for organic reactions. (Evaluating)

Module I:

- a. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group. b. Organic preparations:

Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and phenols (β -naphthol, vanillin, salicylic acid) by any one method:

- i. Using conventional method.
- ii. Using green approach.

- iii. Benzoylation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, p-anisidine) and one of the following phenols (β -naphthol, resorcinol, p- cresol) by Schotten-Baumann reaction.
- iv. Oxidation of ethanol/ isopropanol (Iodoform reaction).
- v. Selective reduction of meta dinitrobenzene to m-nitroaniline.
- vi. Hydrolysis of amides and esters. vii. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
- viii. S-Benzylisothiuronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).
- ix. Aldol condensation using either conventional or green method.
- x. The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization and melting point.

Suggested Readings

1. Practical Organic Chemistry, F. G. Mann, and B. C. Saunders, Pearson Education.
2. Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A.R. Tatchell, Pearson.
3. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia and R. Aggarwal, University Press.
4. Comprehensive Practical Organic Chemistry: Qualitative Analysis, V. K. Ahluwalia and S. Dhingra, University Press.

Mapping of Cos to Syllabus

Course Outcomes	Exp a	Exp b
CO 1	H	H
CO 2	H	
CO 3	H	
CO 4		M

CHTH202T: PHYSICAL CHEMISTRY-I: CHEMICAL THERMODYNAMICS

(3 Credits – 45 hours) (L-T-P:3-0-0)

(NHEQF: 5.5)

Objective

In this course, students learn how the laws of thermodynamics influence chemical and phase equilibria in ideal and non-ideal fluids (liquids and gases).

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explain the laws of thermodynamics and the properties of thermodynamic functions (Understanding)
 CO 2: Derive equations relating different thermodynamic functions (Applying)
 CO 3: Apply thermodynamic laws and equations to explain phase and chemical equilibria in closed systems in the gas and liquid phases. (Application)
 CO 4: Compare conditions in which the different thermodynamic relations can be applied (Evaluating)

Module 1: Chemical Thermodynamics (15 hours)

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics. First law: Concept of heat, q, work, w, internal energy, U, and statement of first law; enthalpy, H, relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions.

Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions and enthalpy of combustion and its applications; calculation of bond energy, bond dissociation energy and

resonance energy from thermochemical data, effect of temperature (Kirchhoff's equations) and pressure on enthalpy of reactions. Adiabatic flame temperature, explosion temperature.

Second Law: Concept of entropy; thermodynamic scale of temperature, statement of these law of thermodynamics; molecular and statistical interpretation of entropy. Calculation of entropy change for reversible and irreversible processes.

Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.

Free Energy Functions: Gibbs and Helmholtz energy; variation of S , G , A with T , V , P ; Free energy change and spontaneity. Relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature; Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

Module II: Systems of Variable Composition (10 hours)

Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases.

Module III: Chemical Equilibrium (10 hours)

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Coupling of exoergic and endoergic reactions. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants K_p , K_c and K_x . Le Chatelier principle (quantitative treatment); equilibrium between ideal gases and a pure condensed phase.

Module 4: Solutions and Colligative Properties (10 hours)

- Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Excess thermodynamic functions.
- Thermodynamic derivation using chemical potential to derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

Suggested Readings

- Physical Chemistry, P. Atkins and J. Paula, Oxford University Press.
- Physical Chemistry, G. W. Castellan, Narosa.
- Physical Chemistry, T. Engel and P. Reid, Prentice-Hall.
- Molecular Thermodynamics, D. A. McQuarrie and J. D. Simon, Viva Books Pvt. Ltd., New Delhi.
- Commonly Asked Questions in Thermodynamic, M. J. Assael, A. R. H. Goodwin, M. Stamatoudis, W. A. Wakeham and S. Will, CRC Press, NY.
- Physical Chemistry, I.N. Levine, Tata Mc GrawHill.
- 2000 solved problems in chemistry, C.R. Metz, Schaum Series.

Mapping of COs to Modules

	Module I	Module II	Module III	Module IV
CO1	H			
CO 2	H	M	M	
CO 3			H	
CO 4		H	H	M

CHTH203L: PHYSICAL CHEMISTRY-I: CHEMICAL THERMODYNAMICS LAB

(1Credits- 30 hours) (L-T-P: 0-0-1)

(NSQF:5)**Objective**

In this course, students learn some practical aspects of thermodynamics viz. calorimetry, which deals with measurements of heats of reaction in the liquid phase using an adiabatic isobaric calorimeter.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall principles and methods of thermochemistry. (Remembering)

CO 2: Explain methods and principles to carry out calorimetric measurements. (Understanding)

CO 3: Measure heats of reactions following appropriate procedures.

(Applying) CO 4: Calculate the heats of reactions in each experiment.

(Analysing)

CO 5: Design experiments to measure enthalpy changes in solution. (Creating)

Module I: Thermochemistry

- Determination of heat capacity of a calorimeter for different volumes using change of enthalpy data of a known system (method of back calculation of heat capacity of calorimeter from known enthalpy of solution or enthalpy of neutralization).
- Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
- Calculation of the enthalpy of ionization of ethanoic acid.
- Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
- Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step.
- Determination of enthalpy of hydration of copper sulphate.
- Study of the solubility of benzoic acid in water and determination of ΔH . Any other experiment carried out in the class.

Suggested Readings

- B. D. Khosla, V. C. Garg and A. Gulati, Senior Practical Physical Chemistry, R. Chand & Co., New Delhi.
- Experimental Physical Chemistry, V. D. Athawale and P. Mathur, New Age International, New Delhi.

Mapping of COs to Modules

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g
CO 1	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H
CO 5	M	M	M	M	M	M	M

CHHC204T: ORGANIC CHEMISTRY II: HETEROCYCLIC CHEMISTRY

(4 Credits – 60 hours) (L-T-P: 4-0-0)

(NHEQF: 5.5)

Objective

This course is designed to make the students familiar with reaction mechanisms, natural product chemistry and heterocyclic chemistry.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the preparation and reactions of amines, nitrile, isonitrile and nitro compounds etc. (Remembering)

CO 2: Preparation and properties of polynuclear aromatic compounds. (Understanding)

CO 3: Synthetic route for the preparation of heterocycles and applications in the present research. (Applying)

CO 4: Structural elucidation of polynuclear aromatic compounds, alkaloids and terpenes etc. (Analysing)

Module I: Nitrogen Containing Functional Groups (20 lectures)

Preparation and important reactions of nitro compounds, nitriles and isonitriles.

Amines: Preparation and properties: Effect of substituent and solvent on basicity; Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid.

Diazonium Salts: Preparation and their synthetic applications.

Module II: Polynuclear Hydrocarbons (6 lectures)

Aromaticity of polynuclear hydrocarbons, structure elucidation of naphthalene; Preparation and properties of naphthalene, phenanthrene and anthracene.

Module III: Heterocyclic Compounds (24 lectures)

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis,

Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole (Fischer indole synthesis and Madelung synthesis),

Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner-Miller synthesis, Bischler-Napieralski reaction, Pictet-Spengler reaction, Pomeranz-Fritsch reaction)

Module IV: Alkaloids and Terpenes (10 lectures)

Natural occurrence, General structural features, Isolation and their physiological action, Hoffmann's exhaustive methylation, Emde's modification; Structure elucidation and synthesis of Nicotine, medicinal importance of Nicotine, Hygrine, Quinine, Morphine, Cocaine, and Reserpine. Occurrence, classification, isoprene rule; Elucidation of structure and synthesis of Citral.

Suggested Readings

1. Organic Chemistry, R. T. Morrison and R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Organic Chemistry (Volume 1), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Introduction to the Chemistry of Heterocyclic compounds, R. M. Acheson, John Wiley & Sons.
5. Organic Chemistry, T. W. G. Solomons, John Wiley & Sons, Inc.
6. Textbook of Organic Chemistry, P. S. Kalsi, New Age International (P) Ltd. Pub.
7. Organic Chemistry, J. Clayden, , N. Greeves, , S. Warren and P. Wothers, Oxford University Press.
8. Natural Product Chemistry, J. Singh, S.M. Ali. and J. Singh, Pragati Parakashan.

Mapping of COs to Syllabus

Course Outcome	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4		H		H

CHHC205L: ORGANIC CHEMISTRY II: HETEROCYCLIC CHEMISTRY LAB

(1 Credits- 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)**Objective***This course is designed to make the students familiar with the concepts of qualitative organic analysis.***Course / Learning Outcomes**

At the end of this course students will be able to:

CO 1: Gain knowledge about Qualitative analysis of organic compounds. (Remembering)

CO 2: Explain the chemistry of various tests used in the detection of functional groups and elements present in an organic sample. (Understanding)

CO 3: Qualitative analysis for the identification of organic compounds from mixtures. (Applying)

CO 4: Analyze the melting point of the compound and its derivative for the determination of its exact structure. (Analysing)

Module I:

- Functional group test for nitro, amine and amide groups.
- Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols, carbonyl compounds and esters).

Suggested Readings

- Practical Organic Chemistry, F. G. Mann, and B. C. Saunders, Pearson Education.
- Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A.R. Tatchell, Pearson.
- Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia and R. Aggarwal, University Press.
- Comprehensive Practical Organic Chemistry: Qualitative Analysis, V. K. Ahluwalia and S. Dhingra, University Press.

Mapping of COs to Module

Course Outcomes	Exp a	Exp b
CO 1		H
CO 2	H	
CO 3		H
CO 4		H

CHPC206T: PHYSICAL CHEMISTRY II: PHASE EQUILIBRIA AND CHEMICAL KINETICS

(3 Credits-45 hours) (L-T-P: 3-0-0)

(NHEQF: 5.5)

Objective

This course is designed to make the students familiar with theories of Chemical kinetics and phase equilibria.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall basic concepts of chemical kinetics and adsorption (Remembering)

CO 2: Explain concepts such as the Gibbs phase rule for non-reactive and reactive systems. (Understanding)

CO 3: Apply the concepts of phase equilibria to systems with varying components. (Applying)

CO 4: Analyze the kinetics of different types of chemical reactions. (Analysing)

Module I: Phase Equilibria (30 lectures)

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications.

Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points, solid solutions, Three component systems, water-chloroform-acetic acid system, triangular plots.

Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and nonideal), azeotropes, lever rule, partial miscibility of liquids, CST, miscible pairs, steam distillation. Nernst distribution law: its derivation and applications.

Module II: Chemical Kinetics (20 lectures)

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws, kinetics of complex reactions (integrated rate expressions up to first order only): (i) Opposing reactions (ii) parallel reactions and (iii) consecutive reactions and their differential rate equations (steady-state approximation in reaction mechanisms) (iv) chain reactions. Temperature dependence of reaction rates; Arrhenius equation; activation energy, collision theory of reaction rates, Lindemann mechanism, qualitative treatment of the theory of absolute reaction rates.

Module III: Catalysis (6 lectures)

Types of catalyst, Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis.

Module IV: Surface chemistry (4 lectures)

Physisorption, chemisorption, adsorption isotherms.

Suggested Readings

1. Physical Chemistry, A. Peter and J. de Paula, Oxford University Press.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. Molecular Thermodynamics, D. A. McQuarrie and J. D. Simon, Viva Books Pvt. Ltd. New Delhi.
4. Physical Chemistry, T. Engel and P. Reid, Prentice-Hall.
5. Commonly Asked Questions in Thermodynamics, M. J. Assael, A. R. H. Goodwin, M. Stamatoudis, W. A. Wakeham and S. Will, CRC Press, NY.
6. Chemistry concepts and applications, S.S. Zundhal, Cengage India.
7. Physical Chemistry, D. W. Ball, Cengage India.
8. Physical Chemistry, R. G. Mortimer, Elsevier: NOIDA, UP.
9. Physical Chemistry, I. N. Levine, Tata McGraw-Hill.
10. Physical Chemistry, C. R. Metz, Tata McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV

CO 1		H		H
CO 2	H			
CO 3	H			
CO 4		H	M	

CHPC207L: PHYSICAL CHEMISTRY-II: PHASE EQUILIBRIA AND CHEMICAL KINETICS LAB

(1 Credits- 30 hours) (L-T-P: 0-0-1)

(NHEQF: 5.5)**Objective**

This course is designed to make the students to understand the practical application of chemical kinetics and phase equilibria.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Measure the distribution coefficient of liquids, CST and equivalence points through potentiometric titrations. (Applying)
 CO 2: Find out how CST of the phenol-water system is affected by impurities. (Analysing)
 CO 3: Find the Kinetics of different types of chemical reaction (Analysing)
 CO 4: Explain the different isotherms using adsorption techniques. (Understanding)

Module I:

- Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.
- Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method:
 - simple eutectic and
 - congruently melting systems.
- Distribution of acetic/ benzoic acid between water and cyclohexane.
- Study the equilibrium of at least one of the following reactions by the distribution method:
 - $I_2(aq) + I^- \rightarrow I_3^-(aq)$
 - $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$.
- Study the kinetics of the following reactions.
 - Initial rate method: Iodide-persulphate reaction.
 - Acid hydrolysis of methyl acetate with hydrochloric acid
 - Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methylacetate.
- Adsorption
 - Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

Suggested Readings

- Senior Practical Physical Chemistry, B. D. Khosla, V. C. Garg and A. Gulati, R. Chand & Co. New Delhi.
- Experiments in Physical Chemistry, C. W. Garland, J. W. Nibler and D. P. Shoemaker, McGraw-Hill, New York.
- Experimental Physical Chemistry, A. M. Halpern and G. C. McBane, W. H. Freeman & Co. New York.

Mapping of COs to Module

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f
CO 1	H					H
CO 2	H		H	H		
CO 3	M				H	

CO 4		M				

CHSP208T: INORGANIC CHEMISTRY I: METALLURGY, S - AND P-BLOCK ELEMENTS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5.5)**Objective**

This course helps the students to understand clearly about the principle of metallurgy and the properties of s and p block elements.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the concepts of general principles of metallurgy, the chemistry of s and p block elements (Remembering)

CO 2: Explain the structure, bonding, properties and uses of some important inorganic compounds. (Understanding)

CO 3: Apply the concepts to solve simple problems on periodic properties of s-block elements. (Applying)

CO 4: Analyze the periodic properties p block elements. (Analysing)

Module I: General Principles of Metallurgy (10 lectures)

Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent, Electrolytic reduction, hydrometallurgy with reference to cyanide process for silver and gold, Methods of purification of metals: electrolytic process, van Arkel-de Boer process and Mond's process, Zone refining.

Module II: Chemistry of s Block Elements (15 lectures)

- General characteristics: melting point, flame colour, reducing nature, diagonal relationships and analogous behaviour of first member of each group.
- Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogen and water.
- Common features such as ease of formation, thermal stability and solubility of the following alkali and alkaline earth metal compounds: hydrides, oxides, peroxides, super oxides, carbonates, nitrates, sulphates.

Module III: Chemistry of p-block elements (5 lectures)

Electronic configuration, atomic and ionic size, metallic/non-metallic character, melting point, ionization enthalpy, electron gain enthalpy, electronegativity, allotropy of C, P, S; inert pair effect; diagonal relationship between B and Si and anomalous behaviour of first member of each group.

Module IV: Structure, bonding and properties: acidic/basic nature, stability, ionic/covalent nature, oxidation/reduction, hydrolysis, action of heat on the following compounds (10 lectures)

- Hydrides: hydrides of Group 13 (only diborane), Group 14, Group 15 (EH_3 where E=N, P, As, Sb, Bi), Group 16 and Group 17.
- Oxides: oxides of phosphorus, sulphur and chlorine.
- Oxoacids: oxoacids of phosphorus and chlorine; peroxyacids of sulphur.
- Halides: halides of silicon and phosphorus.

Module V: Preparation, properties, structure and uses of the following compounds (5 lectures)

- Borazine.
- Silicates, silicones.
- Interhalogen and pseudohalogen compounds.

Suggested Readings

1. Concise Inorganic Chemistry, J. D. Lee, Pearson Education.
2. Concepts & Models of Inorganic Chemistry, B. E. Douglas, D. H. Mc Daniel and J. J. Alexander, John Wiley Sons, N.Y.
3. Chemistry of the Elements, N. N. Greenwood and A. Earnshaw, Butterworth- Heinemann.
4. Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, Wiley, VCH.
5. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Pearson.
6. Inorganic Chemistry, D. F. Shriver, P.W. Atkins and C. H. Langford, Oxford University Press. **Mapping of COs to Modules**

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		
CO 2		L		H	H
CO 3		H			
CO 4			H		

CHSP209L: INORGANIC CHEMISTRY-II: S- AND P-BLOCK ELEMENTS LAB

(1 Credits – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)

Objective

This course helps the students to understand clearly about the synthesis of some inorganic compounds and Iodo/Iodimetric and Complexometric titrations.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the idea of different types of estimations of inorganic compounds. (Remembering)

CO 2: Explain the principles of different types of Iodimetric titrations. (Understanding)

CO 3: Utilize the methods of preparation of some inorganic complexes. (Applying)

CO 4: Analyse the principle of complexometric titrations for the estimation of inorganic compounds. (Analysing)

Module I:

a. Iodo / Iodimetric Titrations

1. Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (iodometrically).
2. Estimation of antimony in tartar-emetic iodimetrically.

b. Complexometric titrations using disodium salt of EDTA

1. Estimation of Mg^{2+} , Zn^{2+} .
2. Estimation of Ca^{2+} by substitution method.

c. Inorganic Preparations

1. Cuprous chloride, Cu_2Cl_2 .
2. Manganese (III) phosphate, $MnPO_4 \cdot H_2O$.
3. Aluminium potassium sulphate $KAl(SO_4)_2 \cdot 12H_2O$ (potash alum) or chrome alum.

Suggested Readings

1. A textbook of quantitative inorganic analysis, A. I. Vogel, ELBS.
2. Practical Inorganic Chemistry, G. Marr and B.W. Rockett, Van Nostrand Reinhold.

3. Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c
CO 1	M	M	
CO 2	H		
CO 3			H
CO 4		H	

CHBI300T: ORGANIC CHEMISTRY III: BIOMOLECULES

(4 Credits – 60 hours) (L-T-P: 4-0-0)

(NHEQF: 6)**Objective**

This course aims at helping the students to become acquainted with the basic concepts of biomolecules, energy in biosystem and pharmaceutical compounds

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concept of energy in the biosystem. (Understanding)

CO 2: Suggest the scheme for the synthesis of a peptide. (Applying)

CO 3: Explain the roles of lipids, proteins, enzymes and nucleic acids in a living system. (Analysing)

CO 4: Suggest mechanisms for creating a particular sequence of the protein or nucleic acid. (Creating)

Module I: Nucleic Acids (8 lectures)

Components of nucleic acids, Nucleosides and nucleotides; Structure, synthesis and reactions of: Adenine, Guanine, Cytosine, Uracil and Thymine; Structure of polynucleotides (DNA and RNA).

Module II: Amino Acids, Peptides and Proteins (20 lectures)

- Amino acids, Peptides and their classification. α -Amino Acids - Synthesis, ionic properties and reactions. Zwitterions, pKa values, isoelectric point and electrophoresis.
- Study of peptides: determination of their primary structures-end group analysis, methods of peptide synthesis. Synthesis of peptides using N-protecting, C-protecting and C-activating groups, Solid-phase synthesis; primary, secondary and tertiary structures of proteins, Denaturation.

Module III: Enzymes (5 lectures)

Introduction, classification and characteristics of enzymes. Salient features of active site of enzymes. Mechanism of enzyme action (taking trypsin as example), factors affecting enzyme action, coenzymes and cofactors, specificity of enzyme action (including stereo specificity), enzyme inhibitors and their importance.

Module IV: Lipids (6 lectures)

Introduction to oils and fats; common fatty acids present in oils and fats, Hydrogenation of fats and oils, Saponification value, acid value, iodine number. Reversion and rancidity.

Module V: Concept of Energy in Bio systems (15 lectures)

Cells obtain energy by the oxidation of foodstuff (organic molecules). Introduction to metabolism (catabolism, anabolism).

ATP: The universal currency of cellular energy, ATP hydrolysis and free energy change. Agents for transfer of electrons in biological redox systems: NAD⁺, FAD.

Conversion of food to energy: Outline of catabolic pathways of carbohydrate- glycolysis, fermentation, Krebs cycle. Caloric value of food, standard caloric content of food types.

Module VI: Pharmaceutical Compounds: Structure and Importance (6 lectures)

Classification, structure and therapeutic uses of antipyretics: Paracetamol (with synthesis), Analgesics: Ibuprofen (with synthesis), Antimalarial: Chloroquine (with synthesis). An elementary treatment of Antibiotics and detailed study of chloramphenicol, Medicinal values of curcumin (haldi), azadirachtin (neem), vitamin C and antacid (ranitidine).

Suggested Readings

1. Biochemistry, J. M. Berg, J. L. Tymoczko and L. Stryer, W.H. Freeman and Co.
2. Principles of Biochemistry, D. L., Nelson, M. M. Cox and A. L. Lehninger, W.H. Freeman and Co.
3. Harper's Illustrated Biochemistry, R. K. Murray, D. K. Granner, P. A. Mayes, V. W. Rodwell, Lange Medical Books/ McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1					H	
CO 2		H				
CO 3	H	H	H	H		
CO 4	H	H				H

CHBI301L: ORGANIC CHEMISTRY III: BIOMOLECULES LAB

(1 Credit -30 hours) (L-T-P: 0-0-1)

(NSQF: 5)**Objective**

This course aims at helping the students to become acquainted with the estimation of some amino acid, protein etc.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Recall principles of estimation of some amino acids and proteins. (Remembering)
 CO 2: Understand the principles involved in estimations of amino acids, proteins. (Understanding)
 CO 3: Apply the principles they learn to carry out the aforementioned estimations. (Applying)
 CO 4: Analyse the experimental data of these experiments. (Analysing)

Module I:

- a. Estimation of glycine by Sorenson's formalin method.
- b. Study of the titration curve of glycine.
- c. Estimation of proteins by Lowry's method.
- d. Study of the action of salivary amylase on starch at optimum conditions.
- e. Effect of temperature on the action of salivary amylase.

Suggested Readings

1. Quantitative Organic Analysis, I. V. Arthur, Pearson.
2. Analytical Techniques in Biochemistry and Molecular Biology, R. Katoch, Springer.

Mapping of COs to Module

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H	H	H	H
CO 2	H	H	H		
CO 3	H	H	H		

CO 4	M	M	M	M	M

CHCO303T: INORGANIC CHEMISTRY II: COORDINATION CHEMISTRY

(4 Credits-60 hours) (L-T-P: 4-0-0)

(NHEQF: 6)**Objective**

This course helps the students to understand clearly about the transition elements, coordination complexes and inorganic reaction mechanism.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recollect the properties of transition elements and coordination compounds. (Remembering)

CO 2: Infer the properties of transition elements. (Understanding)

CO 3: Correlating various Theories of coordination compounds with properties. (Applying)

CO 4: Explain the reaction mechanisms involved in different complexes of transition elements (Analysing)

Module I: Coordination Chemistry (24 lectures)

Theory of coordination complexes, valence bond theory (inner and outer orbital complexes), Crystal field theory, measurement of $10 Dq$ (Δ_o), CFSE in weak and strong fields, Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry, Jahn-Teller theorem, square planar geometry, IUPAC nomenclature of coordination compounds, isomerism in coordination compounds, Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect.

Module II: Transition Elements (15 lectures)

Study of electronic configuration, colour, variable valency, magnetic and catalytic properties, Stability of various oxidation states and e.m.f (Latimer diagrams), difference between the first, second and third transition series.

Chemistry of Cr, Mn, and Fe in various oxidation states with special reference to the following compounds: peroxo compounds of chromium, potassium dichromate, potassium permanganate, potassium ferrocyanide, potassium ferricyanide.

Module III: Lanthanoids and Actinoids (6 lectures)

Electronic configuration (anomalies), common oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method).

Module IV: Inorganic Reaction Mechanism (15 lectures)

Concept of inorganic reaction mechanisms, Labile and inert complexes, substitution reactions in square planar complexes, trans-effect and theories, thermodynamic and kinetic stability.

Suggested Readings

1. Inorganic Chemistry, J. E. Huheey, Keiter and O.K. Medhi, Prentice Hall.
2. Inorganic Chemistry, K. F. Purcell and J. C. Kotz, W.B. Saunders Co.
3. Inorganic Chemistry (adapted), G. L. Miessler and D. A. Tarr, Pearson.
4. Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, Wiley-VCH.
5. Chemistry of the Elements, N. N. Greenwood and A. Earnshaw, Butterworth- Heinemann.

Mapping of the COs to the Modules

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		H	
CO 2	H			

CO 3		H		
CO 4				H

CHCO304L: INORGANIC CHEMISTRY II: COORDINATION CHEMISTRY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)**Objective**

This course helps the students to understand clearly about the synthesis of some inorganic compounds, gravimetric preparation and some spectroscopic methods to understand the properties of some inorganic complexes.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall principles and methods for gravimetric analysis of inorganic compounds. (Remembering)

CO 2: Explain the principle of gravimetric estimation of some transition metal complexes. (Understanding)

CO 3: Apply the principles and methods to know the properties of complexes.

(Applying) CO 4: Adopt suitable methods to prepare inorganic compounds.

(Creating)

Module I:**a. Gravimetric Analysis:**

1. Estimation of nickel (II) using Dimethylglyoxime (DMG).
2. Estimation of copper as CuSCN .
3. Estimation of iron as Fe_2O_3 by precipitating iron as $\text{Fe}(\text{OH})_3$.
4. Estimation of Al(III) by precipitating with oxine and weighing as $\text{Al}(\text{oxine})_3$ (aluminium oxinate).

b. Inorganic Preparations:

1. Tetraamminecopper (II) sulphate, $[\text{Cu}(\text{NH}_3)_4] \text{SO}_4 \cdot \text{H}_2\text{O}$.
2. Acetylacetonate complexes of $\text{Cu}^{2+}/\text{Fe}^{3+}$.
3. Tetraamminecarbonatocobalt (III) nitrate.
4. Potassium tri(oxalato)ferrate(III).

c. Properties of Complexes:

1. Measurement of 10 Dq by spectrophotometric method.
2. Verification of spectrochemical series.
3. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetone, DMG, glycine) by substitution method.

Suggested Readings

1. A text book of Quantitative Analysis, A.I. Vogel, , ELBS.
2. Practical Inorganic Chemistry, G. Marr and B.W. Rockett, Van Nostrand Reinhold.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c
CO 1	M	M	
CO 2	H		
CO 3			H
CO 4		H	

CHSQ305T: PHYSICAL CHEMISTRY III: QUANTUM CHEMISTRY AND SPECTROSCOPY

(3 Credits - 45 hours) (L-T-P: 3-0-0)

(NHEQF: 6)

Objective

This course aims to introduce students to the introductory principles of quantum chemistry and molecular spectroscopy

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the postulates of quantum mechanics and spectroscopy. (Understanding)

CO 2: Apply the postulates to a few model systems and to the Hydrogen atom (Applying)

CO 3: Apply principles of spectroscopy to obtain structural information of small molecules (Applying)

CO 4: Compare spectroscopic techniques, theories of chemical bonding. (Evaluating)

Module 1: Quantum Chemistry (25 hours)

- a. Postulates of quantum mechanics, quantum mechanical operators and commutation rules, Schrödinger equation and its application to free particle and —particle-in-a-box (rigorous treatment), quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle; wave functions, probability distribution functions, nodal properties, Extension to two- and three-dimensional boxes, separation of variables, degeneracy.

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation and discussion of solution and wave functions. Vibrational energy of diatomic molecules and zero-point energy.

Angular momentum, Rigid rotator model of rotation of diatomic molecule. Schrödinger equation in Cartesian and spherical polar (Derivation not required). Separation of variables. Spherical harmonics. Discussion of solution (Qualitative).

Qualitative treatment of hydrogen atom and hydrogen-like ions: setting up of Schrödinger equation in spherical polar coordinates, radial part, quantization of energy (only final energy expression). Average and most probable distances of electron from nucleus. Setting up of Schrödinger equation for many-electron atoms (He, Li). Need for approximation methods. Statement of variation theorem and application to simple systems (particle-in-a-box, harmonic oscillator, hydrogen atom).

- b. Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+ . Bonding and antibonding orbitals. Qualitative extension to H_2 . Comparison of LCAO-MO and VB treatments of H_2 (only wave functions, detailed solution not required) and their limitations. Refinements of the two approaches (Configuration Interaction for MO, ionic terms in VB). Qualitative description of LCAO-MO treatment of homonuclear and heteronuclear diatomic molecules (HF, LiH).

Module 2: Molecular Spectroscopy (20 hours)

Interaction of electromagnetic radiation with molecules and various types of spectra; Born Oppenheimer approximation. Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, Morse potential, dissociation energies, fundamental frequencies, overtones, hot bands, degrees of freedom for polyatomic molecules, modes of vibration, concept of group frequencies.

Vibration-rotation spectroscopy: diatomic vibrating rotator, P, Q, R branches.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence, dissociation and pre dissociation, calculation of electronic transitions of polyenes using free electron model. Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, Larmor precession, chemical shift and low-resolution spectra, different scales (δ and σ), spin-spin coupling and high-resolution spectra, interpretation of PMR spectra of organic molecules.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

Suggested Readings

1. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. Mc Cash, Tata McGraw-Hill: New Delhi.
2. Introductory Quantum Chemistry, A. K. Chandra, Tata McGraw-Hill.
3. Fundamentals of Quantum Chemistry, J. E. House, Elsevier: USA.
4. Quantum Chemistry, J. P. Lowe and K. Peterson, Academic Press.
5. Atomic & Molecular Spectroscopy, R. Kakkar, Cambridge University Press.

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	H
CO 2	H	
CO 3		H
CO4		H

CHSQ306L: PHYSICAL CHEMISTRY III: QUANTUM CHEMISTRY AND SPECTROSCOPY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)

Objective

In this course, students get to learn to use the phenomenon of light absorption by some molecules to determine chemical properties associated with them and the reactions in which they participate.

Course /Learning Outcomes

At the end of this course students will be able to:

- CO 1: Remember the laws to apply when carrying out UV-visible absorbance measurements. (Remembering)
- CO 2: Explain how the laws can be used to determine concentrations or molar extinction coefficients of molecules. (Understanding)
- CO 3: Carry out measurements of molecular absorption in the lab. (Applying)
- CO 4: Analyze vibrational spectra of diatomic molecules (Analyzing)
- CO 5: Suggest alternative ways of carrying out experiments or analysis of data. (Creating)

Module I:

UV/Visible spectroscopy

- a. Study the 200-500 nm absorbance spectra of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1} , kJ mol^{-1} , cm^{-1} , eV).
- b. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $\text{K}_2\text{Cr}_2\text{O}_7$.
- c. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

Colorimetry

- Verify Lambert-Beer's law and determine the concentration of $\text{CuSO}_4/\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ in a solution of unknown concentration.
- Determine the concentrations of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ in a mixture.
- Study the kinetics of iodination of propanone in acidic medium.
- Determine the amount of iron present in a sample using 1, 10-phenanthroline.
- Determine the dissociation constant of an indicator (phenolphthalein).
- Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

Vibrational Spectroscopy

Analysis of the given vibration-rotation spectrum of HCl(g) .

Suggested Readings

- Senior Practical Physical Chemistry, B. D. Khosla, V. C. Garg and A. Gulati, R. Chand & Co.: New Delhi.
- Experiments in Physical Chemistry, C. W. Garland, J. W. Nibler and D. P. Shoemaker, McGraw-Hill: New York.
- Experimental Physical Chemistry, A. M. Halpern and G. C. Mc Bane, W.H. Freeman & Co.: New York.

Mapping of COs to Syllabus

Course Outcomes	UV/Visible spectroscopy	Colorimetry	Vibrational Spectroscopy
CO 1	H	H	
CO 2	H	H	
CO 3	H	H	
CO 4			H
CO 5	M	M	

CHOS307T: ORGANIC CHEMISTRY IV: ORGANIC SPECTROSCOPY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF: 6.5)

Objective

The objective of this course is to make the students familiar with different spectroscopic techniques, carbohydrates, dyes, polymer

Course /Learning Outcomes

At the end of this course students will be able to:

- CO 1: Recall the principles of UV, IR and NMR spectroscopy. (Remembering)
 CO 2: Explain absolute configuration of carbohydrates; mutarotation. (Understanding)
 CO 3: Apply different mechanisms to the polymerization reactions. (Applying)
 CO 4: Analyse the application of different types of dyes. (Analysing)

Module I: Organic Spectroscopy (17 lectures)

General principles Introduction to absorption and emission spectroscopy.

UV Spectroscopy: Types of electronic transitions, λ_{max} , Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption; Application of Woodward Rules for calculation of λ_{max} for the following systems: α , β unsaturated aldehydes, ketones, carboxylic acids and esters; Conjugated dienes: alicyclic, homoannular and heteroannular; Extended conjugated systems (aldehydes, ketones and dienes); distinction between cis and trans isomers.

IR Spectroscopy: Fundamental and non-fundamental molecular vibrations; IR absorption positions of O, N and S containing functional groups; Effect of H-bonding, conjugation, resonance and ring size on IR absorptions; Fingerprint region and its significance; application in functional group analysis.

NMR Spectroscopy: Basic principles of Proton Magnetic Resonance, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant; Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple compounds.

Applications of IR, UV and NMR for identification of simple organic molecules.

Module II: Carbohydrates (12 lectures)

Occurrence, classification and their biological importance.

Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani- Fischer synthesis and Ruff degradation.

Disaccharides – Structure elucidation of maltose, lactose and sucrose.

Polysaccharides – Elementary treatment of starch, cellulose and glycogen.

Module III: Dyes (6 lecture)

Classification, Colour and constitution; Mordant and Vat Dyes; Chemistry of dyeing; Synthesis and applications of:

Azo dyes – Methyl orange; Triphenyl methane dyes -Malachite green and Rosaniline; Phthalein Dyes – Phenolphthalein; Natural dyes –structure elucidation and synthesis of Alizarin and Indigotin; Edible Dyes with examples.

Module IV: Polymers (10 lectures)

Introduction and classification including di-block, tri-block and amphiphilic polymers; Polymerisation reactions -Addition and condensation -Mechanism of cationic, anionic and free radical addition polymerization; Metallocene-based Ziegler-Natta polymerisation of alkenes; Preparation and applications of plastics – thermosetting (phenol-formaldehyde, Polyurethanes) and thermo softening (PVC, polythene); Fabrics – natural and synthetic (acrylic, polyamido, polyester); Rubbers – natural and synthetic: Buna-S, Chloroprene and Neoprene; Vulcanization; Polymer additives; Introduction to; Biodegradable and conducting polymers with examples.

Suggested Readings

1. Textbook of Organic Chemistry, P. S. Kalsi, New Age International (P) Ltd. Pub.
2. Organic Chemistry, R. T. Morrison, R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. F. W. Billmeyer, Textbook of Polymer Science, John Wiley & Sons, Inc.
4. Polymer Science, V. R. Gowariker, N. V. Viswanathan and J. Sreedhar, New Age International (P) Ltd. Pub.
5. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
6. Organic Chemistry, T.W. Graham Solomons, John Wiley & Sons, Inc.
7. Organic Chemistry, J. Clayden, N. Greeves, S. Warren, O. Wothers, Oxford University Press.
8. Natural Product Chemistry, J. Singh, S. M. Ali and J. Singh, Pragati Prakashan.
9. Organic Spectroscopy, W. Kemp, Palgrave.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3				H

CO 4			H	

CHOS308L: ORGANIC CHEMISTRY IV: ORGANIC SPECTROSCOPY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)**Objective**

This course is intended to explain the concept of qualitative organic analysis, extraction of compounds from natural products, synthesis of some polymers

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the principals involved in the extraction of organic compounds. (Remembering)

CO 2: Explain the procedure for the preparation of organic molecules. (Un-

derstanding) CO 3: Analyse unknown organic compounds. (Analysing)

Module I

- Extraction of caffeine from tea leaves.
- Preparation of urea formaldehyde resin.
- Qualitative analysis of unknown organic compounds containing monofunctional groups (carbohydrates, aryl halides, aromatic hydrocarbons, nitro compounds, amines and amides) and simple bifunctional groups, e.g. salicylic acid, cinnamic acid, nitrophenols etc.

Suggested Readings

- Quantitative Organic Analysis, Part 3, A. I. Vogel, , Pearson.
- Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.
- Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell, Pearson.
- Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia, and R. Aggarwal, University Press.
- Comprehensive Practical Organic Chemistry: Qualitative Analysis, V. K. Ahluwalia and S. Dhingra, , University Press.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c
CO 1	H		
CO 2		H	
CO 3			H

CHBO309T: Inorganic Chemistry III: BIOINORGANIC AND ORGANOMETALLIC CHEMISTRY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF: 6.5)**Objective**

This course will explain the biological systems containing metal ions, basic principles of Inorganic qualitative analysis, classification and preparation of organometallic compounds.

Course/ Learning Outcomes

At the end of this course students will be able to:

- CO 1: Recall the role of metal ions in biological systems (Remembering)
 CO 2: Explain the analysis and separation of ions from mixture. (Understanding)
 CO 3: Make use of the properties of metal ions for effective target binding (Applying)
 CO 4: Concept of electron contribution from metals and ligands in analysing reactivity and stability of organometallic compounds. (Analysing)

Module I: Bioinorganic Chemistry (10 lectures)

Metal ions present in biological systems, classification of elements according to their action in biological system,

Geochemical effect on the distribution of metals, Sodium / K-pump, carbonic anhydrase and carboxypeptidase, Excess and deficiency of some trace metals, Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cisplatin as an anti-cancer drug, Iron and its application in bio-systems, Haemoglobin, Myoglobin; Storage and transfer of iron.

Module II: Basic Principles of inorganic Qualitative Analysis (10 lectures)

Basic principles involved in analysis of cations and anions, solubility products, common ion effect, principles involved in separation of cations into groups and choice of group reagents, interfering anions (fluoride, borate, oxalate, phosphate) and removal.

Module III: Organometallic Compounds (20 lectures)

Definition and classification of organometallic compounds on the basis of bond type, Concept of hapticity of organic ligands.

Metal carbonyls: 18 electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series, structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π -acceptor behaviour of CO (MO diagram of CO to be discussed), synergic effect and use of IR data to explain extent of back bonding.

Zeise's salt: Preparation and structure, evidences of synergic effect and comparison of synergic effect with that in carbonyls. Metal Alkyls: Important structural features of methyl lithium (tetramer) and trialkyl aluminium (dimer), concept of multicentre bonding in these compounds.

Ferrocene: Preparation and reactions (acetylation, alkylation, metallation, Mannich Condensation). structure and aromaticity, comparison of aromaticity and reactivity with that of benzene.

Module IV: Catalysis by Organometallic Compounds (5 lectures)

Study of the following catalytic mechanisms:

1. Alkene hydrogenation (Wilkinson's Catalyst).
2. Synthetic gasoline (Fischer Tropsch reaction).
3. Polymerisation of ethene, (Ziegler-Natta catalyst).

Suggested Readings

1. Vogel's Qualitative Inorganic Analysis, G. Svehla, Prentice Hall.
2. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus, Wiley India.
3. Principles of Bioinorganic Chemistry, S. J. Lippard and J.M. Berg, University Science Books.
4. Inorganic Chemistry, Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter, R. L. H. Keiter, Pearson.
5. Inorganic Chemistry, D. D. Shriver, P. Atkins, and C. H. Langford, Oxford University Press.
6. Inorganic Chemistry, K. F. Purcell, and J. C. Kotz, W.B. Saunders Co.
7. Principles of Organometallic Chemistry, P. Powell, Chapman and Hall.
8. Organometallic Chemistry of the Transition Metals, R. H. Crabtree, John Wiley New York, NY.

Mapping of COs to Syllabus

Course Outcome	Module I	Module II	Module III	Module IV

CO 1	H	H	H	H
CO 2		H		
CO 3		H	H	
CO 4			H	H

CHBO310L: INORGANIC CHEMISTRY III: BIOINORGANIC AND ORGANOMETALLIC CHEMISTRY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)

Objective

This course helps the students to understand clearly about the qualitative analysis of some acidic and basic radicals and also about the principles involved in chromatographic separation.

Course Outcomes

At the end of this course students will be able to:

- CO 1: Recall the principles of separating and identifying ions in a mixture. (Remembering)
 CO 2: Interpret the chemistry of the reactions for separation and identification of ions. (Understanding)
 CO 3: Apply the principles to carry out the separation of ions in a mixture in the laboratory. (Applying)
 CO 4: Analyse the experimental results in the laboratory. (Analysing)
 CO 5: Evaluate the process of chromatographic separations of metal ions. (Evaluating)

Qualitative analysis: Qualitative semi-micro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given to the understanding of the chemistry of different reactions. The following radicals are suggested:

CO₃²⁻, NO₂⁻, S²⁻, SO₃²⁻, S₂O₃²⁻, CH₃COO⁻, F⁻, Cl⁻, Br⁻, I⁻, NO₃⁻, BO₃³⁻, C₂O₄²⁻, PO₄³⁻, NH₄⁺, K⁺, Pb²⁺, Cu²⁺, Cd²⁺, Bi³⁺, Sn²⁺, Sb³⁺, Fe³⁺, Al³⁺, Cr³⁺, Zn²⁺, Mn²⁺, Co²⁺, Ni²⁺, Ba²⁺, Sr²⁺, Ca²⁺, Mg²⁺.

Mixtures should preferably contain one interfering anion, **or** insoluble component (BaSO₄, SrSO₄, PbSO₄, CaF₂ or Al₂O₃) **or** combination of anions e.g. CO₃²⁻ and SO₃²⁻, NO₂⁻ and NO₃⁻, Cl⁻ and Br⁻, Cl⁻ and I⁻, Br⁻ and I⁻, NO₃⁻ and Br⁻, NO₃⁻ and I⁻.

Spot tests should be done whenever possible.

Chromatography: Principles involved in chromatographic separations. Paper chromatographic separation of following metal ions:

1. Ni (II) and Co (II).
2. Cu(II) and Cd(II).

Suggested Readings

1. Vogel's Qualitative Inorganic Analysis, Revised by G. Svehla.
2. A Textbook of Quantitative Analysis, A. I. Vogel, ELBS.

Mapping of COs to Module

Course Outcomes	Qualitative analysis	Chromatography
CO 1	M	
CO 2	M	
CO 3	H	
CO 4		M
CO 5		H

CHEL311T: Physical Chemistry IV: Electrochemistry (3 Credits – 45 hours)

(L-T-P: 3-0-0)

(NHEQF: 6.5)**Objective**

This course helps the students to understand clearly about the theories of electrochemistry and electro-chemical cells.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall fundamental concepts of electrochemistry. (Remembering)

CO 2: Explain principles associated with Faraday's laws of electrolysis. (Understanding)

CO 3: Application of theories of conductance measurements. (Applying)

CO 4: Distinguish between different types of electrochemical cells, electrodes. (Analysing)

Module I: Conductance (20 lectures)

Arrhenius theory of electrolytic dissociation. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Walden's rules.

Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water (iii) solubility and solubility product of sparingly soluble salts, (iv) conductometric titrations, and (v) hydrolysis constants of salts.

Module II: Electrochemistry (25 lectures)

Quantitative aspects of Faraday's laws of electrolysis, rules of oxidation/reduction of ions based on half-cell potentials, applications of electrolysis in metallurgy and industry.

Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different kinds of half-cells. Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass and SbO/Sb₂O₃ electrodes.

Concentration cells with and without transference, liquid junction potential; determination of activity coefficients and transference numbers. Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

Suggested Readings

1. Physical Chemistry, P.W. Atkins and J. D. Paula, Oxford University Press.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. Physical Chemistry, R. G. Mortimer, Elsevier, NOIDA, UP.
4. Physical Chemistry, G. M. Barrow, Tata McGraw Hill, New Delhi.
5. Physical Chemistry, T. Engel and P. Reid Prentice-Hall.
6. Concise Physical Chemistry, D. W. Rogers, Wiley.
7. Physical Chemistry, R. J. Silbey, R. A. Alberty and M. G. Bawendi John Wiley & Sons, Inc.

Mapping of COs to Modules

Course Outcomes	Module I	Module II

CO 1	H	H
CO 2	L	H
CO 3	H	L
CO 4		H

CHEL312L: PHYSICAL CHEMISTRY IV: ELECTROCHEMISTRY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)**Objective***This course helps the students to understand clearly about practical application of electrochemistry.***Course / Learning Outcomes:**

At the end of this course students will be able to:

CO 1: Recall the basic concepts of conductometry and potentiometry. (Remembering)

CO 2: Explain the principles of conductometric and potentiometric titrations. (Understanding)

CO 3: Determine the cell constant, conductivity, equivalence points through conductometry. (Applying) CO 4: Analysing and the data obtained from conductometric and potentiometric titrations. (Analysing)

Module I:**Conductometry**

- Determination of cell constant.
- Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- Perform the following conductometric titrations:
 - Strong acid vs. strong base.
 - Weak acid vs. strong base.
 - Mixture of strong acid and weak acid vs. strong base.
 - Strong acid vs. weak base.

Potentiometry:

- Perform the following potentiometric titrations:
 - Strong acid vs. strong base.
 - Weak acid vs. strong base.
 - Dibasic acid vs. strong base.
 - Potassium dichromate vs. Mohr's salt.

Suggested Readings

- Senior Practical Physical Chemistry, B. D. Khosla, V. C. Garg and A. Gulati, R. Chand & Co., New Delhi.
- Experiments in Physical Chemistry, 8th ed, C. W. Garland, J. W. Nibler and D. P. Shoemaker, McGraw-Hill: New York.
- Halpern, A. M. & Mc Bane, G. C. Experimental Physical Chemistry, W. H. Freeman and Co. New York.

Mapping of COs to Syllabus

Course Outcomes	Conductometry	Potentiometry
CO 1	H	H
CO 2	H	H
CO 3	H	

CO 4	H	H

CHAI400T: INORGANIC CHEMISTRY IV: ADVANCED INORGANIC CHEMISTRY

(4 Credits – 60 hours)

(NHEQF: 6.5)**Objectives**

This course helps the students to understand clearly about the inorganic reaction mechanisms including photochemical, chemistry of main group compounds and organometallic compounds. Special focus given to solid state chemistry.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Demonstrate the mechanism of Inorganic photochemical reactions (Understanding)

CO 2: Make use of the properties of metals/non-metals for synthesizing organometallic compounds and catalytic activity study (Applying)

CO 3: Analyse the structure, bonding and synthesis of some inorganic solids. (Analysing)

CO 4: understand structure, properties of different inorganic complexes and mechanism of inorganic reactions.

Module I: Descriptive Inorganic Chemistry (20 lectures)

- Structure and bonding in polyhedral boranes and carboranes, styx notation, Wade's rules, electron count in polyhedral boranes, synthesis of polyhedral boranes, isolobal analogy, boron halides, phosphine-boranes, boron heterocycles, borazine.
- Silanes, silicon halides, silicates, silicones, silanols, zeolites, germanium, tin and lead organyls, silenes, germenes, stannenes, phosphorous halides, phosphazenes, sulphur halides, structural features and reactivity of S-N heterocycles.
- Synthesis and reactivity of organo-lithium, beryllium and magnesium compounds, calixarines, cryptands and crown ethers in complexation chemistry.
- Preparation and reactivity of aluminium organyls, carbalumination, hydro aluminatation, chemistry of Ga (I) and In (I), reduction of Al, Ga and In organyls, Metal organic framework structures (MOFs).

Module II: Mechanism of Inorganic Reactions (10 lectures)

Substitution in octahedral and square planar complexes, lability, trans-effect, conjugate base mechanism, racemisation, electron transfer reactions - inertness and lability, inner sphere and outer sphere mechanism, Marcus theory, solid state reactions – topotactic and epitactic mechanisms.

Module III: Inorganic Photochemistry (5 lectures)

Photosubstitution and photoredox reactions of chromium, cobalt and ruthenium compounds, Ligand field and charge transfer state (Thexi and DOSENCO states), cis-trans isomerization, photocatalysis and solar energy conservation by ruthenium complexes.

Module IV: Organometallic Chemistry (15 lectures)

- Valence electron count (16/18 electron rules), synthesis, structure, bonding and reactivity of mono and polynuclear metal carbonyls, substituted metal carbonyls, vibrational spectra of metal carbonyls, metal-metal bonding.
- Types of M-C bonds, synthesis and reactivity of metal alkyls, carbenes, alkenes, alkynes, and arene complexes, metallocenes and bent metallocenes, isolobal analogy.
- Reactions of organometallic complexes: Substitution, oxidative addition, reductive elimination, insertion and de insertion, catalysis, hydrogenation, hydroformylation, Monsanto process, Wacker process, alkene polymerization.

Module V: Introduction to Solid State Chemistry (10 lectures)

Structure of simple solids – metals, alloys and compounds; common structure types; synthesis of solid-state compounds - ceramic method, microwave synthesis, sol-gel, precursor method, hydrothermal synthesis, CVD and intercalation; characterization of solids, bonding in solids – free-electron and molecular orbital theory; bands in solid state compounds, properties of solids – optical, magnetic and electrical properties of solids.

Suggested Readings

1. Concepts and Models of Inorganic Chemistry, B. E. Douglas, D. H. McDaniel and J. J. Alexander, John Wiley
2. Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Wiley.
3. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter and R. L. Keiter, Pearson Education.
4. Inorganic Chemistry, G. L. Miessler and D. Tarr, Pearson Education.
5. 5 Inorganic Chemistry, G. Wulfsberg, University Science Books.
6. Mechanisms of Inorganic Reactions, F. Basalo and R. G. Pearson, John Wiley
7. Organometallic Chemistry of the Transition Metals, R. H. Crabtree, John Wiley.
8. Solid State Chemistry: An Introduction, L. Smart, E. Moore, Nelson Thorns Ltd.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1			H		
CO 2	M			H	
CO 3		H			H
CO 4	H			H	

CHAI401L: Inorganic chemistry IV: Advanced Inorganic Chemistry Lab

(1Credit -30 hours) (L-T-P: 0-0-1)

(NSQF: 6.5)

Objectives

This course helps the students to understand clearly about the qualitative and quantitative analysis and spectroscopic characterization of coordination compounds after synthesis.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Recall the procedures followed to carry out the qualitative and quantitative analysis. (Remembering)
- CO 2: Explain the reason behind each step for Analysing mixtures and preparing compounds and metal nanoparticles. (Understanding)
- CO 3: Apply different spectroscopic methods to characterize coordination compounds. (Applying)

Module I:

- a. Qualitative analysis (tertiary mixtures, alloys, ores).
- b. Quantitative analysis (binary mixtures, alloys, ores).
- c. Inorganic preparation (crystallization, precipitation, calcination).
- d. Coordination compounds through ligand synthesis and spectroscopic characterization, magnetic properties.
- e. Metal Nanoparticle synthesis and characterization.

Suggested readings

1. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, and B. Sivasankar, Pearson.
2. Vogel's Qualitative Inorganic Analysis, G. Svehla and S. Mittal, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H			
CO 2	H	H	H	L	H
CO 3				H	

CHQC402T: QUANTUM CHEMISTRY AND GROUP THEORY

(5 Credits – 75 hours) (L-T-P: 4-1-0)

(NHEQF: 6.5)**Objective**

In this course students learn quantum mechanics methods (including a few approximation methods) necessary to calculate the energy eigen values and wavefunctions of systems like the H atom and atoms more complex than the H atom as well as to classify molecules into groups based on their symmetry properties

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the postulates and principles of quantum chemistry and group theory. (Understanding)

CO 2: Apply the principles of quantum chemistry to simple model systems and to the Hydrogen atom (Applying)

CO 3: Apply the rules of group theory to assign molecules to different point groups and to set up character tables (Applying)

CO 4: Examine methods to calculate eigenvalues and eigenfunctions of model systems, the H atom and He atom as well as to assign molecules to different point groups. (Analyzing)

CO 5: Evaluate the uses of approximation methods in quantum chemistry and of representations of groups (Evaluating)

Module I: Quantum Chemistry I

Planck's theory, wave-particle duality, uncertainty principle, operators, eigen functions and eigen values in quantum mechanics, postulates of quantum mechanics, Schrodinger equation, free particle, particle in a box, degeneracy, harmonic oscillator, angular momentum, rigid rotator, the hydrogen atom

Module II: Quantum Chemistry II

Approximate methods in quantum mechanics - the variation theorem, linear variation principle and perturbation theory (first order and non-degenerate), application of variation method and perturbation theory to the Helium atom, electron spin, the spin statistics theorem (antisymmetry), the Pauli exclusion principle, Slater determinants, many electron atoms and spin-orbit coupling, term symbols and spectroscopic states

Module III: Chemical Applications of Group Theory

Symmetry elements and operations, equivalent symmetry elements and equivalent atoms, identification of symmetry point groups with examples, groups of very high symmetry, molecular dissymmetry and optical activity, systematic procedure for symmetry classification of molecules and illustrative examples, brief

review of matrix representation of groups, reducible and irreducible representations, rules about irreducible representations as derived from great orthogonality theorem, relationship between reducible and irreducible groups, character tables.

Suggested readings

1. Quantum Chemistry, I. N. Levine, PHI Learning Pvt. Ltd.
2. Molecular quantum Mechanics, P. Atkins and R. Friedman, Oxford University Press.
3. Introduction to Quantum mechanics, D. J. Griffiths, Pearson Education Ltd.
4. Chemical Applications of Group Theory, F. A. Cotton, Wiley India Pvt. Ltd.
5. Molecular Symmetry and Group Theory, R. L. Carter, John Wiley & Sons.
6. Molecular Symmetry and Group Theory, A. Vincent, Wiley.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	M	H	H
CO 5	M	H	H

CHAP403T: PHYSICAL CHEMISTRY V: ADVANCED PHYSICAL CHEMISTRY

(4 Credits – 60 hours) (L-T-P: 4-0-0)

(NHEQF: 6.5)

Objective

This course helps the students to understand clearly about the theories of chemical kinetics, molecular reaction dynamics and electrochemistry.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the interactions of ionic species with solvent molecules. (Understanding)

CO 2: Apply the knowledge of chemical kinetics to some important types of reactions. (Applying) CO 3: Analyse the application of electrochemistry in different fields.

(Analysing)

CO 4: Calculate the rate of different types of chemical reactions. (Evaluating)

Module I: Chemical Kinetics (15 lectures)

Hard Sphere collision theory, theories of unimolecular reactions: Lindemann theory, drawbacks of Lindemann theory-

Hinshelwood modification. Steady state approximation and its applications, oscillating reactions, chemical chaos, BelousovZhabotinski reaction, straight chain reactions - hydrogen-halogen reactions, alkane pyrolysis, Branching-chain reactions - the hydrogen-oxygen reaction, explosion limits, Enzyme catalyzed reactions, Michaelis-Menten mechanism- Lineweaver-Burk and Eadie plots, enzyme inhibition.

Module II: Study of Fast Reactions (8 lectures)

Stopped flow technique, temperature and pressure jump methods, NMR studies in fast reactions, shock tube kinetics, relaxation kinetics, Linearized rate equation, relaxation time in single step fast reactions, determination of relaxation time.

Module III: Molecular Reaction Dynamics (15 lectures)

Collisions of real molecules- trajectory calculations, Laser techniques, reactions in molecular beam, estimation of activation energy and calculation of potential energy surface, the transition state theory (TST) of bimolecular gaseous reactions, statistical and thermodynamic formulations. Comparison between TST and hard sphere collision theory, kinetics of reactions in solution-diffusion controlled and chemically controlled reactions, TST of reactions in solution- Bronsted and Bjerrum equation, effect of ionic strength, kinetic salt effect.

Module IV: Electrochemistry - I (10 lectures)

- Ion-solvent interaction- the Born model, Thermodynamic parameters of ion solvent interactions- structural treatment, the ion-dipole model-its modifications, ion-quadrupole and ion-induced dipole interactions.
- Primary solution- determination of hydration number, compressibility method and viscosity-mobility method, DebyeHuckel theory of ion-ion interactions, derivation, validity and limitations, extended Debye-Huckel-Onsager equation, random walk model of ionic Diffusion-Einstein Smoluchowski reaction.

Module V: Electrochemistry – II (12 lectures)

- Theories of Electrical Interface:** Electrocapillary phenomena - Lippmann equation, electron transfer at interfaces, polarizable, non-polarizable and non-polarisable interfaces, Butler-Volmer equation, Tafel plot.
- Systems for Electro-Chemical Energy Storage and Conversion:** Types of Batteries, Lead- acid batteries, Nickel-cadmium batteries and Li-ion batteries, electrical double layer capacitor, pseudo-capacitor, fuel cells.

Suggested readings

- Physical Chemistry, P. Atkins and J. Paula, Oxford University Press, Oxford.
- Physical chemistry, I. R. Levine, Mcgraw Hill Education.
- Chemical Kinetics, K. J. Laidler, Pearson.
- Modern Electrochemistry Part 1, 2A and 2B, J. O. Bockris and A. K. N. Reddy, Springer.
- Electrochemical Methods Fundamentals and Applications, J. Bard and L. R. Faulkner, Wiley India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 2				H	M
CO 3	H	H	H		
CO 4			H		H
CO 5	H	H	H		

CHAP403T: Physical Chemistry V: Advanced Physical Chemistry Lab

(1Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 6.5)

Objective

This course helps the students to understand clearly about the application of different theories of physical Chemistry

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Recall the theoretical concepts of experiments related to chemical kinetics and electrochemistry etc. (Remembering)
- CO 2: Explain the principles and the procedures for spectrophotometry-based experiments. (Understanding)
- CO 3: Apply the theoretical knowledge for determination of rate constant, pH, emf etc. (Applying)

CO 4: Analyse the practical utility of different theories of chemical kinetics, electrochemistry, adsorption etc. (Analysing)

Module I:

- Chemical Kinetics based experiments.
- Electrochemistry based experiments.
- Spectrophotometry based experiments.
- pH-metric Titrations.
- Adsorption on porous materials - equilibrium, kinetic and thermodynamic studies.

Suggested readings

- Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publishing House.

Mapping of COs to Modules

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H			
CO 2			H		
CO 3	H	H		H	
CO 4	M	M			M

CHRO404T: ORGANIC CHEMISTRY V: REAGENTS IN ORGANIC SYNTHESIS AND MECHANISTIC STUDIES

(4 Credits-60 hours) (L-T-P: 4-0-0)

(NHEQF: 6.5)

Objective

This course is aimed at familiarizing students with the concepts of different reagents in organic synthesis and their mechanistic studies

Course / Learning Outcomes:

At the end of this course students will be able to:

- CO 1: Apply the practical utility of metal and metal-free oxidising agents in organic synthesis. (Applying)
 CO 2: Compare various kinds of reducing agents in chemo selective and stereo selective synthesis. (Analysing)
 CO 3: Recall various concepts associated with the kinetics of organic reaction mechanisms. (Remembering)

Module I: Kinetics and Energetics of Reaction Mechanism (15 lectures)

Transition state theory of reaction rates - kinetics and thermodynamics of activation, reaction profiles for multistep reactions, Hammond postulate, Curtin-Hammett Principle, kinetic and thermodynamic control, Linear free energy relationships (LFER), Hammett equation - substituent and reaction constants, the Taft treatment of polar and steric effects in aliphatic compounds, kinetic isotope effects in organic reactions, effects of conformation on reactivity, stereoelectronic effects, neighbouring group participation, anomeric effect.

Module II: Oxidation Reactions (15 lectures)

Metal and non-metal based oxidations (Cr, Mn, Al, Ag, Os, Ru, Se, DMSO, hypervalent iodine), reagents (Fremy's salt, silver carbonate, peroxides/per-acids), Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation, Sharpless asymmetric dihydroxylation, Baeyer-Villiger oxidation, Wacker oxidation, hydroboration-oxidation, Prevost reaction and Woodward modification.

Module III: Reduction Reactions (15 lectures)

Catalytic hydrogenation (Pd/Pt/Rh/Ni), Wilkinson catalyst, Noyori asymmetric hydrogenation, metal based reductions using Li/Na/Ca in liquid ammonia, Sodium, Magnesium, Zinc, Titanium and Samarium (Birch, Pinacol formation, McMurry, Acyloin formation, dehalogenation and deoxygenations), Hydride transfer reagents from Group III and Group IV in reductions (NaBH₄ triacetoxyborohydride, L-selectride, K-selectride, Luche reduction, LiAlH₄, DIBAL-H, and Red-Al, Trialkylsilanes and Trialkylstannane, Meerwein-Ponndorf-Verley reduction), stereo/enantioselective reductions (Chiral Boranes, Corey-Bakshi-Shibata).

Suggested readings

1. Advanced Organic Chemistry, Part A and B, F. A. Cary and R. I. Sundberg, Springer.
2. Organic Synthesis, M. B. Smith, Academic Press.
3. Modern Methods of Organic Synthesis, W. Carruthers and I. Coldham, Cambridge University Press.
4. Organic Chemistry, J. Clayden, N. Greeves and S. Warren. Oxford University Press.
5. Organic Chemistry, S. H. Pine, McGraw-Hill Book.
6. Advanced Organic Chemistry: Reactions, Mechanisms and Structure (4th edn.), J. March, Wiley Student Edition, John Wiley & Sons Asia Pte. Ltd.
7. Modern Synthetic Reaction, H. O. House, W. A. Benjamin Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1		H	
CO 2			H
CO 3	H		

CHRO405L: ORGANIC CHEMISTRY V: REAGENT IN ORGANIC SYNTHESIS AND MECHANISTIC STUDIES LAB

(1 Credit -30 hours) (L-T-P: 0-0-1)

(NSQF: 5)**Objective**

This course is aimed at familiarizing students with the concepts of calculation of saponification value, iodine number of oil/fat and preparation of some indicator

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Apply the concept of organic reagents synthesis of known compounds (understanding)

CO 2: Evaluate some important parameters in some common substance

(Evaluating) CO 3: Apply the solubility concept for isolation active components (Applying)

Module I:

Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy (Spectra to be provided). a) Preparation of methyl orange.

b) Saponification value of an oil or a fat.

- c) Determination of Iodine number of an oil/ fat.
 d) Isolation and characterization of DNA from onion/ cauliflower/peas.

Suggested Readings:

1. Quantitative Organic Analysis, I. V. Arthur, Pearson.
2. Analytical Techniques in Biochemistry and Molecular Biology, R. Katoch, Springer.
3. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.
4. Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith, and A. R. Tatchell, Pearson.
5. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, V. K. Ahluwalia, and R. Aggarwal, University Press.

Mapping of COs to Modules

Course Outcomes	Exp a	Exp. b	Exp. c	Exp. d	Exp. e
CO 1		H			
CO 2			H		
CO 3	H				H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	CHAS104T	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (3-0-1)	4
		CHAS105L	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab (0-0-1)	
		CHGC106T	Green Chemistry (3-0-1)	4
		CHGC107L	Green Chemistry Lab (0-0-1)	
2	Minor Course 2	CHSP108T	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (3-0-0)	4
		CHSP109L	Chemistry of s- and p-block elements, States of matter and Chemical Kinetics (0-0-1)	
		CHIM110T	Inorganic materials and Industrial Importance (3-0-0)	4
		CHIM111L	Inorganic materials and Industrial Importance (0-0-1)	
3	Minor Course 3	CHFG210T	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I (3-0-0)	4
		CHFG211L	Chemical Energetics, Equilibria & Functional Group Organic Chemistry-I Lab (0-0-1)	
		CHPC212T	Polymer Chemistry (3-0-0)	4
		CHPC213L	Polymer Chemistry Lab (0-0-1)	
4	Minor Course 4	CHSP214T	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (3-0-1)	4
		CHSP215L	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II (0-0-1)	
		CHRO216T	Organic Chemistry V: Reagent in organic synthesis and mechanistic studies (4-0-0)	4

5	Minor Course 5	CHDQ314T	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (3-0-0)	4
		CHDQ315L	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (0-0-1)	
		CHAC316T	Inorganic Chemistry IV: Advanced Inorganic Chemistry (4-0-0)	4
6	Minor Course 6	CHBC317T	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (3-0-0)	4
		CHBC318L	Organometallics, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (0-0-1)	
		CHAP319T	Physical Chemistry V: Advanced Physical Chemistry (4-0-0)	4
7	Minor Course 7	CHAM406T	Analytical Methods in Chemistry (3-0-0)	3
7	Minor Course 8	CHRM407T	Research Methodology	2
8	Minor Course 9	CHML408T	Molecules of Life (3-0-0)	3

CHAS104T: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY AND ALIPHATIC HYDROCARBONS

(3 Credits- 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5)

Objective

This course is intended to explain the fundamental concepts of inorganic chemistry (like atomic structure, chemical bonding) and organic chemistry (Like basics of organic chemistry and hydrocarbons) together.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the fundamental concept of inorganic and organic chemistry. (Remembering)

CO 2: Explain various concepts of atomic structure and chemical bonding. (Understanding)

CO 3: Predict the structure and properties of molecules. (Applying)

CO 4: Evaluate the role of quantum mechanics in inorganic chemistry. (Evaluate)

Module I: Inorganic Chemistry (23 lectures)

a. Atomic Structure (10 lectures)

Review of: Bohr's theory and its limitations, Heisenberg uncertainty principle.

Dual behaviour of matter and radiation, de-Broglie's relation. Hydrogen atom spectra. Need of a new approach to atomic structure.

What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of quantum numbers, orbital angular momentum and quantum numbers m_l and m_s . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s).

Rules for filling electrons in various orbitals, electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.

b. Chemical Bonding and Molecular Structure (13 lectures)

Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR (H_2O , NH_3 , PCl_5 , SF_6 , ClF_3 , SF_4) and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral.

Concept of resonance and resonating structures in various inorganic and organic compounds. MO Approach: Rules for the LCAO method, bonding and antibonding MOs and their characteristics for *s-s*, *s-p* and *p-p* combinations of atomic orbitals, nonbonding combination of orbitals.

Module II: Organic Chemistry (22 lectures)

a. Fundamentals of Organic Chemistry (10 lectures)

Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Reaction intermediates: Carbocations, Carbanions and free radicals. Electrophiles and nucleophiles. Aromaticity: Benzenoids and Hückel's rule.

b. Aliphatic Hydrocarbons (12 lectures)

Functional group approach for the following reactions (preparations physical property & chemical reactions) to be studied with mechanism in context to their structure.

Alkanes: *Preparation:* Catalytic hydrogenation, Wurtz reaction, Kolbe's synthesis, Grignard reagent. *Reactions:* Free radical Substitution: Halogenation.

Alkenes: *Preparation:* Elimination reactions: Dehydration of alcohols and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). *Reactions:* cis-addition (alk. KMnO_4) and transaddition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecurationdemercuration, Hydroboration-oxidation.

Alkynes: *Preparation:* Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. *Reactions:* formation of metal acetylides and acidity of alkynes, addition of bromine and alkaline KMnO_4 , ozonolysis and oxidation with hot alk. KMnO_4 . Hydration to form carbonyl compounds.

Suggested Readings

1. A new Concise Inorganic Chemistry, J. D. Lee, E. L. B. S.
2. Basic Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley.
3. Concepts and Models in Inorganic Chemistry, McDaniel Douglas and J. Alexander, Wiley.
4. Inorganic Chemistry: Principles of Structure and Reactivity, J. Huheey, E. Keiter and R. Keiter, Pearson Publication.
5. Organic Chemistry, T.W. G. Solomon, John Wiley and Sons.
6. A Guide Book to Mechanisms in Organic Chemistry, P. Sykes, Orient Longman.
7. Stereochemistry of Carbon Compounds, E. L. Eliel, Tata McGraw Hill.
8. Organic Chemistry (Vol I and II), I. L. Finar, E. L. B. S.
9. Organic Chemistry, R. T. Morrison, R. N. Boyd, Prentice Hall.
10. Shriver & Atkins' Inorganic Chemistry, P. Atkins, T. Overton, J. Rourke, F. Armstrong and M. Weller, Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	L
CO 3	H	H
CO 4	H	

CHAS105L: ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY AND ALIPHATIC HYDROCARBONS LAB

(1 Credit -30 hours) (L-T-P: 0-0-1)

(NSQF: 5)**Objective**

This course is design to make the students to understand the fundamental application of inorganic and organic chemistry.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the concept of titration and chromatography for estimation and separation. (Remembering)

CO 2: Explain the principles of titration and chromatography. (Understanding)

CO 3: Applying the concept of titration and chromatography to the estimation of samples. (Application)

CO 4: Decide the method for appropriate chromatographic separation of organic molecules in a mixture. (Analysis)

Module I:**Section A: Inorganic Chemistry - Volumetric Analysis**

- Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
- Estimation of oxalic acid by titrating it with KMnO_4 .
- Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .
- Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.
- Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.

Section B: Organic Chemistry

- Purification of OC by crystallisation (from water and alcohol) and distillation.
- Criteria of purity: Determination of M pt/B pt.
- Detection of extra elements (N, S, Cl, Br, I) in organic compounds.
- Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)
- Identify and separate the components of a given mixture of 2 amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography.
- Identify and separate the sugars present in the given mixture by paper chromatography.

Suggested Readings

- Vogel's Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
- Vogel's Quantitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
- Textbook of Practical Organic Chemistry, A. I. Vogel, Prentice Hall.

4. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Orient Longman.

Mapping of COs to Syllabus

Course Outcomes	Section A	Section B	
CO 1	H	H	
CO 2		H	
CO 3	H	H	
CO 4		M	

CHGC106T: GREEN CHEMISTRY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

(NSQF: 5)

Objective

This course is intended to explain the principles of green chemistry and its application.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the principles, goals and limitations of green chemistry. (Remembering)

CO 2: Understand how the principles of green chemistry apply to chemical synthesis. (Understanding)

CO 3: Analyse the benefits of green reactions. (Analysing)

CO 4: Assess the overall impact on research and the environment. (Evaluating)

Module I: Introduction to Green Chemistry (4 lectures)

What is Green Chemistry? Need for Green Chemistry, goals of green chemistry, limitations/ obstacles in the pursuit of the goals of Green Chemistry.

Module II: Principles of Green Chemistry and Designing a Chemical synthesis (21 lectures)

Twelve principles of Green Chemistry with their explanations and special emphasis on the following with examples: a. Designing a Green Synthesis using these principles; Prevention of Waste/ by-products; maximum incorporation of the materials used in the process into the final products, Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions.

- Prevention/ minimization of hazardous/ toxic products reducing toxicity risk = (function) hazard x exposure; waste or pollution prevention hierarchy Green solvents.
- Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy.
- Selection of starting materials; avoidance of unnecessary derivatization—careful use of blocking/protecting groups.
- Use of catalytic reagents, comparison of heterogeneous and homogeneous catalysis, bio catalysis, asymmetric catalysis and photo catalysis.
- Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD — subdivision of ISD, minimization, simplification, substitution, moderation and limitation.
- Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

Module III: Examples of Green Synthesis/ Reactions and some real-world cases (12 lectures)

- Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis).
- Microwave assisted reactions

- c. Ultrasound assisted reactions
- d. Surfactants for Carbon Dioxide – replacing smog producing and ozone depleting solvents with CO₂ for precision cleaning and dry cleaning of garments.
- e. Designing of Environmentally safe marine antifoulant.
- f. Right fit pigment: synthetic azo-pigments to replace toxic organic and inorganic pigments.
- g. An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.
- h. Healthier Fats and oil by Green Chemistry: Enzymatic Inter esterification for production of no Trans-Fats and Oils.
- i. Development of Fully Recyclable Carpet: Cradle to Cradle Carpeting.

Module IV: Future Trends in Green Chemistry (8 lectures)

Oxidation reagents and catalysts, biomimetic, multifunctional reagents; combinatorial green chemistry; Proliferation of solvent free reactions; co crystal controlled solid state synthesis (C₂S₃); Green chemistry in sustainable development.

Suggested Readings

1. New Trends in Green Chemistry, V. K. Ahluwalia, M. R. Kidwai, Anamalaya Publishers.
2. Oxford Green Chemistry -Theory and Practical, P. T. Anastas and J. K. Warner, University Press.
3. Introduction to Green Chemistry, A. S. Matlack, Marcel Dekker.
4. Real-World Cases in Green Chemistry, M. C. Cann and M. E. Connely, American Chemical Society, Washington.
5. Introduction to Green Chemistry, M. A. Ryan and M. Tinnes, American Chemical Society Washington.
6. Green Chemistry an Introductory Text 2nd Ed., M. Lancaster, RSC Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		M	H	
CO 3		H	H	
CO 4			H	

CHGC107L: GREEN CHEMISTRY LAB

(1Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)

Objective

This course is design to make the students to learn the application of principles of green chemistry in laboratory.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the principles. (Understanding)

CO 2: Apply the principles of green chemistry in the laboratory.
(Applying)

CO 3: Analyse and interpret experimental data. (Analysing)

Module I:

Safer starting materials

a. Preparation and characterization of nano particles of gold using tea leaves.

Using renewable resources

a. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil.

Avoiding waste

- Principle of atom economy.
- Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.
- Preparation of propene by two methods can be studied.
 - Triethylamine ion + OH⁻ → propene + trimethyl propene + water H₂SO₄/H₂O
 - 1-propanol propene + water

The other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

Use of enzymes as catalysts

a. Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.

Alternative Green solvents

- Extraction of D-limonene from orange peel using liquid CO₂ prepared from dry ice.
- Mechano chemical solvent free synthesis of azomethines.

Alternative sources of energy

- Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).
- Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Suggested Readings

- Green Chemistry: Theory and Practice, P. T. Anastas and J. C. Warner, Oxford University Press.
- Greener approaches to undergraduate chemistry experiment, M. Kirchoff, and M. A. Ryan, American Chemical Society, Washington DC.
- Introduction to Green Chemistry, M. A. Ryan, American Chemical Society, Washington DC.
- Green Chemistry Experiments: A monograph, R. K. Sharma, I. T. Sidhwani, and M. K. Chaudhari, I. K. International Publishing House Pvt Ltd. New Delhi, Bangalore.
- Real world cases in Green Chemistry, M. C. Cann and M. E. Connelly, American Chemical Society.
- Real world cases in Green Chemistry, M. C. Cann and P. Thomas, American Chemical Society.
- Green Chemistry: An introductory text, M. Lancaster, RSC publishing.
- Introduction to Organic Laboratory Techniques – a Microscale Approach, D. L. Pavia, G. S. Kriz, G. M. Lampman and R. G. Engels, Brooks-Cole Laboratory Series for Organic Chemistry, 2006.

Mapping of COs to Syllabus

Course Outcomes	Safer start ing materials	Using renewa- ble resources	Avoiding waste	Use of en- zymes as cat- alysts	Alternative Green sol- vents	Alternative sources of en- ergy
CO 1	H	H	H	H	H	H
CO 2	H	H	H	H	H	H
CO 3	H	H	H	H	H	H

CHSP108T: CHEMISTRY OF S- AND P- BLOCK ELEMENTS, STATES OF MATTER AND CHEMICAL KINETICS.

(3 Credits- 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5)

Objective

This course is intended to explain the chemistry of s - and p- block elements and states of matter.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explain the properties of s - and p- block elements. (Understanding)
 CO 2: Understand the concept of an ideal gas, real gas and properties of matter. (Understanding)
 CO 3: Apply the Kinetic Theory of gases and Chemical kinetics to solve problems. (Applying)
 CO 4: Analyse different techniques to extract metals from their respective ores. (Analysing)

Module I: Inorganic Chemistry (22 lectures)

a. General Principles of Metallurgy (4 lectures)

Chief modes of occurrence of metals based on standard electrode potentials. Ellingham diagrams for reduction of metal oxides using carbon as reducing agent. Hydrometallurgy with reference to cyanide process for silver and gold, Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn): electrolytic, oxidative refining, van Arkel-de Boer process and Mond's process.

b. s- and p- block Elements (18 lectures)

Periodicity in s- and p-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electronegativity (Pauling, Mulliken, and Alfred-Rochow scales). Allotropy in C, S, and P. Oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship and anomalous behaviour of first member of each group. Compounds of s- and p-Block Elements.

Hydrides of nitrogen (NH_3 , N_2H_4 , N_3H , NH_2OH) Oxoacids of P, S and Cl.

Halides and oxohalides: PCl_3 , PCl_5 , SOCl_2 and SO_2Cl_2 .

Module II: Physical Chemistry (23 lectures)

a. Kinetic Theory of Gases (4 lectures)

Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation.

Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature (derivation not required). Critical phenomena, critical constants and their calculation from van der Waals equation.

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance.

b. Liquids (5 lectures)

Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

c. Solids (5 lectures)

Forms of solids. Unit cells, crystal systems, Bravais lattice type. Laws of Crystallography - Law of constancy of interfacial angles Law of rational indices. X-Ray diffraction by crystals, Bragg's law. Defects in crystals. Glasses and liquid crystals.

d. Chemical Kinetics (9 lectures)

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

Suggested Readings

1. Physical Chemistry, G. M. Barrow, Tata McGraw Hill.
2. Physical Chemistry, G. W. Castellan, Narosa.

- General Chemistry, J. C. Kotz, P. M. Treichel and J. R. Townsend, Cengage Learning India Pvt. Ltd., New Delhi.
- University Chemistry, B. H. Mahan, Narosa.
- General Chemistry, R. H. Petrucci, Macmillan Publishing Co., New York.
- A New Concise Inorganic Chemistry, J. D. Lee, E.L.B.S.
- Basic Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley.
- Inorganic Chemistry, D. F. Shriver and P. W. Atkins, Oxford University Press.
- Inorganic Chemistry, G. Wulfsberg, Viva Books Pvt. Ltd.
- Inorganic Chemistry(adapted), G. L. Miessler and D. A. Tarr. Pearson.

Mapping of COs to Module

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3		H
CO 4	H	

CHSP109L: CHEMISTRY OF S- AND P- BLOCK ELEMENTS, STATES OF MATTER AND CHEMICAL KINETICS LAB.

(1 Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)**Objective***This course will make the students to understand about qualitative analysis and kinetics experiments.***Course / Learning Outcomes**

At the end of this course students will be able to:

- CO 1: Gain knowledge about semi-micro qualitative analysis of salt. (Remembering)
 CO 2: Explanation of group analysis for basic radicals present in salt. (Understanding)
 CO 3: Apply the concept of salt analysis to identify ions present in a mixture of salts. (Applying)
 CO 4: Comparison of acidic strength by studying the kinetics of hydrolysis of the ester. (Analysing)

Module I:**a. Inorganic Chemistry**Semi-micro qualitative analysis of mixtures using H₂S or any other scheme- not more than four ionic species (two anions and two cations and excluding insoluble salts) out of the following:Cations: NH₄⁺, Pb²⁺, Bi³⁺, Cu²⁺, Fe³⁺, Al³⁺, Co²⁺, Ni²⁺, Mn²⁺, Zn²⁺, Ba²⁺, Sr²⁺, Ca²⁺, K⁺.Anions: CO₃²⁻, S²⁻, SO₃²⁻, NO₃⁻, CH₃COO⁻, Cl⁻, Br⁻, I⁻, NO₃⁻, SO₄²⁻, PO₄³⁻, BO₃³⁻, C₂O₄²⁻, F⁻ (Spot tests should be carried out wherever feasible)**b. Physical Chemistry****1. Surface tension measurement (use of organic solvents excluded).**

- Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
- Study of the variation of surface tension of a detergent solution with concentration.

2. Viscosity measurement (use of organic solvents excluded).

- i. Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
- ii. Study of the variation of viscosity of an aqueous solution with concentration of solute.
3. **Chemical Kinetics: Study the kinetics of the following reactions.**
 - i. Initial rate method: Iodide-persulphate reaction.
 - ii. Integrated rate method:
 - Acid hydrolysis of methyl acetate with hydrochloric acid.
 - Saponification of ethyl acetate.
 - Compare the strengths of HCl and H₂SO₄ by studying kinetics of hydrolysis of methyl acetate.

Suggested Readings

1. Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
2. Quantitative Chemical Analysis, A. I. Vogel, Prentice Hall.
3. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b
CO 1	H	
CO 2	H	
CO 3	H	
CO 4		H

CHIM110T: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

(3 Credit – 45 hours) (L-T-P: 3-0-0)

(NSQF: 5)

Objective

This course will make the students to learn about the different types of inorganic materials of industrial importance.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Remember the composition of some industrially important materials. (Remembering)
 CO 2: Understand the processes involved in the preparation of silicates materials. (Understanding)
 CO 3: Know the principle involved in the preparation and applications of fuel cells, industrial application of catalysts. (Applying)
 CO 4: Know the differences between different types of surface coatings; know how to paint formulations are made. (Analysing)

Module I: Silicate Industries (15 lectures)

- a. **Glass:** Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass, composition and properties of the following types of glasses: Soda lime glass, lead glass, armoured glass, safety glass, borosilicate glass, fluorosilicate, coloured glass, photosensitive glass.
- b. **Ceramics:** Brief introduction to types of ceramics, superconducting and semiconducting oxides, fullerenes, carbon nanotubes and carbon fibre.
- c. **Cements:** Manufacture of cement and the setting process, quick setting cements.

Module II: Fertilizers (10 lectures)

Different types of fertilizers (N, P and K). Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, superphosphate of lime.

Module III: Surface Coatings (5 lectures)

Brief introduction to and classification of surface coatings, Paints and pigments-formulation, composition and related properties, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Metallic coatings (electrolytic and electroless).

Module IV: Batteries (10 lectures)

Working of the following batteries: Pb acid, Li-Battery, solid state electrolyte battery, fuel cells, solar cell and polymer cell.

Module V: Catalysis (10 lectures)

General principles and properties of catalysts, homogenous catalysis and heterogenous catalysis and their industrial applications, deactivation or regeneration of catalysts. Application of zeolites as catalysts.

Module VI: Chemical explosives (10 lectures)

Origin of explosive properties in organic compounds, preparation and explosive properties of lead azide, PETN, cyclonite (RDX), Introduction to rocket propellants.

Suggested Readings

1. Industrial Chemistry, Vol I, E. Stocchi, Ellis Horwood Ltd. UK.
2. Elementary Principles of Chemical Processes, R. M. Felder and R. W. Rousseau, Wiley Publishers, New Delhi.
3. Introduction to Ceramics, W. D. Kingery, H. K. Bowen and D. R. Uhlmann, Wiley Publishers, New Delhi.
4. Riegel's Handbook of Industrial Chemistry, J. A. Kent CBS Publishers, New Delhi.
5. Engineering Chemistry, P. C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.
6. Engineering Chemistry, R. Gopalan, D. Venkappayya and S. Nagarajan, Vikas Publications, New Delhi.
7. Engineering Chemistry B. K. Sharma, , Goel Publishing House, Meerut.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M		H		
CO2	H					H
CO3				H	M	
CO4			H			

CHIM111L: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)

Objective

This course will make the students to learn analysis of industrially important inorganic materials.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the aforementioned principles. (Understanding)

CO 2: Apply knowledge and understanding in carrying out lab experiments.
(Applying)

CO 3: Analyse and interpret experimental data. (Analysing)

Module I:

- Determination of free acidity in ammonium sulphate fertilizer.
- Estimation of Calcium in Calcium ammonium nitrate fertilizer.
- Estimation of phosphoric acid in superphosphate fertilizer.
- Analysis of Nitrogen in unknown sample
- Determination of composition of dolomite (by complexometric titration).
- Analysis of Phosphate in unknown sample
- Analysis of Cement.
- Preparation of pigment (zinc oxide).

Suggested Readings

- Industrial Chemistry, Vol I, E. Stocchi, Ellis Horwood Ltd. UK.
- Elementary Principles of Chemical Processes, R. M. Felder and R.W. Rousseau, Wiley Publishers, New Delhi.
- Introduction to Ceramics, W. D. Kingery, H. K. Bowen and D. R. Uhlmann, Wiley Publishers, New Delhi.
- Riegel's Handbook of Industrial Chemistry, J. A. Kent, CBS Publishers, New Delhi.
- Engineering Chemistry, P. C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.
- Engineering Chemistry, R. Gopalan, D. Venkappayya and S. Nagarajan, Vikas Publications, New Delhi.
- Engineering Chemistry, B. K. Sharma, Goel Publishing House, Meerut.

Mapping of COs to Syllabus

	Exp a	Exp b	Exp c	Exp d	Exp e	Exp f	Exp g	Exp h
CO1	H	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H	H

CHFG210T: CHEMICAL ENERGETICS, EQUILIBRIA AND FUNCTIONAL GROUP ORGANIC CHEMISTRY

(3 credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5)

Objective

The objective of this course is to make the students familiar with important concepts of physical chemistry (like chemical energetics, chemical and ionic equilibrium) and organic chemistry (like functional group chemistry) together.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explain the thermodynamics of chemical reactions. (Understanding)
 CO 2: Calculate the change in free energy accompanying a chemical reaction. (Applying)
 CO 3: Explain the mechanism of nucleophilic substitution reaction. (Analysing)
 CO 4: Learn the methods of preparation, reactions and mechanism of some organic compounds. (Creating)

Module I: Physical Chemistry (23 lectures)**a. Chemical Energetics (9 lectures)**

Review of thermodynamics and the Laws of Thermodynamics.

Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

b. Chemical Equilibrium (4 lectures)

Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between G and G° , Le Chatelier's principle. Relationships between K_p , K_c and K_x for reactions involving ideal gases.

c. Ionic Equilibria (10 lectures)

Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Module II: Organic Chemistry (22 lectures)

Functional group approach for the following reactions (preparations physical properties and Chemical reactions) to be studied in context to their structure with mechanism.

a. Aromatic hydrocarbons (6 lectures)

Preparation (benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid.

Reactions (benzene): Electrophilic substitution reactions: nitration, halogenation sulphonation. Friedel-Craft's reaction (alkylation and acylation) Side chain oxidation of alkyl benzenes.

b. Alkyl and Aryl Halides (6 lectures)**1. Alkyl Halides**

Preparation: from alkenes and alcohols.

Reactions: Types of Nucleophilic Substitution (SN_1 , SN_2 and SN_i) reactions, hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

2. Aryl Halides

Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions.

Reactions (Chlorobenzene): Aromatic electrophilic and nucleophilic substitution (replacement by $-OH$ group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$).

c. Alcohols, Phenols and Ethers (10 lectures)**1. Alcohols:**

Preparation: Preparation of 1° , 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3), factors affecting acidity, Oppenauer oxidation.

2. Phenols:

(Phenol case) *Preparation*: Cumene hydroperoxide method, from diazonium salts. *Reactions*: Electrophilic substitution:

Nitration, halogenation and sulphonation.

d. Ethers (aliphatic and aromatic).

Preparation: Williamson ether synthesis.

Reactions: Cleavage of ethers with HI.

e. **Aldehydes and ketones (aliphatic and aromatic):**

Preparation: from acid chlorides and from nitriles.

Reactions – Nucleophilic addition, Nucleophilic addition – elimination reaction including Reaction with HCN, ROH, NaHSO₃, NH₂G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.

Suggested Readings

1. Organic Chemistry, T. W. G. Solomons, John Wiley and Sons.
2. A Guide Book to Mechanism in Organic Chemistry, P. Sykes, Orient Longman.
3. Organic Chemistry (Vol. I & II), I. L. Finar, E. L. B. S.
4. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice Hall.
5. Physical Chemistry, G. M. Barrow, Tata McGraw Hill.
6. Physical Chemistry, G. W. Castellan, Narosa.
7. General Chemistry Cengage Lening India Pvt. Ltd. J. C. Kotz, P. M. Treichel, and J. R. Townsend, New Delhi.
8. University Chemistry, B. H. Mahan, Narosa.
9. General Chemistry, R. H. Petrucci, Macmillan Publishing Co.: New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H

CHFG211L: CHEMICAL ENERGETICS, EQUILIBRIA AND FUNCTIONAL GROUP ORGANIC CHEMISTRY LAB

(1 Credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)

Objective

The objective of this course is to make the students familiar with laboratory experiments related to thermochemistry, ionic equilibria, Preparation of some organic compounds and also qualitative analysis of organic compounds

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall principles and methods used to measure heats of reaction. (Remembering)

CO 2: Explain methods and underlying principles used to carry out the experiments related to ionic equilibria. (Understanding)

CO 3: Learn to prepare specific organic compounds using appropriate procedures. (Applying)

CO 4: Analyses of organic compounds possessing monofunctional groups. (Analysing)

Module I: Physical Chemistry Thermochemistry:

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO₃, NH₄Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of *H*.

Ionic equilibria

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH meter.
2. Preparation of buffer solutions
 - i. Sodium acetate-acetic acid.
 - ii. Ammonium chloride-ammonium hydroxide.
 - iii. Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

Module II: Organic Chemistry

1. Preparations: Mechanism of various reactions involved to be discussed, recrystallization, determination of melting point and calculation of quantitative yields to be done.
 - i. Bromination of phenol/aniline.
 - ii. Benzoylation of amines/phenols.
 - iii. Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone.
2. Systematic qualitative organic analyses of organic compounds possessing monofunctional groups (alcohols, phenols, carbonyl, -COOH) and preparation of one suitable derivative.

Suggested Readings

1. Textbook of Practical Organic Chemistry A. I. Vogel, , Prentice-Hall.
2. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Orient Longman.
3. Senior Practical Physical Chemistry, B. D. Khosla, S. Chand & Co.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H
CO 5	M	M

CHPC212T: POLYMER CHEMISTRY

(3 credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5.5)**Objective**

The objective of this course is to make the students familiar with fundamental concepts of polymers and polymerization process.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Understand the different processes by which polymers are formed. (Understanding)
 CO 2: Apply the methods to measure the molecular weights of polymers. (Applying)
 CO 3: Analyse polymers based on their physical, thermal, flow and mechanical properties. (Analysing)
 CO 4: Based on the properties predict possible applications or uses of the polymer. (Evaluating)

Module I: Introduction and history of polymeric materials (4 hours)

Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

Module II: Functionality and its importance (8 hours)

Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization. Bi-functional systems, Poly-functional systems.

Module III: Kinetics of Polymerization (8 hours)

Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

Module IV: Crystallization and crystallinity (4 hours)

Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

Module V: Nature and structure of polymers and Molecular weight determination of polymers (10 hours)

Structure Property relationships. Determination of molecular weight of polymers (M_n , M_w , etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

Module VI: Glass transition temperature (T_g), determination of T_g , Polymer Solution and properties of Polymers (26 hours)

Free volume theory, WLF equation, Factors affecting glass transition temperature (T_g).
 Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.

Properties of Polymers (Physical, thermal, Flow & Mechanical Properties).

Brief introduction to preparation, structure, properties and application of the following polymers: polyolefins, polystyrene and styrene copolymers, poly (vinyl chloride) and related polymers, poly (vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins (Bakelite, Novalac), polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly (p-phenylene sulphide polypyrrole, polythiophene)].

Suggested Readings

1. Seymour's Polymer Chemistry, Marcel Dekker, Inc.
2. Principles of Polymerization, G. Odian, John Wiley.
3. Text Book of Polymer Science, F.W. Billmeyer, John Wiley.
4. Polymer Science & Technology, P. Ghosh, Tata McGraw-Hill.
5. Organic Chemistry of Synthetic High Polymers, R. W. Lenz.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 2	H	H	H			
CO 3					H	
CO 4				H	H	H

CO 5						H

CHPC213L: POLYMER CHEMISTRY LAB

(1 credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)**Objective**

The objective of this course is to make the students familiar with laboratory experiments related to Synthesis and characterization of Polymer molecules

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Carry out preparations and characterization of polymers in the lab. (Applying)

CO 2: Analyse and interpret experimental results. (Analysing)

Module I: Polymer synthesis

- a. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) / Methyl Acrylate (MA) / Acrylic acid (AA).
 1. Purification of monomer.
 2. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutyronitrile (AIBN).
- b. Preparation of nylon 66/6.
- c. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein.
 1. Preparation of IPC.
 2. Purification of IPC.
 3. Interfacial polymerization.
- d. Redox polymerization of acrylamide.
- e. Precipitation polymerization of acrylonitrile.
- f. Preparation of urea-formaldehyde resin.
- g. Preparations of novalac resin/resold resin.
- h. Microscale Emulsion Polymerization of Poly(methylacrylate).

Module II: Polymer characterization

- a. Determination of molecular weight by viscometry:
 1. Polyacrylamide-aq. NaNO₂ solution.
 2. (Poly vinyl propylidene (PVP) in water.
- b. Determination of the viscosity-average molecular weight of poly (vinyl alcohol) (PVOH) and the fraction of —head-to-head// monomer linkages in the polymer.
- c. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).
- d. Testing of mechanical properties of polymers.
- e. Determination of hydroxyl number of a polymer using colorimetric method.

Suggested Readings

1. Contemporary Polymer Chemistry, H. R. Allcock, F. W. Lampe and J. E. Mark, Prentice-Hall.
2. Textbook of Polymer Science, F. W. Billmeyer, Wiley-Interscience.
3. Polymer Science and Technology, J. R. Fried, Prentice-Hall.
4. Introduction to Macromolecular Science, P. Munk and T. M. Aminabhavi, John Wiley & Sons.
5. Introduction to Physical Polymer Science, L. H. Sperling, John Wiley & Sons.
6. Polymer Chemistry: An Introduction, Malcolm P. Stevens, Oxford University Press.
7. Polymer Chemistry, C. E. Carraher Jr. Seymour/ Carraher's.

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	H

CHSP214T: SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II

(3 credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5.5)

Objective

This course will discuss solutions, phase equilibrium, electrochemistry, biomolecules like amino acid, carbohydrate and some N- and O-containing functional groups

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the concepts of solutions, electrochemistry and phase equilibrium. (Remembering)

CO 2: Explain the properties and reactivity of different organic compounds. (Understanding)

CO 3: Solve problems on electrochemistry, phase equilibrium, solutions etc. (Applying)

CO 4: Differentiating between the primary, secondary, tertiary and quaternary structure of proteins. (Analysing)

Module I: Physical Chemistry (23 Lectures)**a. Solutions (7 lectures)**

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law–non-ideal solutions. Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids.

b. Phase Equilibrium (6 lectures)

Phases, components, and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur).

c. Conductance (5 lectures)

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions.

Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid base).

d. Electrochemistry (5 lectures)

Reversible and irreversible cells. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG , ΔH and ΔS from EMF data. Calculation of equilibrium constant from EMF data.

Module II: Organic Chemistry (22 Lectures)

a. Carboxylic acids and their derivatives (4 lectures)

Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard – Zelinsky Reaction. Carboxylic acid derivatives (aliphatic): (Up to 5 carbons). Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion.

b. Amines and Diazonium Salts (5 Lectures)

Amines (Aliphatic and Aromatic): (Upto 5 carbons) Preparation: from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction.

Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2 , Schotten – Baumann Reaction.

Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes.

c. Amino Acids, Peptides and Proteins (8 Lectures)

Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis. Reactions of Amino acids: ester of $-\text{COOH}$ group, acetylation of $-\text{NH}_2$ group, complexation with Cu^{2+} ions, ninhydrin test. Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C-terminal (thiohydantoin and with carboxypeptidase enzyme).

d. Carbohydrates (5 Lectures)

Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disaccharides (sucrose, maltose) and brief idea about polysaccharides.

Suggested Readings

1. Physical Chemistry, G. M. Barrow, Tata McGraw-Hill.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. General Chemistry, J. C. Kotz, P. M. Treichel and J. R. Townsend, Cengage Learning India Pvt. Ltd., New Delhi.
4. University Chemistry, B. H. Mahan, Narosa.
5. General Chemistry, R. H. Petrucci, Macmillan Publishing Co.: New York.
6. Organic Chemistry, R. T. Morrison and R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
7. Organic Chemistry (Volume 1), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
8. Organic Chemistry (Volume 2), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
9. Lehninger's Principles of Biochemistry, D. L. Nelson and M. M. Cox, W. H. Freeman.
10. Biochemistry, J. M. Berg, J. L. Tymoczko and L. Stryer, W. H. Freeman.

Mapping of COs to syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3	H	
CO 4		H

CHSP215L: SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & FUNCTIONAL GROUP ORGANIC CHEMISTRY-II LAB

(1 credit – 30 hour) (L-T-P: 0-0-1)

(NSQF: 5)

Objective

The objective of this course is to make the students familiar with laboratory experiments related to Distribution, Phase equilibria, conductance, chromatographic techniques, qualitative organic analysis and other related experiments of organic chemistry

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the concepts of phase equilibria and electrochemistry. (Remembering)

CO 2: Explain the chemistry behind the qualitative analysis of unknown organic compounds. (Understanding)

CO 3: Apply chromatography to separate a mixture of two or more amino acids. (Applying)

CO 4: Analyse unknown organic compounds with the help of different chemical tests. (Analysing)

Module I: Physical Chemistry

Distribution

Study of the equilibrium of one of the following reactions by the distribution

method: $I_2(aq) + I^- (aq) \rightleftharpoons I_3^- (aq)$ $Cu^{2+}(aq) + xNH_3(aq) \rightleftharpoons [Cu(NH_3)_x]^{2+}$

Phase equilibria

1. Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.
2. Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.
3. Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

Conductance

1. Determination of cell constant.
2. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
3. Perform the following conductometric titrations:
4. Strong acid vs. strong base.
5. Weak acid vs. strong base.

Module II: Organic Chemistry

1. Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.
2. Separation of amino acids by paper chromatography.
3. Determination of the concentration of glycine solution by formylation method.
4. Titration curve of glycine.
5. Action of salivary amylase on starch.
6. Effect of temperature on the action of salivary amylase on starch.
7. Determination of the saponification value of an oil/fat.
8. Determination of the iodine value of an oil/fat.
9. Differentiation between a reducing/nonreducing sugar.
10. Extraction of DNA from onion/ cauliflower.

Suggested Readings

1. Textbook of Practical Organic Chemistry, A. I. Vogel, Prentice Hall.
2. Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Orient Longman, 1960.
3. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.
4. Comprehensive Practical Organic Chemistry, V. K. Ahluwalia and R. Aggarwal, Universities Press.

Mapping of CO to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3		H
CO 4		H

CHRO216T: ORGANIC CHEMISTRY V: REAGENTS IN ORGANIC SYNTHESIS AND MECHANISTIC STUDIES

(4 credits – 75 hours) (L-T-P: 4-0-0)

(NHEQF: 5.5)**Objective**

The objective of this course is to make the students familiar with Kinetics and Energetics of Reaction Mechanism and oxidation and reduction reaction

Course / Learning Outcomes

- CO 1: Apply the practical utility of metal and metal-free oxidising agents in organic synthesis. (Applying)
 CO 2: Compare various kinds of reducing agents in chemo selective and stereo selective synthesis. (Analysing)
 CO 3: Recall various concepts associated with the kinetics of organic reaction mechanisms. (Remembering)

Module I: Kinetics and Energetics of Reaction Mechanism (15 lectures)

Transition state theory of reaction rates - kinetics and thermodynamics of activation, reaction profiles for multistep reactions,

Hammond postulate, Curtin-Hammett Principle, kinetic and thermodynamic control, Linear free energy relationships (LFER), Hammett equation - substituent and reaction constants, the Taft treatment of polar and steric effects in aliphatic compounds, kinetic isotope effects in organic reactions, effects of conformation on reactivity, stereoelectronic effects, neighbouring group participation, anomeric effect.

Module II: Oxidation Reactions (15 lectures)

Metal and non-metal based oxidations (Cr, Mn, Al, Ag, Os, Ru, Se, DMSO, hypervalent iodine), reagents (Fremy's salt, silver carbonate, peroxides/per-acids), Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation, Sharpless asymmetric dihydroxylation, Baeyer-Villiger oxidation, Wacker oxidation, hydroboration-oxidation, Prevost reaction and Woodward modification.

Module III: Reduction Reactions (15 lectures)

Catalytic hydrogenation (Pd/Pt/Rh/Ni), Wilkinson catalyst, Noyori asymmetric hydrogenation, metal based reductions using Li/Na/Ca in liquid ammonia, Sodium, Magnesium, Zinc, Titanium and Samarium (Birch, Pinacol formation, McMurry, Acyloin formation, dehalogenation and deoxygenations), Hydride transfer reagents from Group III and Group IV in reductions (NaBH₄ triacetoxyborohydride, L-selectride, K-selectride,

LuCh reduction, LiAlH_4 , DIBAL-H, and Red-Al, Trialkylsilanes and Trialkylstannane, Meerwein-Ponndorf-Verley reduction), stereo/enantioselective reductions (Chiral Boranes, Corey-Bakshi-Shibata).

Suggested readings

1. Advanced Organic Chemistry, Part A and B, F. A. Carey and R. I. Sundberg, Springer.
2. Organic Synthesis, M. B. Smith, Academic Press.
3. Modern Methods of Organic Synthesis, W. Carruthers and I. Coldham, Cambridge University Press.
4. Organic Chemistry, J. Clayden, N. Greeves and S. Warren. Oxford University Press.
5. Organic Chemistry, S. H. Pine, McGraw-Hill Book.
6. Advanced Organic Chemistry: Reactions, Mechanisms and Structure (4th edn.), J. March, Wiley Student Edition, John Wiley & Sons Asia Pte. Ltd.
7. Modern Synthetic Reaction, H. O. House, W. A. Benjamin Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1		H	
CO 2			H
CO 3	H		

CHDQ314T: CHEMISTRY OF D-BLOCK ELEMENTS, QUANTUM CHEMISTRY & SPECTROSCOPY

(3 credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5.5)

Objective

The objective of this course is to make the students familiar with coordination chemistry, quantum chemistry, spectroscopy and photochemistry

Course /Learning Outcomes

At the end of this course students will be able to:

- CO 1: Recall properties of d- and f- block elements. (Remembering)
 CO 2: Explain the principles of quantum mechanics and spectroscopy. (Understanding)
 CO 3: Calculate positions of absorption lines of molecules and energies and wavefunctions. (Applying)
 CO 4: Differentiate between theories behind the formation of coordination compounds. (Analysing)

Module I: Inorganic Chemistry (22 Lectures)

a. Transition Elements (8 Lectures)

General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu.

Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

b. Coordination Chemistry (6 Lectures)

Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Drawbacks of VBT. IUPAC system of nomenclature.

c. Crystal Field Theory (8 Lectures)

Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Jahn-Teller distortion, Square planar coordination.

Module II: Physical Chemistry (23 Lectures)**a. Quantum Chemistry & Spectroscopy (19 Lectures)**

Wave-particle duality. Link between spectroscopy and quantum chemistry. Electromagnetic radiation and its interaction with matter. Types of spectroscopy. Difference between atomic and molecular spectra. Born Oppenheimer approximation: Separation of molecular energies into translational, rotational, vibrational and electronic components. Postulates of quantum mechanics, quantum mechanical operators. Free particle. Particle in a 1-D box (complete solution), quantization, normalization of wave functions, concept of zero-point energy.

Microwave (pure rotational) spectra of diatomic molecules. Selection rules. Structural information derived from rotational spectroscopy.

Vibrational Motion: Schrödinger equation of a linear harmonic oscillator and brief discussion of its results (solution not required). Electronic Spectroscopy

b. Photochemistry (4 Lectures)

Laws of photochemistry. Lambert-Beer's law. Fluorescence and phosphorescence. Quantum efficiency. Primary and secondary processes in photochemical reactions. Photochemical and thermal reactions. Photoelectric cells.

Suggested Readings

1. Physical Chemistry, G. M. Barrow, Tata McGraw-Hill.
2. Physical Chemistry, G. W. Castellan, Narosa.
3. General Chemistry, J. C. Kotz, P. M. Treichel and J. R. Townsend, Cengage Learning India Pvt. Ltd., New Delhi.
4. University Chemistry, B. H. Mahan, Narosa.
5. General Chemistry, R. H. Petrucci, Macmillan Publishing Co.: New York.
6. A New Concise Inorganic Chemistry, J. D. Lee, E.L.B.S.
7. Basic Inorganic Chemistry, F. A. Cotton, and G. Wilkinson, John Wiley.
8. Inorganic Chemistry, D. F. Shriver, and P. W. Atkins, Oxford University Press.
9. Inorganic Chemistry, G. Wulfsberg, Viva Books Pvt. Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3		H
CO 4	H	

CHDQ315L: CHEMISTRY OF D-BLOCK ELEMENTS, QUANTUM CHEMISTRY & SPECTROSCOPY LAB

(1 credit – 30 hours) (L-T-P: 0-0-1)

(NSQF: 5)

Objective

This course will make the students familiar with the laboratory experiments related to uv-visible spectroscopy, colourimetry and estimation of metal ions.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall principles and methods for gravimetric analysis of inorganic compounds. (Remembering)

CO 2: Explain the principle involved in gravimetric estimation. (Understanding)

CO 3: Apply the principles to perform complexometric titration. (Applying)

CO 4: Analyse the given vibration-rotation spectrum of HCl(g). (Analysing)

Module I:**a. Inorganic Chemistry**

1. Estimation of the amount of nickel present in a given solution as bis(dimethylglyoximate) nickel (II) or aluminium as oxinate in a given solution gravimetrically.
2. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
3. Estimation of total hardness of a given sample of water by complexometric titration.
4. To draw calibration curve (absorbance at λ_{max} vs. concentration) for various concentrations of a given coloured compound and estimate the concentration of the same in a given solution.
5. Determination of the composition of the Fe^{3+} - salicylic acid complex / Fe^{2+} -phenanthroline complex in solution by Job's method.
6. Determination of concentration of Na^+ and K^+ using Flame Photometry.

b. Physical Chemistry**UV/Visible spectroscopy:**

1. Study the 200-500 nm absorbance spectra of KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values.
Calculate the energies of the two transitions in different units (J molecule⁻¹, kJ mol⁻¹, cm⁻¹, eV).
2. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $\text{K}_2\text{Cr}_2\text{O}_7$.
3. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

Colourimetry:

1. Verify Lambert-Beer's law and determine the concentration of $\text{CuSO}_4/\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7$ in a solution of unknown concentration.
2. Analyse the given vibration-rotation spectrum of HCl(g).

Suggested Readings

1. Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
2. Quantitative Chemical Analysis, A. I. Vogel, Prentice Hall.
3. Senior Practical Physical Chemistry, B. D. Khosla, R. Chand & Co.

Mapping of COs to Syllabus

Course Outcomes	Module I
CO 1	H
CO 2	H
CO 3	H
CO 4	H

CHAC316T: INORGANIC CHEMISTRY IV: ADVANCED INORGANIC CHEMISTRY

(4 credits – 75 hours) (L-T-P: 4-0-0)

(NHEQF: 6.5)

Objective

This course aims at helping the students to become acquainted with the basic concept of transition metals, organometallics, mechanism of Inorganic Reactions, solid state chemistry

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the properties of main group and transition elements for needful applications. (Remembering)

CO 2: Demonstrate the mechanism of Inorganic photochemical reactions (Understanding)

CO 3: Make use of the properties of metals/non-metals for synthesizing organometallic compounds and catalytic activity study (Applying)

CO 4: Analyse the structure, bonding and synthesis of some inorganic solids. (Analysing)

Module I: Descriptive Inorganic Chemistry (20 lectures)

- Structure and bonding in polyhedral boranes and carboranes, styx notation, Wade's rules, electron count in polyhedral boranes, synthesis of polyhedral boranes, isolobal analogy, boron halides, phosphine-boranes, boron heterocycles, borazine.
- Silanes, silicon halides, silicates, silicones, silanols, zeolites, germanium, tin and lead organyls, silenes, germenes, stannenes, phosphorous halides, phosphazenes, sulphur halides, structural features and reactivity of S-N heterocycles.
- Synthesis and reactivity of organo-lithium, beryllium and magnesium compounds, calixarines, cryptands and crown ethers in complexation chemistry.
- Preparation and reactivity of aluminium organyls, carbalumination, hydro aluminination, chemistry of Ga (I) and In (I), reduction of Al, Ga and In organyls, Metal organic framework structures (MOFs).

Module II: Mechanism of Inorganic Reactions (10 lectures)

Substitution in octahedral and square planar complexes, lability, trans-effect, conjugate base mechanism, racemisation, electron transfer reactions - inertness and lability, inner sphere and outer sphere mechanism, Marcus theory, solid state reactions – topotactic and epitactic mechanisms.

Module III: Inorganic Photochemistry (5 lectures)

Photosubstitution and photoredox reactions of chromium, cobalt and ruthenium compounds, Ligand field and charge transfer state (Thexi and DOSENCO states), cis-trans isomerization, photocatalysis and solar energy conservation by ruthenium complexes.

Module IV: Organometallic Chemistry (15 lectures)

- Valence electron count (16/18 electron rules), synthesis, structure, bonding and reactivity of mono and polynuclear metal carbonyls, substituted metal carbonyls, vibrational spectra of metal carbonyls, metal-metal bonding.
- Types of M-C bonds, synthesis and reactivity of metal alkyls, carbenes, alkenes, alkynes, and arene complexes, metallocenes and bent metallocenes, isolobal analogy.
- Reactions of organometallic complexes: Substitution, oxidative addition, reductive elimination, insertion and de insertion, catalysis, hydrogenation, hydroformylation, Monsanto process, Wacker process, alkene polymerization.

Module V: Introduction to Solid State Chemistry (10 lectures)

Structure of simple solids – metals, alloys and compounds; common structure types; synthesis of solid state compounds - ceramic method, microwave synthesis, sol-gel, precursor method, hydrothermal synthesis, CVD and intercalation; characterization of solids, bonding in solids – free-electron and molecular orbital theory; bands in solid state compounds, properties of solids – optical, magnetic and electrical properties of solids.

Suggested Readings

1. Concepts and Models of Inorganic Chemistry, B. E. Douglas, D. H. McDaniel and J. J. Alexander, John Wiley
2. Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Wiley.
3. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter and R. L. Keiter, Pearson Education.
4. Inorganic Chemistry, G. L. Miessler and D. Tarr, Pearson Education.
5. 5 Inorganic Chemistry, G. Wulfsberg, University Science Books.
6. Mechanisms of Inorganic Reactions, F. Basalo and R. G. Pearson, John Wiley
7. Organometallic Chemistry of the Transition Metals, R. H. Crabtree, John Wiley.
8. Solid State Chemistry: An Introduction, L. Smart, E. Moore, Nelson Thorns Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1			H		
CO 2					H
CO 3	H	H	M		
CO 4	H			H	

CHBC317T: ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

(3 credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5.5)

Objective

This course aims at helping the students to become acquainted with the basic concept of transition elements, organometallics, bioinorganic chemistry, active methylene compounds, polynuclear hydrocarbons and organic spectroscopy

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explain the role of metal ions present in biological systems. (Understanding)
 CO 2: Apply the 18-electron rule for organometallic compounds. (Applying)
 CO 3: Compare the reactivity of polynuclear and heteronuclear aromatic molecules. (Analysing)
 CO 4: Evaluate the structure of organic compounds from the UV-Visible and IR-Spectroscopy. (Evaluate)

Module I: Inorganic Chemistry (22 lectures)

a. Chemistry of 3d metals (4 lectures)

Oxidation states displayed by Cr, Fe, Co, Ni and Cu.

A study of the following compounds (including preparation and important properties);

Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $K_4[Fe(CN)_6]$, $K_3[Fe(CN)_6]$, sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

b. Organometallic Compounds (10 lectures)

Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeise's salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach).

c. Bio-Inorganic Chemistry (8 lectures)

A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na⁺, K⁺ and Mg²⁺ ions: Na/K pump; Role of Mg²⁺ ions in energy production and chlorophyll. Role of iron in oxygen transport, haemoglobin, myoglobin, storage and transport of iron.

Module II: Organic Chemistry (23 lectures)

a. Structure, preparation and properties of some aromatic molecules (8 lectures)

Structure elucidation of naphthalene, preparation and properties of naphthalene. Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Furan, Pyrrole, Thiophene, and Pyridine.

b. Active methylene compounds (4 lectures)

Preparation: Claisen ester condensation. Keto-enol tautomerism. Synthetic uses of ethylacetoacetate (preparation of nonheteromolecules having upto 6 carbon).

Reactions: Synthetic uses of ethylacetoacetate (preparation of non-hetero molecules having upto 6 carbon).

c. Application of Spectroscopy to Simple Organic Molecules (11 lectures)

Application of visible, ultraviolet and infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λ_{max} and ϵ_{max} , chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α , β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on $>\text{C}=\text{O}$ stretching absorptions).

Suggested Readings

1. Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. Keiter and R. Keiter, Pearson Publication.
2. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Pearson Publication.
3. A New Concise Inorganic Chemistry, J. D. Lee, E.L.B.S.
4. Basic Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley & Sons.
5. Organic Chemistry (Vol. I & II), I. L. Finar, E.L.B.S.
6. Applications of Absorption Spectroscopy of Organic Compounds, J. L. Dyer, Prentice Hall.
7. Spectroscopic Identification of Organic Compounds, R. M. Silverstein, G. C. Bassler and T. C. Morrill, John Wiley & Sons.
8. Organic Chemistry, R. T. Morrison and R. N. Boyd, Prentice Hall.
9. A Guide Book to Mechanism in Organic Chemistry, P. Sykes, Orient Longman.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H

CHBC318L: ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY LAB

(1Credit – 30 hours) (L-T-P: 0-0-1)

(NHEQF: 5)**Objective**

This course aims at helping the students to become acquainted with the basic experimental concepts on Transition metal complex synthesis and their conductance, systematic qualitative organic analysis, separation by Chromatography

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Qualitative analysis of the organic sample. (Remembering)

CO 2: Explain the concepts of retention factors in chromatographic techniques. (Understanding)

CO 3: Application of paper chromatography techniques. (Applying)

CO 4: Preparation of transition metal complex and comparison of their conductance. (Analysing)

Module I: Inorganic Chemistry

- Separation of mixtures by chromatography: Measure the R_f value in each case. (Combination of two ions to be given) I. Paper chromatographic separation of Fe^{3+} , Al^{3+} and Cr^{3+} .
II. Paper chromatographic separation of Ni^{2+} , Co^{2+} , Mn^{2+} and Zn^{2+} .
- Preparation of any two of the following complexes and measurement of their conductivity: I. Tetraamminecarbonatocobalt (III) nitrate. II. Tetraamminecopper (II) sulphate.
III. Potassiumtrioxalatoferrate (III) trihydrate.
IV. Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl_2 and LiCl_3 .

Module II: Organic Chemistry

Systematic Qualitative Organic Analysis of Organic Compounds possessing mono functional groups (-COOH, alcoholic, phenolic, carbohydrates, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Suggested Readings

- Qualitative Inorganic Analysis, A. I. Vogel, Prentice Hall.
- Quantitative Chemical Analysis, A. I. Vogel, Prentice Hall
- Textbook of Practical Organic Chemistry, A. I. Vogel, Prentice Hall.
- Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Orient Longman.

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO 1		H
CO 2	H	
CO 3	H	
CO 4	H	

CHAP319T: PHYSICAL CHEMISTRY V: ADVANCED PHYSICAL CHEMISTRY

(4 credits – 75 hours) (L-T-P: 4-0-0)

(NHEQF: 6.5)

Objective

This course aims at helping the students to become acquainted with the concepts of chemical kinetics, molecular reaction dynamics, electrochemistry

Course / Learning Outcomes

- CO 1: Explain the interactions of ionic species with solvent molecules. (Understanding)
- CO 2: Apply the knowledge of chemical kinetics to some important types of reactions. (Applying)
- CO 3: Analyse the application of electrochemistry in different fields. (Analysing)
- CO 4: Calculate the rate of different types of chemical reactions. (Evaluating)

Module I: Chemical Kinetics (15 lectures)

Hard Sphere collision theory, theories of unimolecular reactions: Lindemann theory, drawbacks of Lindemann theory-

Hinshelwood modification. Steady state approximation and its applications, oscillating reactions, chemical chaos, BelousovZhabotinski reaction, straight chain reactions - hydrogen-halogen reactions, alkane pyrolysis, Branching-chain reactions - the hydrogen-oxygen reaction, explosion limits, Enzyme catalyzed reactions, Michaelis-Menten mechanism- Lineweaver-Burk and Eadie plots, enzyme inhibition.

Module II: Study of Fast Reactions (8 lectures)

Stopped flow technique, temperature and pressure jump methods, NMR studies in fast reactions, shock tube kinetics, relaxation kinetics, Linearized rate equation, relaxation time in single step fast reactions, determination of relaxation time.

Module III: Molecular Reaction Dynamics (15 lectures)

Collisions of real molecules- trajectory calculations, Laser techniques, reactions in molecular beam, estimation of activation energy and calculation of potential energy surface, the transition state theory (TST) of bimolecular gaseous reactions, statistical and thermodynamic formulations. Comparison between TST and hard sphere collision theory, kinetics of reactions in solution-diffusion controlled and chemically controlled reactions, TST of reactions in solution- Bronsted and Bjerrum equation, effect of ionic strength, kinetic salt effect.

Module IV: Electrochemistry - I (10 lectures)

- a. Ion-solvent interaction- the Born model, Thermodynamic parameters of ion solvent interactions- structural treatment, the ion-dipole model-its modifications, ion-quadrupole and ion-induced dipole interactions.
- b. Primary solution- determination of hydration number, compressibility method and viscosity-mobility method, DebyeHuckel theory of ion-ion interactions, derivation, validity and limitations, extended Debye-Huckel-Onsager equation, random walk model of ionic Diffusion-Einstein Smoluchowski reaction.

Module V: Electrochemistry – II (12 lectures)

- a. **Theories of Electrical Interface:** Electrocapillary phenomena - Lippmann equation, electron transfer at interfaces, polarizable, non-polarizable and non-polarisable interfaces, Butler-Volmer equation, Tafel plot.
- b. **Systems for Electro-Chemical Energy Storage and Conversion:** Types of Batteries, Lead- acid batteries, Nickel-cadmium batteries and Li-ion batteries, electrical double layer capacitor, pseudo-capacitor, fuel cells.

Suggested readings

1. Physical Chemistry, P. Atkins and J. Paula, Oxford University Press, Oxford.
2. Physical chemistry, I. R. Levine, McGraw Hill Education.
3. Chemical Kinetics, K. J. Laidler, Pearson.
4. Modern Electrochemistry Part 1, 2A and 2B, J. O. Bockris and A. K. N. Reddy, Springer.
5. Electrochemical Methods Fundamentals and Applications, J. Bard and L. R. Faulkner, Wiley India.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1				H	M
CO 2	H	H	H		
CO 3			H		H
CO 4	H	H	H		

CHAM406T: ANALYTICAL METHODS IN CHEMISTRY

(3 credits – 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5.5)**Objective**

This course aims at helping the students to become acquainted with Qualitative and quantitative aspects of analysis, different methods of analysis

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Define principles of different methods of analysis. (Remembering)

CO 2: Explain different optical methods of analysis. (Understanding)

CO 3: Identify kinds of errors in chemical analysis. (Applying)

CO 4: Analyse the techniques of thermogravimetry to estimate ions in a mixture. (Analysing)

Module I: Qualitative and quantitative aspects of analysis (5 hours)

Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution of indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Module II: Optical methods of analysis (15 hours)

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer Lambert's law.

UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument.

Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers.

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

Module III: Thermal methods of analysis (5 hours)

Theory of thermogravimetry (TG), basic principle of instrumentation. Techniques for quantitative estimation of Ca and Mg from their mixture.

Module IV: Electroanalytical methods (10 hours)

Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

Module V: Separation techniques (10 hours)

Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation.

Technique of extraction: batch, continuous and counter current extractions.

Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media.

Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods.

Suggested Readings

1. A Text book of Quantitative Inorganic Analysis, A. I. Vogel, ELBS, Longman.
2. Instrumental Methods of Analysis, H. H. Willard, Wadsworth Publishing Company, Belmont, California, USA.
3. Analytical Chemistry, G. D. Christian, John Wiley & Sons, New York.
4. Exploring Chemical Analysis, D. C. Harris, New York, W.H. Freeman.
5. Basic Concepts of Analytical Chemistry, S.M. Khopkar, New Age, International Publisher.
6. Principles of Instrumental Analysis, D.A. Skoog, F. J. Holler and T. A. Nieman, Thomson Asi Pvt. Ltd. Singapore.
7. Laboratory Hand Book of Chromatographic & Allied Methods, O. Mikes and R. A. Chalmers, Elles Horwood Ltd. London.
8. Analytical Chemistry – Methods of separation, R.V. Dilts, Van Nostrand.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	H	H
CO 2		H			
CO 3	H				
CO 4			H		H

CHRM407T: RESEARCH METHODOLOGY

(2 credits – 30 hours) (L-T-P: 2-0-0)

(NHEQF: 5)**Objective**

This course aims at helping the students to become acquainted with different methods of scientific research, data analysis, way to write project proposal **Course / Learning Outcomes**

At the end of this course students will be able to:

CO 1: Explain the different methods of scientific Research. (Un-

derstanding) CO 2: Explain how to use e-resources for research. (Understanding)

CO 3: Explain the analysis and presentation of data. (Understanding)

CO 4: Apply the knowledge of chemical safety and handle chemicals safely in the lab. (Applying)

CO 5: Construct a proposal for project funding. (Creating)

Mode of Assessment:

Modules I-II will be assessed based on a written examination (2 credits) while Module III will be assessed on the basis of a seminar (1-credit).

Module I: Methods of Scientific Research and Chemical Safety (10 lectures)

- Print resources, digital resources, information technology and library resources, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving an oral presentation, writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publication of scientific work; writing ethics – avoiding plagiarism.
- Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals, overview of chemical regulations in India.

Module II: Data Analysis (10 lectures)

The Investigative Approach: Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments.

Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemometrics, Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, r and its abuse. Basic aspects of multiple linear regression analysis.

Module III: Project Proposal Writing (Seminar Module) (10 lectures)

In this module, students will be reviewing scientific articles, writing reports on the papers they have read and finally prepare a research proposal. **Suggested Readings**

- Practical skills in chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A. Jones, Prentice-Hall, Harlow.
- Data analysis for chemistry, D. B. Hibbert and J. J. Gooding, Oxford University Press.
- Errors of observation and their treatment, Fourth Ed., J. Topping, Chapman Hall, London.
- Quantitative chemical analysis, D. C. Harris, Freeman.
- How to use Excel in analytical chemistry and in general scientific data analysis, R. de Levie, Cambridge Univ. Press.
- Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.
- OSU safety manual 1.01.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	H		L
CO 3		H	
CO 4	H		
CO 5			H

CHML408T: MOLECULES OF LIFE (3-0-0)

(NHEQF: 5)

Objective

This course aims to introduce properties of molecules involved in various physiological processes.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the properties and functions of the biomolecules they study. (Understanding)

CO 2: Write mechanisms of biomolecular reactions. (Applying)

CO 3: Differentiate between different biomolecules. (Analysing)

CO 4: Assess the importance of biomolecules in specific processes. (Evaluating)

Module I: Carbohydrates (8lectures)

Classification of carbohydrates, reducing and non-reducing sugars, General Properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of Glucose (Fischer proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosachharides, structure of disacharrides (sucrose) and brief idea of polysaccharides.

Module II: Amino Acids, Peptides and Proteins (8 lectures))

Classification of Amino Acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and

Quaternary structure of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C-terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme). Synthesis of simple peptides.

Module III: Enzymes and correlation with drug action (8 lectures)

Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions,

Specificity of enzyme action (Including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non-competitive inhibition including allosteric inhibition). Drug action-receptor theory. Structure –activity relationships of drug molecules, binding role of –OH group, -NH₂ group, double bond and aromatic ring.

Module IV: Nucleic Acids (10 lectures)

Components of Nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

Module V: Lipids (5 lectures)

Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number.

Module VI: Concept of Energy in Biosystems (6 lectures)

Calorific value of food. Standard caloric content of carbohydrates, proteins and fats. Oxidation of foodstuff (organic molecules) as a source of energy for cells. Introduction to Metabolism (catabolism, anabolism), ATP: the universal currency of cellular energy, ATP hydrolysis and free energy change. Conversion of food into energy. Outline of catabolic pathways of Carbohydrate- Glycolysis, Fermentation, Krebs Cycle.

Suggested Readings

1. Organic Chemistry, R. T. Morrison and R. N. Boyd, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Organic Chemistry (Volume 1), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Organic Chemistry (Volume 2), I. L. Finar, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Lehninger's Principles of Biochemistry, D. L. Nelson and M. M. Cox, W. H. Freeman.
5. Biochemistry, J. M. Berg, J. L. Tymoczko and L. Stryer, W. H. Freeman.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M	H	M	M	H
CO 2		H		H		M
CO 3		M			M	
CO 4			H		H	

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	CHBC112L	Basic Analytical Chemistry (1-0-2)	3
2	S E Course 2	CHCH113L	Chemoinformatics (1-0-2)	3
3	S E Course 3	CHIP217L	Intellectual Property Rights (3-0-0)	3

CHBC112L: BASIC ANALYTICAL CHEMISTRY

(3 Credits- 45 hours) (L-T-P: 1-0-2)

(NHEQF: 5)**Objective***This course is intended to explain the fundamental concepts analytical chemistry and its applications.***Course / Learning Outcomes**

At the end of this course students will be able to:

CO 1: Recall concept of data analysis and principles of chromatography. (Remembering)

CO 2: Explain terms associated with analytical measurements. (Understanding)

CO 3: Determining various parameters of soil and water samples.

(Applying) CO 4: Analyse a mixture of metal ions through paper chromatography. (Analysis)

Module I:

Introduction to Analytical Chemistry and its interdisciplinary nature, concept of sampling, importance of accuracy, precision and sources of error in analytical measurements, Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators.

- Determination of pH of soil samples.
- Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

- Determination of pH, acidity and alkalinity of a water sample.
- Determination of dissolved oxygen (DO) of a water sample.

Module II:**Chromatography:** Definition, general introduction on principles of chromatography, paper chromatography, TLC etc. Paper chromatographic separation of mixture of metal ion (Ni^{2+} and Co^{2+}).**Ion-exchange:** Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).**Suggested Instrumental demonstrations:**

- Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.
- Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.
- Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft Drink.

Suggested Readings

- Instrumental Methods of Analysis, H. H. Willard, CBS Publishers.
- Instrumental Methods of Analysis, D. A. Skoog and J. J. Leary, Saunders College Publications, New York.

- Fundamentals of Analytical Chemistry, D. A. Skoog, D. M. West, F. J. Holler, Saunders College Publishing, Fort Worth.
- Quantitative Chemical Analysis, D. C. Harris, W. H. Freeman and Co., New York.
- Analytical Chemistry Handbook, J. A. Dean, McGraw Hill.
- Vogel's Qualitative Inorganic Analysis, G. Svehla, Prentice Hall.
- Vogel's Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D. Barnes and M.J.K. Thomas, Prentice Hall.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	M	
CO 2	H	H
CO 3	H	
CO 4	M	H

CHCH113L: CHEMOINFORMATICS

(3 Credits- 45 hours) (L-T-P: 1-0-2)

(NHEQF: 5)

Objective

This course is intended to explain concepts of molecular modelling and its application in drug designing.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Recall the principles of molecular modelling. (Remembering)
 CO 2: Explain principles of molecular modelling. (Understanding)
 CO 3: Predict properties of compounds, build models. (Applying)
 CO 4: Elucidate structure and properties, carry out the computer-assisted synthesis of drugs. (Creating)

Module I:

- Introduction to Chemoinformatics:** History and evolution of chemoinformatics, Use of chemoinformatics, Prospects of chemoinformatics, Molecular Modelling and Structure elucidation.
 Representation of molecules and chemical reactions: Nomenclature, Different types of notations, SMILES coding, Matrix representations, Structure of Mol files and Sd files, Libraries and toolkits, Different electronic effects, Reaction classification.
 Searching chemical structures: Full structure search, sub-structure search, basic ideas, similarity search, three-dimensional search methods, basics of computation of physical and chemical data and structure descriptors, data visualization.
- Applications:** Prediction of Properties of Compounds; Linear Free Energy Relations; Quantitative Structure-Property Relations; Descriptor Analysis; Model Building; Modelling Toxicity; Structure-Spectra correlations; Prediction of NMR, IR and Mass spectra; Computer Assisted Structure elucidations; Computer Assisted Synthesis Design, Introduction to drug design; Target Identification and Validation; Lead Finding and Optimization; Analysis of HTS data; Virtual Screening; Design of Combinatorial Libraries; Ligand-Based and Structure Based Drug design; Application of Chemoinformatics in Drug Design.

Hands-on Exercises

Suggested Readings

- An introduction to Chemoinformatics, R. L. Andrew and J. Valerie, Gillet Springer: The Netherlands.
- Chemoinformatics: A text-book. J. Gasteiger and T. Engel, Wiley-VCH.
- QSAR & Molecular Modeling, S. P. Gupta, Anamaya Pub.: New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I
CO 1	H
CO 2	M
CO 3	M
CO 4	M

CHIP217L: INTELLECTUAL PROPERTY RIGHTS

(3 Credits- 45 hours) (L-T-P: 3-0-0)

(NHEQF: 5)

Objective

This course is intended to explain the concepts intellectual property rights and its need.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall the basic concepts of intellectual property. (Remembering)

CO 2: Explain the need for protection of intellectual property. (Understanding)

CO 3: Develop the knowledge of different types of intellectual property. (Applying)

CO 4: Distinguish between different types of intellectual property. (Analysing)

Module I: Introduction to Intellectual Property

Historical Perspective, different Types of IP, importance of protecting IP.

Module II: Copyrights, Trade Marks, Patents

- Introduction, how to obtain, differences from Patents.
 - Introduction, how to obtain, Different types of marks – Collective marks, certification marks, service marks, Trade names, etc., differences from designs.
 - Historical Perspective, Basic and associated right, WIPO, PCT system, Traditional Knowledge.
 - Patents and Healthcare – balancing promoting innovation with public health, Software patents and their importance for India, geographical indications.
 - Definition, rules for registration, prevention of illegal exploitation, importance to India.
 - Industrial Designs: Definition, how to obtain, features, international design registration.
- Layout design of integrated circuits, Circuit Boards, Integrated Chips, importance for electronic industry.

Module III: Trade Secrets

Introduction and Historical Perspectives, Scope of Protection, Risks involved and legal aspects of Trade Secret Protection.

Module IV: Different International agreements World Trade Organization (WTO):

- General Agreement on Tariffs & Trade (GATT), Trade Related Intellectual Property Rights (TRIPS) agreement.
- General Agreement on Trade related Services (GATS).
- Madrid Protocol.
- Berne Convention.
- Budapest Treaty.
- Paris Convention.

WIPO and TRIPS, IPR and Plant Breeders Rights, IPR and Biodiversity.

IP Infringement issue and enforcement – role of Judiciary, role of law enforcement agencies – Police, Customs etc. Economic Value of Intellectual Property – Intangible assets and their valuation, Intellectual Property in the Indian Context – Various laws in India Licensing and technology transfer.

Suggested Readings

1. Textbook on intellectual property rights, N. K. Acharya, Asia Law House.
2. Understanding Trips: Managing Knowledge in Developing Countries, M. Guru and M. B. Rao, Sage Publications.
3. Intellectual Property Rights: Unleashing the Knowledge Economy, P. Ganguli, Tata McGraw-Hill.
4. Intellectual Property: Patents, Trademarks and Copyright in a Nutshell, A. R. Miller and M. H. Davis, West Group Publishers.
5. Intellectual property rights in the WTO and developing countries, J. Watal, Oxford University Press, Oxford.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	M	
CO 3	M			H
CO 4	M	M		

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	CHIN114I	Internship	4
4	Internship	CHIN218I	Internship	4
5	Internship	CHIN320I	Internship	2

CHIN114I/ CHIN218I: INTERNSHIP (Exit of 1st Year or 2nd Year)
(4 Credits: 120 hours)

CHIN320I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)
(2 Credits-60 Hours)

Internship programme Objectives:

1. To help students in gaining experience in their chosen professional field and hence building their own network.
2. To prepare students for the job market.
3. To help students in developing their interpersonal skills.
4. To offer students the real world exposure.

Keeping in mind about the above objectives, the department of chemistry, ADBU is planning for student's internship as per the following strategies

1. Finding of suitable organization/ institutions/ industries offering internship programme by the students.
2. Students must seek consent from the project supervisor/departmental head for application.
3. After due approval, students should appear in the internship interview.
4. Confirmation from the respective institutions end for allowing the internship.
5. After being selected, students should apply to the Director of school or Dean (academics) supported by the industry offer letter.
6. An office order will be issued to the students from academic section on recommendation by the Director/Dean.

7. Finally, a student can proceed to an internship only after receiving an office order from academic section.
8. Internship report submission at the department by the interns and notification of completion by the department.

Note: The internships of 8-10 weeks of 10 credits, after 2nd or 4th semester, will be mandatory for the students desirous of exiting with a certificate or Diploma, respectively. [Source: Internship policy of NEP].

RESEARCH PROJECT /DISSERTATION

BSC CHEMISTRY (Honours)				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	CHDI409P	Research Project Phase I	6
8	Research Project/Dissertation	CHDI410P	Research Project Phase II	6
BSC CHEMISTRY (Honours) with Research				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	CHDI411P	Dissertation I	18
8	Research Project/Dissertation	CHDI412P	Dissertation II	20

CHDI409P: RESEARCH PROJECT PHASE I

(6 credits – 180 hours) (L-T-P: 0-0-6)

In the project Phase I, the students will be trained to carry out literature survey. In addition, proper training will be provided to learn the uses of various software and tools for enhancing their skills in the field of research and development.

CHDI410P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-6)

After successful completion of the Literature Review work, the students will be trained to carry out both **Theoretical and Experimental** based research projects. Finally, they will report and submit their dissertation thesis. Research training in **Phase II** will definitely help them in their future research study.

BSC CHEMISTRY (Honours) with Research

CHDI411P: DISSERTATION I

(18 Credits -540 Hours) (L-T-P: 0-0-18)

In the Dissertation Phase I, the students will be trained to carry out literature survey. In addition, proper training will be provided to learn the uses of various software and tools for enhancing their skills in the field of research and development. Along with their Literature review work, they will also carry out the research problem as assigned by the supervisor.

CHDI412P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-20)

In the Dissertation Phase II, the students will complete and summarize their research work. They will present their research work in front of faculty members and external examiner and will finally submit the dissertation thesis.

BSC CHEMISTRY (Honours) with Research				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	MADI412P	Dissertation I	18
8	Research Project/Dissertation	MADI413P	Dissertation II	20

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES**DEPARTMENT OF PHYSICS****PROGRAMME: BACHELOR OF SCIENCE (BSC) in PHYSICS (Honours/Honours with Research)****MAJOR COURSES**

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	PSMC100T	Mechanics (3-0-0)	4	384
		PSMC101L	Mechanics Lab (0-0-1)		386
2	Major Course 2	PSMP102T	Introduction to Modern Physics (3-1-0)	4	386
3	Major Course 3	PSMA200T	Mathematical Physics (3-1-0)	4	388
3	Major Course 4	PSEM201T	Electricity and Magnetism (3-0-0)	4	389
		PSEM202L	Electricity and Magnetism Lab (0-0-1)		390
4	Major Course 5	PSTP203T	Thermal Physics and Statistical Mechanics (4-1-0)	5	391
4	Major Course 6	PSQM204T	Quantum Mechanics (4-1-0)	5	392
4	Major Course 7	PSEN205T	Electronic Circuits, Networks and Devices (3-0-0)	4	393
		PSEN206L	Electronic Circuits, Networks and Devices Lab (3-0-1)		394
5	Major Course 8	PSCM300T	Condensed Matter Physics (3-1-0)	5	395
		PSCM301L	Condensed Matter Physics Lab (0-0-1)		396
5	Major Course 9	PSET302T	Electromagnetic Theory (3-1-0)	5	397
		PSET303L	Electromagnetic Theory Lab (0-0-1)		398
5	Major Course 10	PSSD304T	Semiconductor Devices (3-0-1)	4	398
		PSSD305L	Semiconductor Devices Lab (3-0-1)		401
6	Major Course 11	PSQM306T	Advanced Quantum Mechanics (3-1-0)	4	401
6	Major Course 12	PSNP307T	Atomic and Nuclear Physics (3-1-0)	4	403
6	Major Course 13	PSCM308T	Classical Mechanics (3-1-0)	4	404
6	Major Course 14	PSMP309P	Minor Project	4	
7	Major Course 15	PSED400T	Electrodynamics (4-1-0)	5	405
7	Major Course 16	PSPP401T	Particle Physics and Accelerators (4-1-0)	5	406

8	Major Course 17	PSSM402T	Statistical Mechanics (4-1-0)	5	408
8	Major Course 18	PSAM403T	Advanced Mathematical Physics (4-1-0)	5	409

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	PSAO103T	Wave - Acoustics and Optics (3-1-0)	4	411
	Minor Course	PSID115T	Introduction to Drone Technology (1-0-0)	1	425
	Minor Course	PSBI116L	Drone Fundamentals, Basic Flight Simulation & Intermediate Flight Skills (0-0-3)	3	428
2	Minor Course 2	PSMP102T	Introduction to Modern Physics (3-1-0)	4	412
	Minor Course	PSDS117T	Drone Systems, Simulation & Applications (1-0-0)	1	426
	Minor Course	PSMP118L	Mission Planning, Aerial Survey, Mapping, Data Processing & Analytics (0-0-3)	3	429
3	Minor Course 3	PSEM201T	Electricity and Magnetism (3-0-0)	4	413
		PSEM202L	Electricity and Magnetism Lab (0-0-1)		414
	Minor Course	PSEF212T	Drone Policy, Entrepreneurship & Future Trends (1-0-0)	1	427
	Minor Course	PSAO213L	Advanced Operations, Compliance & Industry Integration (0-0-3)	3	430
4	Minor Course 4	PSMP209T	Mathematical Physics-II (3-1-0)	4	415
5	Minor Course 5	PSAP310T	Introduction to Astrophysics and Plasma Physics(3-1-0)	4	416
		PSCM300T	Condensed matter Physics (3-0-1)		418
		PSCM301L	Condensed matter Physics Lab (0-0-1)		419
		PSSED311T	Electrodynamics (3-1-0)		419
6	Minor Course 6	PSSD312T	Semiconductor Devices (3-1-0)	4	420
		PSST313T	Statistical Mechanics (3-1-0)		421
7	Minor Course 7	PSMP404T	Materials Physics (3-0-0)	3	422
7	Minor Course 8	PSRM405T	Research Methodology	2	
8	Minor Course 9	PSSA406T	Physics of Sensors and Actuators (3-0-0)	3	424

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	PSTI104L	Basics of lab tools and Instrumentation (1-0-2)	3	432
2	S E Course 2	PSPC105T	Basics of Programming (C/C++/Fortran) (1-0-2)	3	433
3	S E Course 3	PSPP210L	Computational Physics using Python (1-0-2)	3	435

INTERNSHIP

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	PSIN105I	Internship	4	
4	Internship	PSIN211I	Internship	4	436
5	Internship	PSIN314I	Internship	2	436

RESEARCH PROJECT /DISSERTATION

BSC PHYSICS (Honours)					
Semester	Category	Course Code	Course Name	Credits	Page No
7	Research Project/Dissertation	PSDI407P	Research Project Phase I	6	437
8	Research Project/Dissertation	PSDI408P	Research Project Phase II	6	437
BSC PHYSICS (Honours) with Research					
Semester	Category	Course Code	Course Name	Credits	Page No
7	Research Project/Dissertation	PSDI409P	Dissertation I	18	437
8	Research Project/Dissertation	PSDI410P	Dissertation II	20	438

DEPARTMENT OF PHYSICS**PROGRAMME: BACHELOR OF SCIENCE in PHYSICS (BSC)****DEGREE: BSC PHYSICS (HONOURS)/ BSC PHYSICS (HONOURS)****WITH RESEARCH VISION**

To endow the students with profound understanding of physics, the foundation for all natural sciences, and drive them towards critical thought for further study and research, to pave the way for suitable career opportunities and enable them to be of service to the society as responsible human beings.

MISSION

To strengthen the fundamental concepts of physics, to provide advanced understanding of physical phenomena by emphasizing on the correlation between theory and observation, and to spark creative interest towards the pursuit of innovative research in fundamental and applied physics.

FOUR YEAR UNDERGRADUATE PROGRAMME IN PHYSICS (HONOURS/HONOURS WITH RE-SEARCH)

Programme Outcomes:

- PO 1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study.
- PO 2: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. Critically evaluate practices, policies and theories by following scientific approach to knowledge development.
- PO 3: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; communicate with others using appropriate media; confidently share one's views and express herself/ himself; demonstrate the ability to listen carefully; and present complex information in a clear and concise manner to different groups.
- PO 4: Social Interaction: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO 5: Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO 6: Moral and Ethical Awareness: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
- PO 7: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
- PO 8: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes. Critical sensibility to life experiences, with self-awareness and reflexivity of both individual and society.
- PO 9: Information and Digital Literacy: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.
- PO 10: Research-related skills: A sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause- and- effect relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Ability to apply one's learning to real life situations.

Programme Specific Outcomes:

- PSO 1: Understand the core theoretical concept of physics: Understand the core theoretical principles of physics.
- PSO 2: Acquire analytical and logical skill for higher Education: Acquire the ability to analyse critical problems logically.
- PSO 3: Excel in experimental physics and learn good laboratory practices and safety: Learn to handle experiments perfectly and safely.
- PSO 4: Trained to take up jobs in allied fields: Use the knowledge of physics to seek opportunities in other allied fields.

Mapping of Courses with POs/PSOs:

MAJOR COURSES			
Sl. No.	Course Code	Course Name (L-T-P)	Mapping Code
1	PSMC100T	Mechanics (3-0-0)	100
2	PSMC101L	Mechanics Lab (0-0-1)	101
3	PSMP102T	Introduction to Modern Physics (3-1-0)	102
4	PSMA200T	Mathematical Physics (3-1-0)	200
5	PSEM201T	Electricity and Magnetism (3-0-0)	201
6	PSEM202L	Electricity and Magnetism Lab (0-0-1)	202
7	PSTP203T	Thermal Physics and Statistical Mechanics (4-1-0)	203
8	PSQM204T	Quantum Mechanics (4-1-0)	204
9	PSEN205T	Electronic Circuits, Networks and Devices (3-0-0)	205
10	PSEN206L	Electronic Circuits, Networks and Devices Lab (0-0-1)	206
11	PSCM300T	Condensed Matter Physics (3-1-0)	300
12	PSCM301L	Condensed Matter Physics Lab (0-0-1)	301
13	PSET302T	Electromagnetic Theory (3-1-0)	302
14	PSET303L	Electromagnetic Theory Lab (0-0-1)	303
15	PSSD304T	Semiconductor Devices (3-0-1)	304
16	PSSD305L	Semiconductor Devices Lab (3-0-1)	305
17	PSQM306T	Advanced Quantum Mechanics (3-1-0)	306
18	PSNP307T	Atomic and Nuclear Physics (3-1-0)	307
19	PSCM308T	Classical Mechanics (3-1-0)	308
20	PSMP309P	Minor Project	309
21	PSSED400T	Electrodynamics (4-1-0)	400
22	PSPP401T	Particle Physics and Accelerators (4-1-0)	401
23	PSSM402T	Statistical Mechanics (4-1-0)	402
24	PSAM403T	Advanced Mathematical Physics (4-1-0)	403
MINOR COURSES			
25	PSAO103T	Wave - Acoustics and Optics (3-1-0)	103
26	PSMP102T	Introduction to Modern Physics (3-1-0)	102
27	PSEM201T	Electricity and Magnetism (3-0-0)	207
28	PSEM202L	Electricity and Magnetism Lab (0-0-1)	208
29	PSMP209T	Mathematical Physics-II (3-1-0)	209
30	PSAP310T	Introduction to Astrophysics and Plasma Physics(3-1-0)	310
31	PSCM300T	Condensed matter Physics (3-0-1)	300
32	PSCM301L	Condensed matter Physics Lab (0-0-1)	301
33	PSSED311T	Electrodynamics (3-1-0)	311
34	PSSD312T	Semiconductor Devices (3-1-0)	312
35	PSST313T	Statistical Mechanics (3-1-0)	313
36	PSMP404T	Materials Physics (3-0-0)	404
37	PSRM405T	Research Methodology	405
38	PSSA406T	Physics of Sensors and Actuators (3-0-0)	406
	PSID115T	Introduction to Drone Technology (1-0-0)	
	PSBI116L	Drone Fundamentals, Basic Flight Simulation & Intermediate Flight Skills (0-0-3)	
	PSDS117T	Drone Systems, Simulation & Applications (1-0-0)	
	PSMP118L	Mission Planning, Aerial Survey, Mapping, Data Processing & Analytics (0-0-3)	
	PSEF212T	Drone Policy, Entrepreneurship & Future Trends (1-0-0)	
	PSAO213L	Advanced Operations, Compliance & Industry Integration (0-0-3)	
SKILL ENHANCEMENT COURSES			
39	PSTI104L	Basics of lab tools and Instrumentation (1-0-2)	104
40	PSPC105T	Basics of Programming (C/C++/Fortran) (1-0-2)	105
41	PSPP214L	Computational Physics using Python (1-0-2)	214

Mapping	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PSO 4
100														
101														
102														
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104														
105														
214														

DETAILED MAJOR COURSE

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	PSMC100T	Mechanics (3-0-0)	4
		PSMC101L	Mechanics Lab (0-0-1)	
2	Major Course 2	PSMP102T	Introduction to Modern Physics (3-1-0)	4
3	Major Course 3	PSMA200T	Mathematical Physics (3-1-0)	4
3	Major Course 4	PSEM201T	Electricity and Magnetism (3-0-0)	4
		PSEM202L	Electricity and Magnetism Lab (0-0-1)	
4	Major Course 5	PSTP203T	Thermal Physics and Statistical Mechanics (4-1-0)	5
4	Major Course 6	PSQM204T	Quantum Mechanics (4-1-0)	5
4	Major Course 7	PSEN205T	Electronic Circuits, Networks and Devices (3-0-0)	4
		PSEN206L	Electronic Circuits, Networks and Devices Lab (3-0-1)	
5	Major Course 8	PSCM300T	Condensed Matter Physics (3-1-0)	5
		PSCM301L	Condensed Matter Physics Lab (0-0-1)	
5	Major Course 9	PSET302T	Electromagnetic Theory (3-1-0)	5
		PSET303L	Electromagnetic Theory Lab (0-0-1)	
5	Major Course 10	PSSD304T	Semiconductor Devices (3-0-1)	4
		PSSD305L	Semiconductor Devices Lab (3-0-1)	
6	Major Course 11	PSQM306T	Advanced Quantum Mechanics (3-1-0)	4
6	Major Course 12	PSNP307T	Atomic and Nuclear Physics (3-1-0)	4
6	Major Course 13	PSCM308T	Classical Mechanics (3-1-0)	4
6	Major Course 14	PSMP309P	Minor Project	4
7	Major Course 15	PSED400T	Electrodynamics (4-1-0)	5
7	Major Course 16	PSPP401T	Particle Physics and Accelerators (4-1-0)	5
8	Major Course 17	PSSM402T	Statistical Mechanics (4-1-0)	5
8	Major Course 18	PSAM403T	Advanced Mathematical Physics (4-1-0)	5

PSMC100T: MECHANICS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of this course is to provide students with a comprehensive understanding of the fundamental principles and laws that govern the motion of objects and systems. Through theoretical concepts and practical applications, this course aims to develop students' problem-solving skills, analytical thinking, and mathematical reasoning in the context of classical mechanics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concepts of Newtonian Mechanics. (Remembering)

CO 2: Explain the concepts of work, energy and forces. (Understanding)

CO 3: Explain the concepts of rotational and periodic motions. (Understanding)

CO 4: Analyze the concepts of Special Theory of relativity. (Analysis)

Module I: Fundamentals of Dynamics (10 hours)

Reference frames, Inertial frames, Review of Newton's Laws of Motion, Galilean transformations, Galilean invariance, Momentum of variable- mass system: motion of rocket, Motion of a projectile in Uniform gravitational field Dynamics of a system of particles, Centre of Mass, Principle of conservation of momentum, Impulse, Work and Kinetic Energy Theorem, Conservative and non-conservative forces, Potential Energy, Energy diagram, Stable and unstable equilibrium, Elastic potential energy, Force as gradient of potential energy, Work & Potential energy, Work done by non-conservative forces, Law

of conservation of Energy, Elastic and inelastic collisions between particles, Centre of Mass and Laboratory frames.

Module II: Rotational Dynamics and Elasticity (8 hours)

Angular momentum of a particle and system of particles, Torque, Principle of conservation of angular momentum, Rotation about a fixed axis, Moment of Inertia, Calculation of moment of inertia for rectangular, cylindrical and spherical bodies, Kinetic energy of rotation, Motion involving both translation and rotation, Relation between Elastic constants, Twisting torque on a Cylinder or Wire.

Module III: Fluid Motion, Gravitation and Central Force Motion (8 hours)

Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube, Law of gravitation, Gravitational potential energy, Inertial and gravitational mass, Potential and field due to spherical shell and solid sphere.

Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, The energy equation and energy diagram, Kepler's Laws, Satellite in circular orbit and applications, Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS).

Module IV: Oscillations and Non-Inertial Systems (9 hours)

SHM: Simple Harmonic Oscillations, Differential equation of SHM and its solution, Kinetic energy, potential energy, total energy and their time-average values, Damped oscillation, Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor, Non-inertial frames and fictitious forces, Uniformly rotating frame, Laws of Physics in rotating coordinate systems, Centrifugal force, Coriolis force and its applications, Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.

Module V: Special Theory of Relativity (10 hours)

Michelson-Morley Experiment and its outcome, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation, Relativistic transformation of velocity, frequency and wave number, Relativistic addition of velocities, Variation of mass with velocity, Massless Particles, Mass-energy Equivalence, Relativistic Doppler effect, Relativistic Kinematics, Transformation of Energy and Momentum.

Suggested Readings

1. An introduction to mechanics, D. Kleppner, R. J. Kolenkow, McGraw-Hill.
2. Mechanics, Berkeley Physics, Vol.1, C. Kittel, W. Knight, et.al., Tata McGraw-Hill.
3. Physics, Resnick, Halliday and Walker, Wiley.
4. Analytical Mechanics, G. R. Fowles and G. L. Cassiday, Cengage Learning.
5. Feynman Hours, Vol. I, R. P. Feynman, R. B. Leighton and M. Sands, Pearson Education.
6. Introduction to Special Relativity, R. Resnick, John Wiley and Sons.
7. University Physics, Ronald Lane Reese, Thomson Brooks/Cole.
8. Mechanics, D. S. Mathur, S. Chand and Company Limited.
9. University Physics, F. W. Sears, M.W. Zemansky and H. D. Young, Addison Wesley.
10. Physics for scientists and Engineers with Modern Phys., J. W. Jewett and R. A. Serway, Cengage Learning.
11. Theoretical Mechanics, M. R. Spiegel, Tata McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	H	L	L		
CO3		H		H	
CO4				M	M

PSMC101L: MECHANICS LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to provide students with hands-on experience in conducting experiments related to classical mechanics. Through practical activities, analysis, and interpretation, this course aims to enhance students' understanding of theoretical concepts and develop their skills in experimental techniques.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Measure distances and angles accurately. (Application)
 CO 2: Measure various properties of solid matters. (Application)
 CO 3: Measure acceleration due to gravity by different techniques. (Application)

At least 10 Experiments to be performed from the following:

1. Measurements of length (or diameter) using Vernier caliper, screw gauge and traveling microscope.
2. Study the random error in observations.
3. Study the Motion of Spring and calculate (a) Spring constant, (b) g and (c) Modulus of rigidity.
4. Determine the Moment of Inertia of a Flywheel.
5. Determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille's method).
6. Determine the Young's Modulus of a Wire by Optical Lever Method.
7. Determine the Modulus of Rigidity of a Wire by Maxwell's needle.
8. Determine the elastic Constants of a wire by Searle's method.
9. Determine the value of g using Bar Pendulum.
10. Determine the value of g using Kater's Pendulum.

Mapping of COs to the syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1	M	M	M							
CO2				M	M		M	M	M	M
CO3						M				L

PSMP102T: INTRODUCTION TO MODERN PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to provide students with a comprehensive understanding of the fundamental principles and concepts that form the basis of modern physics. The students will develop a strong foundation in the theoretical aspects of quantum mechanics, enabling them to analyze and explain the behavior of matter and energy at the atomic and subatomic levels. They will also learn about lasers.

Course / Learning Outcomes

- CO 1: Demonstrate an elementary knowledge of quantum mechanics. (Understanding)
 CO 2: Explain the physics of an atomic nucleus. (Understanding)
 CO 3: Summarize the basic principles of LASER. (Understanding)

Module I: Fundamentals of Quantum Mechanics-I (22 hours)

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo- electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions.

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle- application to virtual particles and range of an interaction.

Module II: Fundamentals of Quantum Mechanics–II (14 hours)

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.

Module III: Nuclear Physics (16 hours)

Size and structure of atomic nucleus, Impossibility of an electron being in the nucleus, Nature of nuclear force, N-Z graph, Semi- empirical mass formula and binding energy, Nuclear Shell Model and magic numbers. Radioactivity, Law of radioactive decay, Mean life and half-life, Alpha decay, Beta decay, Gamma ray emission, Fission and fusion, Nuclear reactor: slow neutrons interacting with Uranium 235; Thermonuclear reactions(brief qualitative discussions).

Module IV: Laser (8 hours)

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser. Basic lasing.

Suggested Readings

1. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard and Coop, Tata McGraw Hill.
3. Introduction to Quantum Mechanics, David J. Griffith, Pearson Education.
4. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, Cengage Learning.
5. Modern Physics, G. Kaur and G. R. Pickrell, 2014, McGraw Hill.
6. Quantum Mechanics: Theory & Applications, A. K. Ghatak and S. Lokanathan, Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		

CO2			H	
CO3				H

PSMA200T: MATHEMATICAL PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The main objectives of a course on Mathematical Physics are to provide students with a solid foundation in mathematical methods and techniques that are essential for understanding and solving problems in theoretical physics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Apply the concepts and theorems of vectors to different branches of Physics (Applying)

CO 2: Solve physical problems using the concepts of differential equation and complex analysis. (Applying)

CO 3: Apply the concepts of Beta function, Dirac delta function and curvilinear coordinates. (Applying)

Module I: Vector Calculus (15 hours)

Recapitulation of vectors, Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).

Module II: Differential Equation (15 hours)

First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Particular Integral. Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers.

Module III: Complex Analysis (15 hours)

Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Residues and Residue Theorem.

Module IV: Some Special topics in MP (15 hours)

Beta and Gamma Functions and Relation between them, Expression of Integrals in terms of Gamma Functions.

Orthogonal Curvilinear Coordinates, Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

Definition of Dirac delta function, Properties of Dirac delta function.

Suggested Readings

1. Mathematical Methods for Physicists, G. B. Arfken, H. J. Weber and F. E. Harris, Elsevier.
2. An introduction to ordinary differential equations, E. A. Coddington, PHI learning.
3. Differential Equations, George F. Simmons, McGraw Hill.
4. Mathematical Tools for Physics, James Nearing, Dover Publications.

5. Mathematical methods for Scientists and Engineers, D. A. McQuarrie, Viva Book.
6. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley India.
7. Advanced Engineering Mathematics, H. K. Das, S. Chand.
8. Complex Variables, A. K. Kapoor, Cambridge Univ. Press.
9. First course in complex analysis with applications, D. G. Zill and P. D. Shanahan, Jones & Bartlett.
10. Complex Variables and Applications, J. W. Brown and R. V. Churchill, Tata McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

PSEM201T: ELECTRICITY AND MAGNETISM

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of the course is to teach the students about the fundamental concepts concerning electric field, magnetic field, electro-magnetic effects and electrical circuits.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Summarize the fundamental concepts of electric field, electric potential, capacitors and polarization. (Remember)

CO 2: Explain the concept of magnetic field, types of different magnetic materials and its associated phenomena. (Understand)

CO 3: Outline the laws governing electromagnetic induction and electrical circuits (Understand)

Module I: Electric Field and its related phenomena (15 hours)

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere.

Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D . Relations between E , P and D . Gauss' Law in dielectrics.

Module II: Magnetic Field (15 hours)

Magnetic force between current elements and definition of Magnetic Field B . Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B : curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field. Magnetization vector (M). Magnetic Intensity (H). Magnetic Susceptibility and permeability. Relation between B , H , M . Ferromagnetism. B - H curve and hysteresis.

Module III: Electromagnetic Induction and Electrical Circuits (15 hours)

Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored

in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current. AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit. Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping.

Suggested Readings

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, Tata McGraw.
2. Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education.
3. Introduction to Electrodynamics, D. J. Griffiths, Benjamin Cummings.
4. Feynman Hours, R. P. Feynman, R. B. Leighton and M. Sands, Pearson Education.
5. Elements of Electromagnetics, M. N. O. Sadiku, Oxford University Press.
6. Electricity and Magnetism, Vol. I, J. H. Fewkes & J. Yarwood, Oxford Univ. Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H		
CO2		H	
CO3			H

PSET303L: ELECTRICITY AND MAGNETISM LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to provide students with hands-on experience in conducting experiments related to electricity and magnetism. Through practical activities, analysis, and interpretation, this course aims to enhance students' understanding of theoretical concepts and develop their skills in experimental techniques.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Measure various parameters of electrical devices, circuits and apparatus. (Evaluating)

CO 2: Measure fields using electrical apparatus. (Evaluating)

CO 3: Demonstrate the validity of various network theorems in practical applications. (Understanding)

CO 4: Utilize the concept of induction to study various AC circuits. (Applying)

At least 5 experiments to be performed from the following:

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. Study the characteristics of a series RC Circuit.
3. Determine an unknown Low Resistance using Potentiometer.
4. Determine an unknown Low Resistance using Carey Foster's Bridge.
5. Compare capacitances using De'Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. Verify the Thevenin and Norton theorems.
8. Verify the Superposition, and Maximum power transfer theorems.
9. Determine self-inductance of a coil by Anderson's bridge.
10. Study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.

Mapping of COs to the syllabus

Course comes	Out-	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO 1		H	H	H	H	H					
CO 2							H				
CO 3								H	H		
CO4										H	H

PSTP203T: THERMAL PHYSICS AND STATISTICAL MECHANICS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The objective of the course is to provide students with a comprehensive understanding of the principles and concepts that govern the behavior of systems in equilibrium and non-equilibrium states. This course aims to equip students with the necessary tools and knowledge to analyze and explain the macroscopic properties of matter, as well as to understand the statistical behavior of particles at the microscopic level.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Summarize the various thermodynamical processes. (Understanding)

CO 2: Apply the kinetic theory of gases to different transport phenomena. (Applying)

CO 3: Summarize the various laws governing blackbody radiation. (Understanding)

CO 4: Combine the concepts of thermodynamics and statistical mechanics. (Creating)

Module I: Laws of Thermodynamics (20 hours)

Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between C_P and C_V , Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

Module II: Thermodynamical Potentials (15 hours)

Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius Clapeyron Equation, Expression for $(C_P - C_V)$, C_P/C_V , TdS equations.

Module III: Kinetic Theory of Gases (15 hours)

Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.

Module IV: Theory of Radiation (15 hours)

Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh- Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.

Module V: Statistical Mechanics (10 hours)

Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann distribution, Quantum statistics- Fermi-Dirac and Bose-Einstein distributions.

Suggested Readings

1. Thermal Physics, S. Garg, R. Bansal and C. Ghosh, Tata McGraw-Hill.
2. A Treatise on Heat, Meghnad Saha, and B. N. Srivastava, Indian Press.
3. Thermodynamics, Enrico Fermi, Courier Dover Publications.
4. Heat and Thermodynamics, M. W. Zemasky and R. Dittman, McGraw Hill.
5. Thermodynamics, Kinetic theory & Statistical thermodynamics, F. W. Sears and G. L. Salinger, Narosa.
6. University Physics, Ronald Lane Reese, Thomson Brooks/Cole.
7. Thermal Physics, A. Kumar and S. P. Taneja, R. Chand Publications.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H			
CO2			H		
CO3				H	
CO4					H

PSQM204T: QUANTUM MECHANICS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The objective of the course is to make students aware of the basic concepts of quantum mechanics such as the state and behavior of a particle moving in space and time that is described by a complex wave function. Through the basic formulation in quantum mechanics, the students will be able to understand different phenomena in nature and recent technologies based on quantum mechanical effects.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Interpret the significance of the Schrödinger wave equation. (Understanding)

CO 2: Solve problems involving bound states in arbitrary potential. (Applying)

CO 3: Examine the quantum behaviour of the one-electron system and many-electron systems. (Analysing)

Module I: Time-Dependent and Independent Schrödinger Equation (26 hours)

Schrödinger equation; Time-dependent Schrodinger equation and dynamical evolution of a quantum state, Properties of Wave Function. Interpretation of Wave Function, Probability and probability current densities in three dimensions, Conditions for Physical Acceptability of Wave Functions. Normalization, Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators. Commutator of position and momentum operators. Ehrenfest theorem, Expectation values of position and momentum.

Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time-independent Schrodinger equation; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle with proof.

Module II: Bound States in an Arbitrary Potential (17 hours)

Continuity of wave function, boundary condition and the emergence of discrete energy levels, application to the one-dimensional problem, infinite and finite rectangular potential well, potential barrier and quantum mechanical tunnelling. Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method; Hermite polynomials; ground state, zero point energy & uncertainty principle.

Module III: Three-dimensional problems (15 hours)

Three-dimensional problems: Separation of variables; orbital angular momentum; spherical harmonics. Harmonic oscillator in Cartesian and polar coordinates. A free particle and a particle in a 3-D box in Cartesian and polar coordinates, Coulomb problem in spherical and parabolic coordinates - regular and irregular solutions.

Module IV: Quantum Theory of One-Electron and Many-Electron Systems (17 hours)

Hydrogen atom, angular momentum operator & quantum numbers; Radial wavefunctions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum, quantum numbers l and m ; s, p, d,... shells. Spin-Orbit Interaction, Identical Particles, Ground State Energy of He atom. Elementary Idea of Hartree's Field. Elementary idea of Heisenberg's picture of quantum mechanics.

Suggested Readings

1. A Textbook of Quantum Mechanics, P. M. Mathews and K. Venkatesan, McGraw Hill.
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, Wiley.
3. Quantum Mechanics, Leonard I. Schiff, Tata McGraw Hill.
4. Quantum Mechanics, G. Aruldas, PHI Learning of India.
5. Quantum Mechanics, Bruce Cameron Reed, Jones and Bartlett Learning.
6. Quantum Mechanics: Foundations & Applications, Arno Bohm, Springer.
7. Quantum Mechanics for Scientists & Engineers, D. A. B. Miller, Cambridge University Press.
8. Quantum Mechanics, Eugen Merzbacher, John Wiley and Sons, Inc.
9. Introduction to Quantum Mechanics, D. J. Griffith, Pearson Education.
10. Quantum Mechanics, Walter Greiner, Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

PSEN205T: ELECTRONIC CIRCUITS, NETWORKS AND DEVICES

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of this course is to introduce the laws that govern the response of electrical circuits and networks, the various passive and active components used in these circuits. The course focuses on solving simple electrical networks using associated theorems and principles. The objective is also to learn the basic properties and principles of basic semiconductor materials, semiconductor junctions, electronic devices and electronic circuit design. The course will also help in understanding the operation of simple devices such as p-n junctions and optoelectronic devices and more complex devices such as Bipolar Junction Transistors (BJT) through theory and practice.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Describe passive components and DC networks and electronic devices. (Remembering)
 CO 2: Discuss the principles of operation of analog and digital electronic devices. (Understanding)
 CO 3: Analysis of devices for solving simple mathematical problems. (Application, Analysis)

Module I: Passive Components and DC Networks (15 hours)

- Passive components: resistors, capacitors and inductors-types, characteristics and applications;
- DC networks: voltage and current sources, dependent sources, KCL, KVL, current division rule, voltage division rule, Y-Delta conversion, mesh analysis, node analysis, Thevenin's theorem, Norton's theorem, superposition theorem, maximum power transform theorem.

Module II: Electronic Devices and Circuits (20 hours)

- Semiconductor concepts: Semiconductor material basics, intrinsic semiconductor, extrinsic semiconductor, energy levels, concept of hole and electron, mobility, conductivity, n-type and p-type, majority and minority carriers, mechanism of current flow.
- Semiconductor diode: PN junction and various biasing conditions, V-I characteristics, diode equation, diode resistance, equivalent circuit, transition capacitance and diffusion capacitance; rectifier circuit with filter, clipper, clamper, voltage multiplier.
- Bipolar Junction Transistor: BJT: construction, npn, pnp, operation and configuration, V-I characteristics.
- Special purpose devices: Zener diodes, LED, Solar Cell, photo diode, photo transistor, Schottky diode, varactor diode, tunnel diode.

Module III: Fundamentals of Digital Circuits (10 hours)

Number systems: Definition, type and interconversion, Boolean algebra, De-Morgan's law, AND, OR, NOT, Universal gates, combinational logic circuits.

Suggested Readings

- Electronic Devices and Circuits, S. Salivahanan, McGraw Hill Publications.
- Networks and Systems, D. Roy Choudhury, New Age International.
- Electronic Devices and Circuits, David A. Bell, Oxford University Press.
- Digital electronics, Moris Mano, EEE.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III
CO1	H		
CO2		H	
CO3	H	H	H
CO4	H	H	H

PSEN206L: ELECTRONIC CIRCUITS, NETWORKS AND DEVICES LAB

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to provide students with hands-on experience and practical skills in designing and analyzing electronic circuits and devices in order to complement the theoretical knowledge gained in related coursework.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Analyze electronic devices and tools used in the lab for various applications. (Analysing)

CO 2: Construct and evaluate electronic circuits using different devices and components to perform certain operations. (Creating)

At least 10 Experiments to be performed from the following:

- Introduction to electronic lab components.

2. Introduction to electronic lab tools and equipment.
3. Verification of KCL using discrete components.
4. Verification of KVL using discrete components.
5. Study the Characteristics of PN junction Diodes.
6. Study the Characteristics of Zener Diodes.
7. Design half wave rectifier using diode and evaluate ripple factor with and without filter.
8. Design full wave rectifier using diodes and evaluate ripple factor with and without filter.
9. Design and study the clipper circuit.
10. Design and study the clamper circuit.
11. Design various multiplier circuits using diodes and capacitors
12. Study Static Characteristics of a Bipolar Junction Transistor (CE Mode)
13. Study Static Characteristics of a Bipolar Junction Transistor (CB Mode)
14. Study the Characteristics of Light Emitting Diodes Diodes.

Mapping of COs to Syllabus:

Course Out-comes	Exp t. 1	Exp t. 2	Exp t. 3	Exp t. 4	Exp t. 5	Exp t. 5	Exp t. 7	Exp t. 8	Exp t. 9	Exp t. 10	Exp t. 11	Expt. 12	Exp t. 13	Expt . 14
CO1	H	H												
CO2			H	H	H	H	H	H	H	H	H	H	H	H

PSCM300T: CONDENSED MATTER PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to provide the students to deal with the solid state of matter and its various physical properties. It is also required to pursue studies on specialised topic like electronics, nano-sciences, etc. Emphasis shall be laid upon the solution of numerical problems.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain crystal structure and the concepts of lattice vibrations (Understanding)

CO 2: Illustrate the dielectric and magnetic behavior of matter (Applying)

CO 3: Construct band theory and explain superconductivity (Applying)

Module I: Crystal Structure and Lattice Dynamics (17 hours)

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.

Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law.

Module II: Magnetic and Dielectric Properties of Matter (18 hours)

Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia- and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mossotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeier relations. Langevin- Debye equation. Complex Dielectric Constant.

Module III: Ferroelectric Properties of Materials (10 hours)

Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

Module IV: Elementary Band Theory and Superconductivity (15 hours)

Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient. Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation).

Suggested Readings

1. Charles Kittel, Introduction to Solid State Physics, Wiley India Pvt. Ltd.
2. J. P. Srivastava, Elements of Solid State Physics, Prentice-Hall of India
3. Leonid V. Azaroff, Introduction to Solids, 2004, Tata Mc-Graw Hill.
4. N. W. Ashcroft and N. D. Mermin, Solid State Physics, Cengage Learning.
5. H. Ibach and H. Luth, Solid-state Physics, Springer.
6. Rita John, Solid State Physics, McGraw Hill.
7. M. Ali Omar, Elementary Solid State Physics, Pearson India.
8. M. A. Wahab, Solid State Physics, Narosa Publications.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

PSCM301L: CONDENSED MATTER PHYSICS LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of the course is to demonstrate experiments related to basic properties of solid state materials. Also it is aimed to explain few basic experiments related to semiconductors.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Learn about magnetic properties of matter. (Understanding)

CO 2: Analyse dielectric properties of materials. (Applying)

CO 3: Understand and analyse few topics related to semiconductor physics. (Analysing)

At least 5 experiments should be performed from the following:

1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method).
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency.
5. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
6. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150°C) and to determine its band gap.
7. To determine the Hall coefficient of a semiconductor sample.

Mapping of COs to the syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7
CO1	H	H	M		M		

CO2				H			
CO3						H	H

PSET302T: ELECTROMAGNETIC THEORY

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to provide students with a comprehensive understanding of the fundamental principles and laws governing electricity and magnetism. Through theoretical concepts, mathematical formalism, and practical applications, this course aims to develop students' knowledge and skills in analysing electromagnetic phenomena.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Apply Maxwell's equations in solving problems related to various physical phenomena. (Applying)

CO 2: Explain physical phenomena involving electric charges and currents from the standpoint of electromagnetic theory. (Understanding)

CO 3: Analyze the behavior of physical systems using electromagnetic theory. (Analyzing)

Module I: Maxwell Equations (15 hours)

Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density.

Module II: EM Wave Propagation in Unbounded Media (15 hours)

Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth. Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere.

Module III: EM Wave in Bounded Media (15 hours)

Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection & Transmission coefficients. Total internal reflection, evanescent waves. Metallic reflection (normal Incidence).

Module IV: Polarization of Electromagnetic Waves (15 hours)

Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Babinet Compensator and its Uses. Analysis of Polarized Light.

Suggested Readings

1. Introduction to Electrodynamics, D. J. Griffiths, Benjamin Cummings.
2. Elements of Electromagnetics, M. N. O. Sadiku, Oxford University Press.
3. Introduction to Electromagnetic Theory, T. L. Chow, Jones & Bartlett Learning.
4. Fundamentals of Electromagnetics, M. A. W. Miah, Tata McGraw Hill.
5. Electromagnetic field Theory, R. S. Kshetrimayun, Cengage Learning.
6. Engineering Electromagnetic, William H. Hayt, McGraw Hill.

7. Electromagnetic Field Theory for Engineers & Physicists, G. Lehner, Springer.
8. Electromagnetic Fields & Waves, P. Lorrain and D. Corson, W.H. Freeman & Co.
9. Electromagnetics, J. A. Edminster and Schaum Series, Tata McGraw Hill.
10. Electromagnetic field theory fundamentals, Guru and H. Hiziroglu, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

PSET303L: ELECTROMAGNETIC THEORY LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to complement theoretical knowledge with practical skills, providing students with a deeper understanding of electromagnetic principles through hands-on experimentation. It encourages students to think critically, analyse data, and draw conclusions based on evidence specific to electromagnetism. The course also fosters skills in teamwork, communication, and laboratory safety awareness relevant to the field of electromagnetism.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: To Know about the physics of polarization of electromagnetic waves. (Understanding)

CO 2: To build a clear concept of wave properties of electromagnetic waves and its application to various systems / media. (Understanding and Applying)

CO 3: Analyze the physics of radiation. (Analyzing)

At least 8 experiments should be performed from the following

1. To verify the law of Malus for plane polarized light.
2. To determine the specific rotation of the sugar solution using Polarimeter.
3. To analyze elliptically polarized Light by using a Babinet's compensator.
4. To study dependence of radiation on angle for a simple Dipole antenna.
5. To determine the wavelength and velocity of ultrasonic waves in a liquid (Kerosene Oil, Xylene, etc.) by studying the diffraction through ultrasonic grating.
6. To study the reflection, refraction of microwaves.
7. To study Polarization and double slit interference in microwaves.
8. To study the polarization of light by reflection and determine the polarizing angle for air-glass interface.
9. To verify the Stefan's law of radiation and to determine Stefan's constant.
10. To determine the Boltzmann constant using V-I characteristics of PN junction diode.

Mapping of COs to the syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1	H	H	M				H			H
CO2					M	H	H	M	M	M
CO3				M					M	

PSSD304T: SEMICONDUCTOR DEVICES

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of this course is to provide basic analog electronic circuit design techniques and analytical skills using diodes, op- amps, FETs and BJTs. This course also introduces the concepts of digital and binary systems and how these concepts are connected to digital electronics. It also provides fundamental concepts used in the design of digital systems, the basic tools for the design and implementation of digital circuits, modules and subsystems through and practice.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Illustrate theoretical concepts related to analog electronics circuit analysis and digital electronics circuit design. (Understanding)
- CO 2: Analyze transistors for optimum performance as amplifiers using load line, frequency response and feedback. (Analysing)
- CO 3: Apply transistor operational knowledge for high gain operations and various logical and mathematical operations. (Applying)
- CO 4: Design simple analog electronic circuits and digital electronic systems for various outcomes. (Applying)

Module I: Bipolar Junction Transistor (18 hours)

- a. BJT biasing and stabilization: Load Line analysis of Transistors. DC Load line and Q-point and stability considerations, fixed bias, emitter feedback bias, collector feedback bias, voltage divider bias.
- b. BJT modelling: Two port representation of BJT with h-parameter model for BJT for C-E, C-B, C-C configurations, calculation of voltage gain, current gain, input impedance and output impedance.
- c. Frequency response of BJT amplifiers: Frequency response, Low frequency and high frequency response of BJT amplifiers, importance of coupling capacitors and bypass capacitors, cascading of amplifiers.
- d. Feedback amplifiers: Concept of negative and positive feedback, impact of negative feedback, concept of sinusoidal and non-sinusoidal oscillators, 555 timers.
- e. Operational Amplifier: Block diagram, ideal op-amp equivalent circuit, ideal characteristics, transfer curve, open loop and closed loop configuration, Common mode rejection ratio; Op-amp applications: inverting amplifier, non-inverting amplifier, adder, subtractor.

Module II: Field Effect Transistors (15 hours)

- a. Introduction: Introduction to FET- JFET, MOSFET and CMOS; structure, operation, characteristic curves and equations.
- b. FET biasing: Different biasing methods; self-bias, fixed bias, voltage divider bias, stabilization of Q-point.
- c. JFET amplifiers: CS, CD amplifiers; enhancement mode MOSFET amplifier, depletion mode MOSFET amplifiers.

Module III: Digital Circuits (12 hours)

- a. Number systems: Signed and unsigned representation, binary arithmetic on signed and unsigned integers and detection of overflow and underflow, weighted binary Codes: BCD, 2421, non-weighted codes: excess-3 codes, gray codes, error detecting codes, error correcting codes, alphanumeric codes: ASCII code, EBCDIC codes.
- b. Boolean algebra and Logic Gates: Logic gates (basic and universal), rules of Boolean algebra, sum of products and product of sums forms. Conversion between different forms, conversion between Boolean expression and truth table; implementing logic expressions with logic gates (logic circuits).
- c. Combinational logic circuits: Simplification of Boolean expressions using algebraic method, Karnaugh map method and Don't Care conditions. Designing Combinational logic circuits: half-adder, full-adder, encoder, decoder, Multiplexer, demultiplexer.

- d. Digital logic families: Elementary idea of DTL, TTL, RTL, ECL, I²L logic family and characteristics.

Suggested Readings:

1. Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, Pearson Education.
2. Millman's Electronic Devices and Circuits, Jacob Millman, Christos C. Halkias and Satyabrata Jit, Tata McGraw Hill.
3. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Tata McGraw-Hill.
4. Solid State Electronic Devices, Streetman and Banerjee, Prentice Hall.
5. Electronic Devices and Circuits, David A. Bell, Prentice Hall of India.
6. Op-amps and Linear Integrated Circuits, Ramakant A. Gayakwad, PHI.
7. Digital Logic and computer Design, M. Mano, PHI.
8. Modern Digital Electronics, R. P. Jain, TMGH.

Mapping of COs to Syllabus:

Course Out-comes	Module I	Module II	Module III
CO1	H	H	H
CO2	H	H	
CO3		H	H
CO4	H		H

PSSD305L: SEMICONDUCTOR DEVICES LAB

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to provide students with hands-on experience and practical skills in designing and analyzing electronic circuits and devices in order to complement the theoretical knowledge gained in related coursework.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Design and evaluate electronic circuits using different devices and components to perform certain operations. (Creating)

CO 2: Design and evaluate electronic circuits using electronic simulation software to perform certain operations. (Creating)

At least 10 Experiments to be performed from the following:

1. Design a CE amplifier using voltage divider biasing and find its Voltage Gain.
2. Design a CE amplifier using voltage divider biasing and plot and understand its frequency response curve.
3. Design Inverting amplifier using op-amp and calculate gain.
4. Design Non Inverting amplifier using op-amp and calculate gain.
5. Design a summing amplifier circuit using op-amp.
6. Design a voltage subtractor circuit using op-amp.
7. Design a signal integrator circuit using op-amp.
8. Design zero crossing detector and positive and negative comparators using op-amp.
9. Design 1st order low pass filters using op-amp.
10. Design 2nd order low pass filters using op-amp.
11. Design 1st order high pass filters using op-amp.
12. Design 2nd order high pass filters using op-amp.
13. Design astable multivibrator using op-amp.
14. Design monostable stable multivibrator using op-amp.
15. Design bistable stable multivibrator using op-amp.
16. Use electronic simulation software like Multisim to design and simulate simple circuits

Mapping of COs to Syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 5	Expt. 7	Expt. 8	Expt. 9	Expt. 10	Expt. 11	Expt. 12
CO1	H	H	H	H	H	H	H	H	H	H	H	
CO2												H

PSQM306T: ADVANCED QUANTUM MECHANICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The main objectives of an advanced quantum mechanics course are to understand the Mathematical Framework, mastering the Principles of Quantum Mechanics, developing Analytical and Critical Thinking, connecting Quantum Mechanics to Applications etc. Good knowledge of advanced quantum mechanics course can serve as a stepping stone for students interested in pursuing research or further studies in quantum mechanics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain different representations and postulates of quantum mechanics (Understanding)

- CO 2: Discuss orbital and spin angular momentum (Understanding)
 CO 3: Illustrate the concepts of perturbation and scattering theory (Applying)
 CO 4: Develop concepts on relativistic quantum mechanics (Applying)

Module I: Representations, Postulates and Symmetries (10 hours)

Dirac notations, Representation in Discrete Bases, Representation in continuous Bases, postulates of quantum mechanics: The

State of a System, Observables and Operators, Measurement in Quantum Mechanics, Time Evolution of the System's State. Symmetry in quantum mechanics. Reflections, time reversal, space inversion, particle exchange. Displacement in space and time, space translation and rotational symmetry.

Module II: Angular Momentum and Spinors (15 hours)

Orbital Angular Momentum, General Formalism of Angular Momentum, Matrix Representation of Angular Momentum, Geometrical Representation of Angular Momentum, Eigenfunctions of Orbital Angular Momentum.

Spinors and their transformation properties. Pauli spin matrices. Identical particles and statistics. Addition of angular momenta. Clebsch-Gordan coefficients. Wigner-Eckart Theorem.

Module III: Perturbation Theory (12 hours)

Variational methods for bound states; lower and upper limits in simple cases. WKB approximation; Stationary perturbation theory: Non Degenerate case; first and second order of energy and wave functions, Time dependent perturbation theory; first order transition probabilities; constant perturbation. Transition to continuum;

Harmonic perturbation; Fermi's golden rule; Sudden and adiabatic approximations.

Module IV: Scattering Theory (10 hours)

Scattering theory: asymptotic behaviour of scattering wave function; relation to cross sections, Green's function for scattering problem; Green's function with different boundary conditions; scattering integral equations; Born approximation and its validity criteria; scattering by screened Coulomb potential; Born series. Partial waves and phase shifts. Scattering amplitude; optical theorem; low energy scattering. Effective range; scattering length; resonance.

Module V: Relativistic Quantum Mechanics (13 hours)

Relative wave equations: Klein-Gordon equation. Difficulty with probability interpretation. Dirac equation; four component solutions for free particle; negative energy solutions – particles and antiparticles. Covariant form of Dirac equation; 4-current density. Properties of γ -matrices. Dirac equation in the presence of electromagnetic field; non-relativistic reduction; spin and magnetic moment.

Suggested Readings

1. Quantum Mechanics, E. Merzbacher, John Wiley.
2. Quantum Mechanics, G. Ahrulldhas, Prentice Hall.
3. Quantum Mechanics, L. I. Schiff, McGraw Hill.
4. Quantum Mechanics, V. K. Thankappan, New Age Int. Pub.
5. Quantum Mechanics, P. T. Mathews and Venkatesan, Tata McGraw Hill.
6. Principles of Non-Relativistics and Relativistic Quantum Mechanics, K. D. Krori, PHI.
7. Quantum Mechanics (3 volumes), L. D. Landau and E. M. Lifshitz, Pergamon Press.
8. Quantum Mechanics, Albert Messiah, Dover Publications.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H			
CO2		H			
CO3			H	H	
CO4					H

PSNP307T: ATOMIC AND NUCLEAR PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to provide students with an advanced understanding of the principles and theories that govern atomic and nuclear phenomena. Through theoretical concepts, experimental techniques, and mathematical formalism, this course aims to develop students' knowledge and skills in analyzing the structure, properties, and interactions of atoms and nuclei.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain atomic spectra for single electron systems and many-electron system in details. (Understanding)

CO 2: Understand interaction of radiation with atoms. (Understanding)

CO 3: Understand the basic properties of nuclei, their reactions and different models to explain nuclear structure. (Understanding)

CO 4: Explain the phenomena of radioactive decays of different nuclei. (Analyzing)

Module I: (12 hours)

Introduction of atomic spectrum; fine structure and hyperfine structure of energy levels. Sommerfeld's relativistic corrections, Quantum mechanical treatment of one electron atom, orbital angular momentum, Gyromagnetic Ratio and Bohr magneton. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Normal and Anomalous Zeeman effect. Stern-Gerlach Experiment. Paschen Back and Stark Effect (Qualitative Discussion only). Spectral Notations for Atomic States; Vector atom Model. Spin-orbit coupling in atoms- L-S and J-J couplings.

Module II: (14 hours)

Quantum mechanical theory of atomic structure; fine structure of hydrogen spectral terms, Zeeman effect, Paschen Back effect. Identical particles, Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Periodic table. Multi electron atoms; Hartree's self consistent field. Hund's Rule. Fine structure of spectral lines in helium and Alkali Atoms (Na etc.). Doublet structure energy levels. Term symbols and fine structure of energy levels of two electron atoms using L-S coupling and j-j coupling schemes; identification of ground state. Interaction of nuclear and electronic magnetic moments and hyperfine structure with examples.

Module III: General Properties of Nuclei (10 hours)

Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, NZ plot, angular momentum, parity, magnetic moment, electric moments, nuclear excited states.

Module IV: Nuclear Models (12 hours)

Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

Module V: Radioactivity Decay and Nuclear Reactions (12 hours)

Alpha decay: basics of α -decay processes, theory of α -emission, Gamow factor, Geiger Nuttall law, α -decay spectroscopy. β - decay: energy kinematics for β -decay, positron emission, electron capture, neutrino hypothesis. Gamma decay: Gamma rays emission & kinematics, internal conversion.

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction.

Suggested Readings

1. Introduction to Atomic Spectra, H. E. White, Mc-Graw Hill.
2. Atoms and Molecules, Martin Karplus and Richard N. Porter, W. A. Benjamin.
3. Introductory nuclear Physics, Kenneth S. Krane, Wiley India Pvt. Ltd.
4. Concepts of nuclear physics, Bernard L. Cohen, Tata Mcgraw Hill.
5. Introduction to the physics of nuclei & particles, R. A. Dunlap, Thomson Asia.
6. Introduction to High Energy Physics, D. H. Perkins, Cambridge Univ. Press.
7. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons.
8. Quarks and Leptons, F. Halzen and A. D. Martin, Wiley India.
9. Basic ideas and concepts in Nuclear Physics - An Introductory Approach, K. Heyde, IOP- Institute of Physics Publishing.
10. Radiation detection and measurement, G. F. Knoll, John Wiley & Sons.
11. Physics and Engineering of Radiation Detection, Syed Naeem Ahmed, Academic Press, Elsevier.
12. Theoretical Nuclear Physics, J. M. Blatt & V. F. Weisskopf, Dover Pub.Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H		H	
CO2			H		
CO3					H
CO4					H

PSCM308T: CLASSICAL MECHANICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to provide the basic knowledge of classical mechanics in terms of Lagrangian and Hamiltonian instead of Newtonian mechanics. Here the students will learn how to construct Lagrangian and Hamiltonian for a system and hence to obtain equation of motion. The course will also provide deep insights on relativistic mechanics and let the students learn the required mathematical tools and prepare them for higher studies. Emphasis shall be laid upon solving numerical problems.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Construct Lagrangian and Hamiltonian for different physical systems (Apply)
 CO 2: Explain small oscillations (Understanding)
 CO 3: Solve problems related to special theory of relativity (Analyzing)
 CO 4: Apply the laws of fluid dynamics to build technologies (Applying)

Module I: Classical Mechanics of Point Particles (20 hours)

Review of Newtonian Mechanics, Generalized coordinates and velocities, constraints and degrees of freedom, Hamilton's variational principle; Lagrangian and the Euler-Lagrange equations, one-dimensional examples of the Euler-Lagrange equations- one-dimensional Simple Harmonic Oscillations and falling body in uniform gravity; Cyclic coordinates and conservation theorems, Canonical momenta & Hamiltonian, Hamilton's equations of motion, Applications: Hamiltonian for a harmonic oscillator, particle in a central force field- conservation of angular momentum and energy.

Module II: Small Amplitude Oscillations (10 hours)

Minima of potential energy and points of stable equilibrium, expansion of the potential energy around a minimum, small amplitude oscillations about the minimum, normal modes of oscillations example of N identical masses connected in a linear fashion to (N -1) - identical springs.

Module III: Special Theory of Relativity (20 hours)

Postulates of Special Theory of Relativity, Lorentz transformations, Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams, Time-dilation, length contraction and twin paradox, Four-vectors: Four-velocity and acceleration. Four-momentum and energy-momentum relation, Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle.

Module IV: Fluid Dynamics (10 hours)

Density and pressure in a fluid, an element of fluid and its velocity, continuity equation and mass conservation, stream-lined motion, laminar flow, Poiseuille's equation for flow of a liquid through a pipe, Navier-Stokes equation, qualitative description of turbulence, Reynolds number.

Suggested Readings

1. H. Goldstein, C. P. Poole and J. L. Safko, Classical Mechanics, Pearson Education.
2. L. D. Landau and E. M. Lifshitz, Mechanics, Pergamon.
3. L. D. Landau and E. M. Lifshitz, The Classical Theory of Fields, Elsevier.
4. P. S. Joag, N. C. Rana, Classical Mechanics, McGraw Hall.
5. R. Douglas Gregory, Classical Mechanics, Cambridge University Press.
6. Dieter Strauch, Classical Mechanics: An Introduction, Springer.
7. O. L. Delange and J. Pierrus, Solved Problems in Classical Mechanics, Oxford Press.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

PSED400T: ELECTRODYNAMICS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The main objective of electrodynamics is to provide a comprehensive understanding of the behavior of electric and magnetic fields, as well as their interactions with charged particles and currents. It is a branch of physics that explores the fundamental principles and mathematical formalism underlying electromagnetic phenomena. Overall, the main objective of electrodynamics is to provide a comprehensive understanding of electromagnetic phenomena, enabling students to analyze and solve problems related to electric and magnetic fields and their interactions with matter.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Outline the origin and propagation of electromagnetic waves. (Understanding)

CO 2: Explain the nature of electromagnetic radiation. (Understanding)

CO 3: Infer the extension of classical electrodynamics to the generalized 4-dimensional case. (Analyzing)

CO 4: Apply the laws of electrodynamics to solve various physical problems. (Applying)

Module I: Introduction (16 hours)

Revision of Maxwell's Equations; Electromagnetic waves: linear and circular polarisation; Stoke's parameters; Poynting theorem of complex field vectors; frequency dispersion (normal and anomalous); characteristics of dielectrics, conductors and plasma and their interaction with electromagnetic waves.

Module II: Green's Function and Radiating systems (25 hours)

- a) Simple radiating systems: Gauge invariance; Green's function for the wave equation; concept of retarded potential, radiation from an oscillating dipole and its polarisation. Electric dipole

fields, magnetic dipole and electric quadrupole fields; centre fed linear antenna, scattering at long wavelengths – viz. by dipoles induced in a small scatterer, scattering by a small dielectric sphere.

- b) Diffraction: Scalar diffraction theory; vectorial diffraction theory, Scattering in a short wavelength limit.
- c) Guided waves: waveguides, TE waves in a rectangular waveguide, coaxial transmission lines.

Module III: Radiation by an accelerated Charge (17 hours)

Radiation from accelerated charge: Lienard-Wiechart potentials; radiated power from accelerated charge at low velocities. Larmor's power formula. The fields of a point charge in arbitrary and uniform motion. Radiation from an ultra-relativistic particle. Angular and frequency distribution of radiation from moving charges.

Module IV: Covariant Form of Maxwell's Equations and Relativity (17 hours)

Special theory of relativity: Four dimensional Lorentz transformation, covariance of Maxwell's equations, electromagnetic field tensor; matrix representation of Lorentz transformation; infinitesimal generators; Thomas precession; invariance of electric charge; covariance of electrodynamics; transformation of electromagnetic fields.

Suggested Readings

1. Classical Electrodynamics, J. D. Jackson, John Wiley and Sons.
2. Classical Electrodynamics, S. P. Puri, Tata McGraw Hill Publishing Company Ltd.
3. Electrodynamics, S. L. Gupta, V. Kumar and S. P. Singh, Pragati Prakashan.
4. Introduction to Electrodynamics, D. J. Griffiths, Prentice Hall of India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	H	H		
CO3			H	H
CO4			H	H

PSPP401T: PARTICLE PHYSICS AND ACCELERATORS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The main objectives of a course on Particle Physics and Accelerators are to provide students with a comprehensive understanding of the fundamental particles and their interactions, as well as the technology and principles behind particle accelerators. By accomplishing these objectives, the course on Particle Physics and Accelerators aims to equip students with a solid foundation in the field, enabling them to pursue further studies or careers in particle physics, accelerator science, or related disciplines.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explore different concepts of Linear and Cyclic accelerators (understanding)
- CO 2: Explain superconductivity and its application in accelerators (understanding)
- CO 3: Learn the basics of particle physics (understanding)

Module I: Introductions to Accelerators (15 hours)

Introduction to DC accelerators, Cockcroft-Walton, Van de Graaff, Tandem, Pelletron accelerators. Ion sources, high voltage generation, voltage stabilization, Charging systems (capacitive and inductive), Magnets, insulating gases and their characteristics.

Control systems, beam handling components, Focussing systems, interlocks, Voltage / Energy calibration, beam optics.

Module II: Introduction to LINACs (15 hours)

Introduction and basic principles of LINACs. Relativistic expressions. Propagation of electromagnetic waves through matter (relevant to LINACs only), boundary conditions, phase velocity, group velocity, wave equation. Generation of modes in a cavity/waveguide.

Application to the different types of LINACs including traveling and standing wave types. Transit time factor and the energy gained in a LINAC. General ideas of surface resistance, power loss, Quality factor, shunt impedance in cavities; Normal conducting LINAC structures.

Module III : Superconductivity in accelerators (10 hours)

Superconductivity in accelerators, advantages of Superconducting cavities, breakdown mechanisms in Superconducting cavities, Superconducting accelerating cavities

Module IV: Dynamics at LINACs (20 hours)

Longitudinal dynamics in LINACs: Longitudinal stability, stability criteria, separatrix, synchronous oscillation with small and large amplitudes. FD, FFDD focusing, Stability criteria, phase advance and stability in LINACs; Space charge effects in high intensity beams. Cyclotrons. Synchrocyclotron. AVF principle and concept of hills and valleys in magnetic field. Different applications of cyclotrons.

Equation of motion in magnetic field and concept of focusing, Weak and strong focusing, Quadrupole magnets, Principle of AG focusing, Edge focusing; particle acceleration, Proton storage ring; Basic concept of space charge and tune shift. Fixed target collision and colliding beams. Luminosity and circular colliders

Module V: Introduction to Particle Physics (15 hours)

Elementary Particle Physics: Fundamental forces, Elementary particles and their classification, characteristics of the elementary particles, quantum numbers, behaviour under charge conjugation, time reversal and parity operation, Isotopic multiplet and Gellmann-Nishijima scheme, SU (3) classification and Quark model, Standard model.

Suggested Readings

1. Particle Accelerators, M.S. Livingston and J.B. Blewett, McGraw-Hill Inc, US (1962)
2. Particle Accelerator Physics, Helmut Wiedemann, Fourth Edition, Springer (2015).
3. Introduction to Accelerator Physics, Arvind Jain, MacMillan India Ltd, (2007).
4. RF Linear Accelerators-second, completely revised and enlarged edition (Wiley 2008) Thomas P. Wangler
5. An Introduction to the Physics of Particle Accelerators - second edition (World Scientific 2008), Mario Conte and William M. MacKay
6. Particle Accelerator Physics - fourth edition (Springer 2015). -Helmut Wiedemann
7. Accelerator Physics - fourth edition (World Scientific 2019) -S. Y. Lee.
8. Principles of Charged Particle Acceleration – Stanley Humphries
9. Helmut Wiedemann, "Particle Accelerator Physics", Springer
10. A. Edwards and M. J. Syphers, "Physics of High Energy Accelerators", WILEY-VCH
11. Phillip J. Bryant and Kjell Johnson, "The Principles of Circular Accelerators and Storage Rings", Cambridge University press
12. S. Y. Lee, "Accelerator Physics", World Scientific
13. Andrzej Wolski, "Beam Dynamics in High Energy Particle Accelerators", World Scientific
14. Proceedings of 5th General Accelerator Physics Course, Vol-1 and 2, CERN Accelerator School, Ed. S

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H		H	
CO2			H		

CO3					H

PSSM402T: STATISTICAL MECHANICS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The objective of the course is to teach the students about the connection between statistical mechanics and thermodynamics, quantum statistical mechanics, phase transitions and non-equilibrium physics.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Illustrate the connection between statistical mechanics and thermodynamics. (Analyzing)
 CO 2: Explain the concept of quantum statistical mechanics. (Understanding)
 CO 3: Outline the physics of phase transition. (Understanding)
 CO 4: Explain the importance of non-equilibrium physics. (Understanding)

Module I: Essentials (20 hours)

Probability theory: the random walk problem, binomial, Poisson and Gaussian distributions, central limit theorem; Classical equilibrium statistical mechanics: concept of equilibrium; Ergodic hypothesis; micro-canonical, canonical and grand canonical Ensembles; partition functions and their relation to thermodynamics; Classical non-equilibrium statistical mechanics: approach to equilibrium, Liouville's theorem, Boltzmann's H theorem

Module II: Quantum Statistics (20 hours)

Quantum statistical mechanics: Schrödinger and Heisenberg Picture; pure and mixed states, the density matrix, quantum mechanical Liouville's theorem; the fundamental postulates; Quantum statistics: quantum gases of independent particles; partition functions; Bose Einstein and Fermi Dirac's distributions; electrons in metals; black body radiation; Bose Einstein's Condensation

Module III: Phase Transitions (18 hours)

Phenomenology: first and second order phase transitions; elementary ideas of critical phenomena; universality of critical exponents; scaling of thermodynamic functions; Theory: the Landau theory of phase transition with examples. c) Exact solutions: Ising model in one dimension.

Module IV: Non Equilibrium Phenomena and Irreversible Processes (17 hours)

Non equilibrium phenomena: transport theory; Boltzmann equation; Maxwell-Boltzmann distribution; Irreversible processes: fluctuations; Brownian motion; Langevin's equation; Wiener Khintchine relations, Nyquist theorem, Fluctuation- Dissipation theorem; Fokker Planck equation.

Suggested Readings

1. Fundamental of Statistical and Thermal Physics, Federick Reif, McGraw Hill, Singapore.
2. Statistical Mechanics, Shang-Keng Ma, World Scientific, Singapore.
3. Statistical Mechanics: Fundamental and Modern Applications, Richard E. Wilde, and Surjit Singh, Wiley-Interscience, John Wiley and Sons Inc., New York.
4. Statistical Physics: Statics, Dynamics and Renormalisation, Leo P. Kadanoff, World Scientific, River Edge, New Jersey.
5. Statistical Mechanics, K. Huang, John Wiley and Sons Inc., New York.
6. Statistical Physics, D. J. Amit and J. Verbin, World Scientific, Singapore.
7. Statistical Physics, L. D. Landau, E. M. Lifshitz, Butterworth-Heinemann.
8. Statistical Mechanics, R. K. Pathria, Academic Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV

CO1	H			
CO2		H		
CO3			H	
CO4				H

PSAM403T: ADVANCED MATHEMATICAL PHYSICS

(5 Credits – 75 hours) (L-T-P: 4-1-0)

Objective(s)

The main objectives of a course on Advanced Mathematical Physics are to provide students with a deeper understanding of the mathematical methods and techniques used in theoretical physics and to develop their ability to apply advanced mathematical concepts to solve problems in physics.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explain the concepts and applications of the Fourier series, Laplace and Integral transformation and special function (Applying)
- CO 2: Illustrate some of the basic concepts of tensor analysis and its application to different branches of physics. (Understanding, Applying)
- CO 3: Analyse some of the basic concepts of group theory and its application to different branches of physics. (Understanding, Applying)

Module I: Fourier Series (10 hours)

Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions.

Module II: Integrals and Laplace Transforms (20 hours)

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.).

Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT.

Module III: Frobenius Method and Special Functions (15 hours)

Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions ($J_0(x)$ and $J_1(x)$) and Orthogonality.

Module IV: Tensor Calculus (15 hours)

Transformation of coordinates: Galilean and Lorentz transformations. Tangent vectors and gradients, inner and outer products, contraction, symmetric and antisymmetric tensors, metric tensor, covariant and contravariant derivatives. Metric tensor in different curved spaces. Four vectors and physical examples from special relativity and electrodynamics.

Module V: Group Theory (15 hours)

Group axioms, permutation groups (S_2 and S_3) and symmetry operations of equilateral triangle, multiplication table, subgroup, classes and characters, finite groups (Z_n), cosets, factor group, normal subgroup, point symmetry group, direct and semi direct product of groups, homomorphism and isomorphism, direct and semi-direct products, block diagonalisation - reducible and irreducible representation, group representation by matrix [unitary representation and conservation laws], Lie groups and algebras [generators, $SO(2)$, $SO(3)$ and $SU(2)$]; unitary group, special unitary group.

Suggested Readings

1. Mathematical Methods for Physicists, G. Arfken, H. Weber and F. Harris, Elsevier.
2. Mathematical Methods of Physics, J. Mathews and R. L. Walker, The Benjamin-Cumminngs Publishing Company.
3. Mathematics for Physicists, P. Dennery and A. Krzywicki, Harper and Row
4. A.W.Joshi, Matrices and Tensors in Physics, 3rd Edition, New Age Int. (2005)
5. M. Hamermesh, Group Theory and Its Applications to Physical Problems, Dover (1989)
6. D.B. Lichtenberg, Unitary symmetry and elementary particles, second edition, Academic Press (1978).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	H		
CO2				H	
CO3					H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	PSAO103T	Waves: Acoustics and Optics (3-1-0)	4
2	Minor Course 2	PSMP102T	Introduction to Modern Physics (3-1-0)	4
3	Minor Course 3	PSEM207T	Electricity and Magnetism (3-0-0)	4
		PSEM208L	Electricity and Magnetism Lab (0-0-1)	
4	Minor Course 4	PSMP209T	Mathematical Physics-II (3-1-0)	4
5	Minor Course 5	PSAP310T	Introduction to Astrophysics and Plasma Physics(3-1-0)	4
		PSCM300T	Condensed matter Physics (3-0-1)	
		PSCM301L	Condensed matter Physics Lab (0-0-1)	
		PSED311T	Electrodynamics (3-1-0)	
6	Minor Course 6	PSSD312T	Semiconductor Devices (3-1-0)	4
		PSST313T	Statistical Mechanics (3-1-0)	
7	Minor Course 7	PSMP404T	Materials Physics (3-0-0)	3
7	Minor Course 8	PSRM405T	Research Methodology	2
8	Minor Course 9	PSSA406T	Physics of Sensors and Actuators (3-0-0)	3

PSAO103T: WAVES: ACOUSTICS AND OPTICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to provide students with a comprehensive understanding of the fundamental principles and properties of waves, with a specific focus on acoustics and optics. This course aims to equip students with the necessary knowledge and skills to analyze and explain the behavior of waves, both in the context of sound and light, and their applications in various fields.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Make use of the superposition principle in different scenarios. (Applying)

CO 2: Classify and illustrate different wave motions. (Understanding)

CO 3: Analyze and interpret the wave nature of light. (Analyzing)

Module I: Superposition of Harmonic Oscillations (10 hours)

Simple harmonic motion, Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. Lissajous Figures.

Module II: Wave Motion (12 hours)

Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction.

Module III : Standing Waves (8 hours)

Standing (Stationary) Waves in a String: Fixed and Free Ends. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes.

Module IV: Interference (15 hours)

Electromagnetic nature of light. Wave front. Huygens Principle. Temporal and Spatial Coherence. Division of amplitude and wavefront. Young's double slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Haidinger and Fizeau Fringes. Newton's Rings. Michelson Interferometer and Fabry-Perot interferometer.

Module V: Diffraction (15 hours)

Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitative discussion only). Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire.

Suggested Readings

1. Waves: Berkeley Physics Course, Vol. 3, Francis Crawford, Tata McGraw-Hill.
2. Fundamentals of Optics, F. A. Jenkins and H.E. White, McGraw-Hill.
3. Principles of Optics, Max Born and Emil Wolf, Pergamon Press.
4. Optics, Ajoy Ghatak, Tata McGraw Hill.
5. The Physics of Vibrations and Waves, H. J. Pain, John Wiley and Sons.
6. The Physics of Waves and Oscillations, N. K. Bajaj, Tata McGraw Hill.
7. Fundamental of Optics, A. Kumar, H. R. Gulati and D. R. Khanna, R. Chand Publications.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H			
CO2			H		
CO3				H	H

PSMP102T: Introduction to Modern Physics

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to provide students with a comprehensive understanding of the fundamental principles and concepts that form the basis of modern physics. The students will develop a strong foundation in the theoretical aspects of quantum mechanics, enabling them to analyze and explain the behavior of matter and energy at the atomic and subatomic levels. They will also learn about lasers.

Course / Learning Outcomes

- CO 1: Demonstrate an elementary knowledge of quantum mechanics. (Understanding)
 CO 2: Explain the physics of an atomic nucleus. (Understanding)
 CO 3: Summarize the basic principles of LASER. (Understanding)

Module I: Fundamentals of Quantum Mechanics-I (22 hours)

Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo- electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions.

Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations involving Canonical pair of variables): Derivation from Wave

Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle- application to virtual particles and range of an interaction.

Module II: Fundamentals of Quantum Mechanics–II (14 hours)

Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.

Module III: Nuclear Physics (16 hours)

Size and structure of atomic nucleus, Impossibility of an electron being in the nucleus, Nature of nuclear force, N-Z graph, Semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers. Radioactivity, Law of radioactive decay, Mean life and half-life, Alpha decay, Beta decay, Gamma ray emission, Fission and fusion, Nuclear reactor: slow neutrons interacting with Uranium 235; Thermonuclear reactions(brief qualitative discussions).

Module IV: Laser (8 hours)

Lasers: Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser. Basic lasing.

Suggested Readings

1. Concepts of Modern Physics, Arthur Beiser, McGraw-Hill.
2. Introduction to Modern Physics, Rich Meyer, Kennard and Coop, Tata McGraw Hill.
3. Introduction to Quantum Mechanics, David J. Griffith, Pearson Education.
4. Physics for scientists and Engineers with Modern Physics, Jewett and Serway, Cengage Learning.
5. Modern Physics, G. Kaur and G. R. Pickrell, 2014, McGraw Hill.
6. Quantum Mechanics: Theory & Applications, A. K. Ghatak and S. Lokanathan, Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2			H	
CO3				H

PSEM201T: ELECTRICITY AND MAGNETISM

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of the course is to teach the students about the fundamental concepts concerning electric field, magnetic field, electro-magnetic effects and electrical circuits.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Summarize the fundamental concepts of electric field, electric potential, capacitors and polarization. (Remember)

CO 2: Explain the concept of magnetic field, types of different magnetic materials and its associated phenomena. (Understand)

CO 3: Outline the laws governing electromagnetic induction and electrical circuits (Understand)

Module I: Electric Field and its related phenomena (15 hours)

Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with

spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to: (1) Plane Infinite Sheet and (2) Sphere. Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector D . Relations between E , P and D . Gauss' Law in dielectrics.

Module II: Magnetic Field (15 hours)

Magnetic force between current elements and definition of Magnetic Field B . Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B : curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field. Magnetization vector (M). Magnetic Intensity (H). Magnetic Susceptibility and permeability. Relation between B , H , M . Ferromagnetism. B - H curve and hysteresis.

Module III: Electromagnetic Induction and Electrical Circuits (15 hours)

Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current. AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit. Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping.

Suggested Readings

1. Electricity, Magnetism & Electromagnetic Theory, S. Mahajan and Choudhury, Tata McGraw.
2. Electricity and Magnetism, Edward M. Purcell, McGraw-Hill Education.
3. Introduction to Electrodynamics, D. J. Griffiths, Benjamin Cummings.
4. Feynman Hours, R. P. Feynman, R. B. Leighton and M. Sands, Pearson Education.
5. Elements of Electromagnetics, M. N. O. Sadiku, Oxford University Press.
6. Electricity and Magnetism, Vol. I, J. H. Fewkes & J. Yarwood, Oxford Univ. Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H		
CO2		H	
CO3			H

PSEM208L: ELECTRICITY AND MAGNETISM LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of this course is to provide students with hands-on experience in conducting experiments related to electricity and magnetism. Through practical activities, analysis, and interpretation, this course aims to enhance students' understanding of theoretical concepts and develop their skills in experimental techniques.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Measure various parameters of electrical devices, circuits and apparatus. (Evaluating)
 CO 2: Measure fields using electrical apparatus. (Evaluating)

CO 3: Demonstrate the validity of various network theorems in practical applications. (Understanding)

CO 4: Utilize the concept of induction to study various AC circuits. (Applying)

At least 5 experiments to be performed from the following:

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. Study the characteristics of a series RC Circuit.
3. Determine an unknown Low Resistance using Potentiometer.
4. Determine an unknown Low Resistance using Carey Foster's Bridge.
5. Compare capacitances using De'Sauty's bridge.
6. Measurement of field strength B and its variation in a solenoid (determine dB/dx)
7. Verify the Thevenin and Norton theorems.
8. Verify the Superposition, and Maximum power transfer theorems.
9. Determine self inductance of a coil by Anderson's bridge.
10. Study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.

Mapping of COs to the syllabus

Course comes	Out-	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1		H	H	H	H	H					
CO2							H				
CO3								H	H		
CO4										H	H

PSMP209T: MATHEMATICAL PHYSICS II

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The main objectives of a course on Mathematical Physics are to provide students with a solid foundation in mathematical methods and techniques that are essential for understanding and solving problems in theoretical physics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain the concepts and applications of the Fourier series, Laplace and Integral transformation and special function (Applying)

CO 2: Illustrate some of the basic concepts of tensor analysis and its application to different branches of physics. (Understanding, Applying)

CO 3: Analyse some of the basic concepts of group theory and its application to different branches of physics. (Understanding, Applying)

Module I: Fourier Series (8 hours)

Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions.

Module II: Integrals and Laplace Transforms (8 hours)

Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral.

Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting

Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs.

Module III: Frobenius Method and Special Functions (18 hours)

Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions ($J_0(x)$ and $J_1(x)$) and Orthogonality.

Module IV: Tensor Calculus (12 hours)

Transformation of coordinates: Galilean and Lorentz transformations. Tangent vectors and gradients, inner and outer products, contraction, symmetric and antisymmetric tensors, metric tensor, covariant and contravariant derivatives.

Module V: Introduction to Group Theory (14 hours)

Group axioms, permutation groups (S_2 and S_3) and symmetry operations of equilateral triangle, multiplication table, subgroup, classes and characters, finite groups (Z_n), cosets, factor group, normal subgroup, point symmetry group, direct and semi direct product of groups, homomorphism and isomorphism, direct and semi-direct products, block diagonalisation - reducible and irreducible representation.

Suggested Readings

1. Mathematical Methods for Physicists, G. Arfken, H. Weber and F. Harris, Elsevier.
2. Mathematical Methods of Physics, J. Mathews and R. L. Walker, The Benjamin-Cumminngs Publishing Company.
3. Mathematics for Physicists, P. Dennery and A. Krzywicki, Harper and Row
4. A.W.Joshi, Matrices and Tensors in Physics, 3rd Edition, New Age Int. (2005)
5. M. Hamermesh, Group Theory and Its Applications to Physical Problems, Dover (1989)
6. D.B. Lichtenberg, Unitary symmetry and elementary particles, second edition, Academic Press (1978).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H		
CO 2				H	
CO 3					H

PSAP310T: INTRODUCTION TO ASTROPHYSICS AND PLASMA PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to give a basic understanding of Astrophysics and plasma physics. The course dealing with the stellar properties, the solar system and the fundamentals of plasma are important for the basic as well as advanced level studies in these areas. The knowledge of the fourth state of matter, plasma, is also useful in other branches of physics. Emphasis shall be laid upon the solution of numerical problems.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explain the Stellar properties and the solar system (Applying)
CO 2: Explain the fundamentals of cosmology (Understanding)

CO 3: Illustrate the behaviour of a single charged particle in electric and magnetic fields (Applying)

CO 4: Analyse your knowledge of Plasma physics in laboratory (Applying)

Module I: Stellar properties and the solar system (20 Hours)

Radiant flux and Luminosity, Magnitude scale. Measurement of astronomical quantities: Stellar distances(parallax), Radii, Mass and Effective Temperature. Equilibrium of stars, Stellar spectral classification – Hertzsprung-Russell (HR) diagram. Introductory idea of stellar evolution: white dwarf, neutron stars and black holes.

The Sun; properties of photosphere, chromosphere and corona. Solar system's objects: Nebular hypothesis of the formation of the solar system (introductory idea only); physical properties of the planets-their distances, atmospheres, asteroid belt, meteorites and the comets; Introduction to exoplanets.

Module II: Fundamentals of Cosmology (13 hours)

Cosmic distance ladder; standard candles: cepheid variables, type 1a supernovae; cosmic expansion of the universe, Hubble's law. Concept of hot Big Bang; cosmic microwave background radiation; dark matter (qualitative idea only), oscillating universe theory (qualitative idea only)

Module III: Plasma Single Particle Motion (17 hours)

Role of temperature in occurrence of plasma; definition of plasma: quasineutrality and collective behaviour of plasma; concept of temperature; Debye shielding; criteria for plasma

Single Particle Motion in Uniform electric and magnetic fields; non-uniform magnetic field: grad-B drift, curvature drift, magnetic mirrors, the loss cone

Module IV: Laboratory and Space Plasma (10 hours)

Glow discharge plasma; principle of DC, AC and high frequency discharges, RF plasmas, fusion plasma, sun and solar winds, Van Allen belts, the ionosphere, formation of accretion disks.

Suggested Readings

1. An Introduction to Astronomy and Astrophysics, P. Jain, CRC Press.
2. An Introduction to Astrophysics, B. Basu, PHI Learning Pvt. Ltd.
3. Astrophysics: Stars and Galaxies, K. D. Abhayankar, Universities Press.
4. F. F. Chen, Introduction to Plasma Physics and Controlled Fusion, Plenum.
5. J. A. Bittencourt, Fundamentals of plasma physics, Springer.
6. Robert J Goldston and Paul H Rutherford, Introduction to Plasma Physics, Institute of Physics Publishing, Bristol and Philadelphia.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

PSCM300T: CONDENSED MATTER PHYSICS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of the course is to equip the students to deal with the solid state of matter and its various physical properties. It is also required to pursue studies on specialized topic like electronics, nano-sciences, etc. Emphasis shall be laid upon the solution of numerical problems.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explain crystal structure and the concepts of lattice vibrations (Understanding)

CO 2: Illustrate the dielectric and magnetic behavior of matter (Applying)

CO 3: Construct band theory and explain superconductivity (Applying)

Module I: Crystal Structure and Lattice Dynamics (13 hours)

Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.

Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T^3 law.

Module II: Magnetic and Dielectric Properties of Matter (13 hours)

Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia- and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mossotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeier relations. Langevin- Debye equation. Complex Dielectric Constant.

Module III: Ferroelectric Properties of Materials (7 hours)

Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Curie-Weiss Law, Ferroelectric domains, PE hysteresis loop.

Module IV: Elementary Band Theory and Superconductivity (12 hours)

Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient. Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors,

London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation).

Suggested Readings

1. Charles Kittel, Introduction to Solid State Physics, Wiley India Pvt. Ltd.
2. J. P. Srivastava, Elements of Solid State Physics, Prentice-Hall of India
3. Leonid V. Azaroff, Introduction to Solids, 2004, Tata Mc-Graw Hill.
4. N. W. Ashcroft and N. D. Mermin, Solid State Physics, Cengage Learning.
5. H. Ibach and H. Luth, Solid-state Physics, Springer.
6. Rita John, Solid State Physics, McGraw Hill.
7. M. Ali Omar, Elementary Solid State Physics, Pearson India.
8. M. A. Wahab, Solid State Physics, Narosa Publications.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

PSCM301L: CONDENSED MATTER PHYSICS LABORATORY

(1 Credits – 30 hours) (L-T-P: 0-0-1)

Objective(s)

The objective of the course is to demonstrate experiments related to basic properties of solid state materials. Also it is aimed to explain few basic experiments related to semiconductors.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Learn about magnetic properties of matter. (Understanding)

CO 2: Analyse dielectric properties of materials. (Applying)

CO 3: Understand and analyse few topics related to semiconductor physics. (Analysing)

At least 5 experiments should be performed from the following:

1. Measurement of susceptibility of paramagnetic solution (Quinck's Tube Method).
2. To measure the Magnetic susceptibility of Solids.
3. To determine the Coupling Coefficient of a Piezoelectric crystal.
4. To measure the Dielectric Constant of a dielectric Materials with frequency.
5. To draw the BH curve of Fe using Solenoid & determine energy loss from Hysteresis.
6. To measure the resistivity of a semiconductor (Ge) with temperature by four-probe method (room temperature to 150°C) and to determine its band gap.
7. To determine the Hall coefficient of a semiconductor sample.

Mapping of COs to the syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7
CO1	H	H	M		M		
CO2				H			
CO3						H	H

PSED311T: ELECTRODYNAMICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to learn how to

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Outline the origin and propagation of electromagnetic waves. (Understanding)

CO 2: Explain the nature of electromagnetic radiation. (Understanding)

CO 3: Infer the extension of classical electrodynamics to the generalized 4-dimensional case. (Analysing)

CO 4: Apply the laws of electrodynamics to solve various physical problems. (Applying)

Module I: Introduction (14 hours)

Revision of Maxwell's Equations; Electromagnetic waves: linear and circular polarisation; Stoke's parameters; Poynting theorem of complex field vectors; frequency dispersion (normal and anomalous); characteristics of dielectrics, conductors and plasma and their interaction with electromagnetic waves.

Module II: Green's Function and Radiating systems (14 hours)

Simple radiating systems: Gauge invariance; Green's function for the wave equation; concept of retarded potential, radiation from an oscillating dipole and its polarisation. Electric dipole fields, magnetic dipole and electric quadrupole fields; centre fed linear antenna, scattering at long wavelengths – viz. by dipoles induced in a small scatterer, scattering by a small dielectric sphere.

Module III: Radiation by an accelerated Charge(18 hours)

Radiation from accelerated charge: Lienard-Wiechart potentials; radiated power from accelerated charge at low velocities. Larmor's power formula. The fields of a point charge in arbitrary and uniform motion. Radiation from an ultra relativistic particle. Angular and frequency distribution of radiation from moving charges.

Module IV: Covariant Form of Maxwell's Equations and Relativity (14 hours)

Special theory of relativity: Four dimensional Lorentz transformation, covariance of Maxwell's equations, electromagnetic field tensor; matrix representation of Lorentz transformation; infinitesimal generators.

Suggested Readings

5. Classical Electrodynamics, J. D. Jackson, John Wiley and Sons.
6. Classical Electrodynamics, S. P. Puri, Tata McGraw Hill Publishing Company Ltd.
7. Electrodynamics, S. L. Gupta, V. Kumar and S. P. Singh, Pragati Prakashan.
8. Introduction to Electrodynamics, D. J. Griffiths, Prentice Hall of India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	H	H		
CO3			H	H
CO4			H	H

PSSD312T: SEMICONDUCTOR DEVICES

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to provide basic analog electronic circuit design techniques and analytical skills using diodes, op- amps, FETs and BJTs. This course also introduces the concepts of digital and binary systems and how these concepts are connected to digital electronics. It also provides fundamental concepts used in the design of digital systems, the basic tools for the design and implementation of digital circuits, modules and subsystems.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Relate principles of operation of semiconductor devices. (Understanding)

CO 2: Design simple logic circuits using principles of logic design. (Applying)

CO 3: Analyze of semiconductor devices for different applications. (Analysis)

Module I: Semiconductor and diodes (20 hours)

- a. Semiconductor concepts: Semiconductor material basics, intrinsic semiconductor, extrinsic semiconductor, energy levels, concept of hole and electron, mobility, conductivity, n-type and p-type, majority and minority carriers, mechanism of current flow.
- b. Semiconductor diode: PN junction and various biasing conditions, V-I characteristics, diode equation, diode resistance, equivalent circuit, transition capacitance and diffusion capacitance; rectifier

circuit with filter, clipper, clamper, voltage multiplier.

- c. Special purpose diodes: Zener diodes, LED, Solar Cell, photo diode, Schottky diode, varactor diode, tunnel diode.

Module II: Transistors: (20 hours)

- Bipolar Junction Transistor: BJT: construction, npn, pnp, operation and configuration, V-I characteristics.
- BJT biasing and stabilization: Load Line analysis of Transistors. DC Load line and Q-point and stability considerations, fixed bias, emitter feedback bias, collector feedback bias, voltage divider bias.
- Field Effect Transistors: Introduction to FET- JFET, MOSFET and CMOS; structure, operation, characteristic curves and equations

Module III: Fundamentals of Digital Circuits (20 hours)

- Number systems: Definition, type and inter-conversion, Signed and unsigned representation, binary arithmetic on signed and unsigned integers and detection of overflow and underflow, weighted binary Codes: BCD, 2421, non-weighted codes: excess-3 codes, gray codes, error detecting codes, error correcting codes, alphanumeric codes: ASCII code, EBCDIC codes.
- Boolean algebra and Logic Gates: Logic gates (basic and universal), rules of Boolean algebra, sum of products and product of sums forms. Conversion between different forms, conversion between Boolean expression and truth table; implementing logic expressions with logic gates (logic circuits).
- Combinational logic circuits: Simplification of Boolean expressions using algebraic method, Karnaugh map method and Don't Care conditions. Designing Combinational logic circuits: half-adder, full-adder, encoder, decoder, Multiplexer, demultiplexer.

Suggested Readings

- Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, Pearson Education.
- Millman's Electronic Devices and Circuits, Jacob Millman, Christos C. Halkias and Satyabrata Jit, Tata McGraw Hill.
- Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Tata McGraw-Hill.
- Solid State Electronic Devices, Streetman and Banerjee, Prentice Hall.
- Electronic Devices and Circuits, David A. Bell, Prentice Hall of India.
- Op-amps and Linear Integrated Circuits, Ramakant A. Gayakwad, PHI.
- Digital Logic and computer Design, M. Mano, PHI.
- Modern Digital Electronics, R. P. Jain, TMGH.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III
CO1	H	H	H
CO2			H
CO3	H	H	

PSST313T: STATISTICAL MECHANICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of the course is to learn how to

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate the connection between statistical mechanics and thermodynamics. (Analysing)

CO 2: Explain the concept of quantum statistical mechanics. (Understanding)

CO 3: Outline the physics of phase transition. (Understanding)

CO 4: Explain the importance of non-equilibrium physics. (Understanding)

Module I: Essentials (15 hours)

Probability theory: the random walk problem, binomial, Poisson and Gaussian distributions, central limit theorem; Classical equilibrium statistical mechanics: concept of equilibrium; Ergodic hypothesis; micro-canonical, canonical and grand canonical Ensembles; partition functions and their relation to thermodynamics;

Module II: Quantum Statistics (15 hours)

Quantum statistical mechanics: Schrödinger and Heisenberg Picture; pure and mixed states, the density matrix, quantum mechanical Liouville's theorem; the fundamental postulates; Quantum statistics: quantum gases of independent particles; partition functions; Bose Einstein and Fermi Dirac's distributions; electrons in metals; black body radiation; Bose Einstein's Condensation

Module III: Phase Transitions (15 hours)

Phenomenology: first and second order phase transitions; elementary ideas of critical phenomena; universality of critical exponents; scaling of thermodynamic functions; Theory: the Landau theory of phase transition with examples. Basic concepts of Ising model in one dimension.

Module IV: Non Equilibrium Phenomena (15 hours)

Non equilibrium phenomena: transport theory; Boltzmann equation; Maxwell-Boltzmann distribution; Irreversible processes: fluctuations; Brownian motion; Langevin's equation.

Suggested Readings

1. Fundamental of Statistical and Thermal Physics, Frederick Reif, McGraw Hill, Singapore.
2. Statistical Mechanics, Shang-Keng Ma, World Scientific, Singapore.
3. Statistical Mechanics: Fundamental and Modern Applications, Richard E. Wilde, and Surjit Singh, Wiley-Interscience, John Wiley and Sons Inc., New York.
4. Statistical Physics: Statics, Dynamics and Renormalisation, Leo P. Kadanoff, World Scientific, River Edge, New Jersey.
5. Statistical Mechanics, K. Huang, John Wiley and Sons Inc., New York.
6. Statistical Physics, D. J. Amit and J. Verbin, World Scientific, Singapore.
7. Statistical Physics, L. D. Landau, E. M. Lifshitz, Butterworth-Heinemann.
8. Statistical Mechanics, R. K. Pathria, Academic Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

PSMP404T: MATERIALS PHYSICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to make students aware of the basic concepts of material science and nanotechnology. The students will develop an understanding of the material properties and how to manufacture, study, and control/ manipulate them for specific applications.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Explore the properties of materials at the micro and nano level. (Understanding)

CO 2: Explain different techniques used in the synthesis and characterization of materials. (Remembering)

CO 3: Illustrate a few applications of materials at the micro and nano level. (Applying)

Module I: Micro and Nanosystems (Properties) (15 hours)

Length scales in physics and scaling law. Quantum confinement: Applications of Schrodinger equation- infinite potential well, potential step, potential box. Band structure and density of states, size effects. Crystal structures and mechanical properties; grain and grain boundary, defects, Hall-Patch relations, creep, diffusion and dislocations, and strengthening mechanisms. Magnetic properties; domain theory, hysteresis, and super-paramagnetism, giant magnetoresistance (GMR). Optical and electrical properties; Coulomb interaction in nanostructures. Concept of dielectric constant and dielectric properties. Quasi-particles and excitons. Radiative processes: General formalization-absorption, emission, and luminescence. Non-linear optical processes. Surface Plasmon Resonance. Thermal Properties. Polymers and their properties (Nano perspective). Hybrid and advanced materials.

Module II: Synthesis of Materials in micro and nano dimensions (10 hours)

Top-down and Bottom-up approach. Ball milling. Gas phase condensation. Physical Vapor Deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition and Sputtering. Chemical Vapor Deposition (CVD) and Plasma Enhanced Chemical Vapor Deposition (PECVD). Sol-Gel. Electro deposition. Sonochemical and Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dots. Green synthesis methods. Lithography and Microfabrication techniques. Hot Working and Cold Working. Molding, Casting and Pelletization Techniques. Composites and Alloy.

Module III: Characterization (10 hours)

Qualitative and Quantitative Analysis. Optical Microscopy. Scanning Electron Microscopy (SEM and FESEM). Transmission Electron Microscopy (TEM). Atomic Force Microscopy and Scanning Tunneling Microscopy (AFM and STM). Spectroscopic Methods: NMR, ESR, FTIR, Raman, Photoluminescence and UV-Visible spectroscopy. Thermal analysis: Differential Scanning Calorimetry (DSC) and Thermo Gravimetric Analysis (TGA). Diffraction methods; X-Ray Diffraction, Neutron Diffraction, Positron Annihilation, Synchrotron Radiation. X-Ray Photoelectron Spectroscopy and Auger Electron Spectroscopy XPS. Zeta

potential. Vibrating Sample Magnetometry (VSM). Mossbauer Spectrometer. Mechanical Properties; Nanoindentation, Creep and Tensile Test. Metallography (Basic Idea).

Module IV: Applications (10 hours)

Applications of nanoparticles, quantum dots, nanowires, and thin films; for photonic devices (LED, solar cells), and sensors. Nanomaterials for energy and environmental applications. Nanobiotechnology: Nanomaterials for biomedical applications, agriculture, drug delivery, bio-imaging, microfluidics etc. Nanomaterial-based Devices: Quantum well and dot based heterostructures, optical switching, and optical data storage. Magnetic quantum well; magnetic dots, magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS) (preliminary idea). Materials for harsh environment application.

Suggested Readings

1. Introduction to Nanotechnology, C. P. Poole, Jr. and Frank J. Owens, Wiley India Pvt. Ltd.
2. Nanotechnology: Principles & Practices, S. K. Kulkarni, Capital Publishing Company.
3. Introduction to Nanoscience and Technology, K. K. Chattopadhyay and A. N. Banerjee, PHI Learning Private Limited.
4. Nanotechnology, Richard Booker and Earl Boysen, John Wiley, and Sons.
5. Nanoparticle Technology Handbook, M. Hosokawa, K. Nogi and M. Naita, T. Yokoyama, Elsevier.
6. Introduction to Nanoelectronics, V. V. Mitin, V. A. Kochelap and M.A. Stroscio, Cambridge University

Press.

7. Springer Handbook of Nanotechnology, Bharat Bhushan, Springer-Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

PSSA406T: PHYSICS OF SENSORS AND ACTUATORS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s)

The objective of this course is to give a fundamental idea about the mechanisms of sensing and actuation. The students will learn about cutting-edge technologies and recent developments in microelectronics and nanoelectronics.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate the key concept of sensors and actuators. (Analyzing)

CO 2: Explain different techniques and materials used in the fabrication of sensors and actuators. (Understanding)

CO 3: Apply the concepts for design and development of micro and nano-sensors. (Applying)

Module I: Basic Concepts (10 hours)

Energy domain and Transducers. Sensors and Actuators. Conductivity of Semiconductors, and Resistivity. Crystal Orientations and Mechanical Properties of Semiconductors. Resonant frequency and Quality factor. Properties of Polymers and Polymer- based composites. Conductive Polymers.

Module II: Mechanism of Sensing and Actuation (15 hours)

Electrostatic based Sensing and Actuation, Thermal Sensing and Actuation, Piezoelectric and Piezoresistive Sensing and Actuation, Magnetic and Optical Sensing and Actuation. Microfluidics.

Module III: Micro and Nano fabrication (10 hours)

Vacuum and Clean room, Thin film deposition methods. Nanowire/ Nanorod and Nanoparticles for sensors (Synthesis and Properties), Bulk and Surface Micromachining, Wet and Dry etching, DRIE, Optical and E-Beam lithography.

Module IV: Applications (10 hours)

Nanostructured and Nanomaterials-based sensor and Actuators (Strain gauge, Accelerometer, Resonators, RTD, FET, SED etc.). Flexible and Wearable Sensors. Sensors for Biomedical, Agricultural and Environmental Applications.

Suggested Readings

1. Foundation of MEMS. Chang Liu. Pearson Education International.
2. Microsystem Design. Stephen D. Senturia. Springer.
3. Fundamentals of microfabrication : Madou, Marc J. CRC Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2			H	
CO3				H

PSID115T: Introduction to Drone Technology (Credit -1)

Objective(s): To develop a comprehensive foundational knowledge of Unmanned Aerial Vehicles (UAVs), including their various types, operational principles, and key components, enabling a clear understanding of their functionalities and applications.

Course / Learning Outcomes

At the end of this course, students will be able to:

- CO1:** Understand the classification of UAVs, their components, and key principles of flight.
- CO2:** Explain the evolution and history of drone technology and its applications.
- CO3:** Identify and describe the components and functionality of drone systems and sensors.
- CO4:** Demonstrate basic knowledge of drone safety protocols and their applications in real-world scenarios.

Module I: Fundamentals of Drones (3 Hours)

Definition and classification of UAVs (Micro, Small, Medium, Large), Evolution and history of drone technology, Drone components overview

Module II: Types and Configurations (3 Hours)

Multirotor, Fixed-wing, VTOL, Hybrid, Applications by drone type

Module III: Basics of Aerodynamics (3 Hours)

Principles of flight (lift, drag, thrust, weight), Centre of gravity and stability, Propulsion systems overview

Module IV: Drone Electronics and Sensors (2 Hours)

Flight controller basics, IMU, GPS, barometer, compass, Battery types and power systems

Module V: Introduction to Drone Safety & Applications (4 Hours)

Pre-flight checks and SOPs, Case studies: Agriculture, Survey, Photography, **Mapping and Surveying**- GNSS fundamentals, RTK/PPK concepts, Photogrammetry and 3D mapping overview; **Agriculture**-NDVI and crop health analysis, Spray drones and precision farming; **Industrial and infrastructure inspection**- Powerlines, pipelines, solar plant inspection, Thermal imaging basics

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	H	M	L
CO2	M	L	L	L	L
CO3	L	M	L	H	M
CO4	L	L	M	L	H

PSDSI117T: Drone Systems, Simulation & Applications (Credit-1)

Objective(s): To gain an in-depth understanding of drone systems, including their design, components, and operational functionalities, along with hands-on experience using simulations to assess performance and behaviour and to explore a wide range of real-world applications of drone technology across various industries. Learn about drone subsystems software tools for design and simulation.

Course / Learning Outcomes

At the end of this course, students will be able to:

- CO1:** Identify and classify various drone subsystems and materials used in structural design.
- CO2:** Explain the integration and functioning of flight control systems and communication protocols.
- CO3:** Demonstrate the ability to use mission planning tools and understand ground control systems.
- CO4:** Evaluate the role of drone simulators in design and simulation, including their features and tools.

Module I: Structural Design, Materials, Payloads and Sensors (3 Hours)

Frame types and material selection, Load analysis and mounting considerations, RGB, Multispectral, Thermal, Lidar sensors, Gimbals and image stabilization

Module II: Control Systems & Communication (3 Hours)

Flight controller integration, Radio communication: RC protocols, telemetry

Module III: Ground Control & Mission Planning (2 Hours)

Ground control stations, Mission planning tools (Q Ground Control, Mission Planner)

Module IV: Drone Simulation Tools, Software and troubleshooting (4 Hours)

Introduction to simulators: Gazebo, Drone code, etc., Hands-on mission simulation walkthrough, Basics of SITL and PID tuning, Common system faults and diagnosis

Module V: Data Processing & Visualization (3 Hours)

Tools: Pix4D, Drone Deploy, Open Drone Map, Introduction to GIS

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	L	L	L	L
CO2	M	H	M	M	L
CO3	L	M	H	M	L
CO4	L	L	M	H	M

PSEF212T: Drone Policy, Entrepreneurship & Future Trends (Credit-1)

Objective(s): The objective of this course is to provide students with a comprehensive understanding of drone operations, regulations, risk management, and business strategies. The course will focus on India's DGCA regulations, emerging trends in drone technology, including BVLOS and drone taxis, as well as ethical considerations. Students will gain practical knowledge on managing drone operations, evaluating risk, and identifying potential entrepreneurial opportunities in the growing UAV sector.

Course / Learning Outcomes

At the end of this course, students will be able to:

- CO1:** Understand the regulatory framework for drones in India, including DGCA regulations and compliance requirements.
- CO2:** Explain the principles of drone operations, risk management, and safety assessments.
- CO3:** Analyse the drone start up ecosystem, focusing on business models, cost-benefit analysis, and ROI.
- CO4:** Evaluate emerging trends in drone technology, including BVLOS, drone taxis, delivery drones, and ethical considerations.

Module I Unit 1: DGCA Regulations & Compliance (3 Hours)

India's Drone Rules, No Permission No Take-off (NPNT), RPTOs, UIN, UAOP

Module II: Drone Operations & Risk Management (3 Hours)

Airspace categories and flight permissions, Safety assessments and SOPs

Module III: Business & Entrepreneurship in UAVs (3 Hours)

Drone startup ecosystem, Cost-benefit analysis, ROI

Module IV: Drone Swarms & AI Integration (3 Hours)

Introduction to drone swarms, AI/ML in autonomous navigation

Module V: Future Trends & Ethical Considerations (3 Hours)

BVLOS, drone taxis, delivery drones, Privacy, surveillance, and ethical use

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	L	L	L	L
CO2	M	H	L	L	M
CO3	L	L	H	L	L
CO4	L	M	M	H	H

Hands On

This syllabus is designed for undergraduate engineering/technology programs and emphasizes on:

- Hands-on drone training
- Real-world applications
- Industry exposure
- Practical assessments
- Group discussions, seminars, and viva

PSBI116L: Drone Fundamentals, Basic Flight Simulation & Intermediate Flight Skills (Credit -3)

Objective: To Build a strong foundation in drone hardware, assembly, basic flight simulation and intermediate flight skills.

Course / Learning Outcomes

At the end of this course, students will be able to:

- CO1:** Identify and understand the key components of a drone, including their functions and safety procedures.
- CO2:** Assemble a multirotor drone, including wiring, soldering, and mounting key components such as the flight controller, ESCs, and motors.
- CO3:** Configure and calibrate a flight controller, including flashing firmware and performing necessary calibrations.
- CO4:** Demonstrate proficiency in flight simulation, performing basic navigation exercises and familiarizing with FPV, DRL, and Mission Planner.

Topics & Activities:

Topic	Hours	Activities
1. Drone Components & Safety	11 hrs	Hands-on component identification, safety training, DGCA guidelines intro
2. Assembly of Multirotor Drone	12 hrs	Frame building, wiring, soldering, mounting FC, ESCs, motors
3. Flight Controller Setup	10 hrs	FC firmware flashing (INAV, PX4, ArduPilot, calibration
4. Simulator Training	12 hrs	FPV Freerider, DRL, Mission Planner (basic navigation exercises)
5. Battery & Power Management	6 hrs	LiPo handling, charging, discharging, safety drills
6. Manual Flight Training (LOS)	12 hrs	Take off, landing, yaw/pitch/roll/hovering in open field
7. GPS Modes & Auto Flight	10 hrs	Loiter, RTH, Position Hold, Waypoints
8. Group Discussion	5 hrs	Topics: Drone safety, ethics, real-life incidents
9. Internal Practical Test	6 hrs	Component quiz, simulator handling test
10. Seminar + Viva Voce	6 hrs	Students present a component/tech topic + viva

Key Deliverables:

- **Completed drone assembly**

- Lab report on component usage
- Basic simulator logbook
- Seminar presentation

Mapping of COs to Syllabus

	Activity 1	Activity 2	Activity 3	Activity 4	Activity 5	Activity 6	Activity 7
CO1	H	L	L	L	H	L	L
CO2	L	H	M	L	M	L	L
CO3	L	M	H	M	L	L	L
CO4	L	L	M	H	L	L	H

PSMP118L: Mission Planning, Aerial Survey, Mapping, Data Processing & Analytics (Credit-3)

Objective: To Gain confidence in manual and assisted drone flying with real-time mission planning, aerial data collection, photogrammetry, and analytical processing.

Course / Learning Outcomes

At the end of this course, students will be able to:

- CO1:** Remember and identify key components and tools used in drone systems, including GCS, telemetry, payload integration, and photogrammetry software.
- CO2:** Demonstrate the ability to set up and operate mission planning tools, payloads, and simulators for real-world drone applications such as survey mapping and aerial data collection.
- CO3:** Evaluate and analyze the data from drone surveys, photogrammetry, and multispectral imaging, and troubleshoot mission issues through simulations and real-time data collection.
- CO4:** Assess the effectiveness of drone systems, including flight accuracy, data collection quality, and the integration of new technologies such as thermal sensors and AI-based applications.

Topics & Activities:

Topic	Hours	Activities
1. GCS & Telemetry Setup	10 hrs	Mission Planner, Q Ground Control – mission upload, telemetry
2. Payload Integration	5 hrs	RGB camera/gimbal mounting, wiring, control setup
3. Simulator Challenges (Timed)	8 hrs	Indoor challenges and obstacle training in virtual environments
4. Mission Planning for Survey	10 hrs	Flight path design for mapping/survey using Drone Deploy, Pix4Dcapture
5. Group Discussion	4 hrs	Drone licensing, job roles, role of RPTOs
6. Practical Flight Evaluation	6 hrs	Checklist execution, hovering accuracy, GPS lock test
7. Aerial Data Collection	10 hrs	Real field data capture with geotagged images
8. Photogrammetry Software	10 hrs	Processing in Pix4D, WebODM, generating orthomosaics & DEM
9. NDVI & Multispectral Intro	6 hrs	Crop mapping, NDVI interpretation, agri analytics
10. Thermal/Infrared Sensor Demo	4 hrs	Intro to payload calibration and FLIR demo

11. Industry Case Study Discussion	5 hrs	Powerline inspection, solar plant mapping, mining projects
12. Mini Project + Assessment	10 hrs	Students form teams, execute and process their drone map mission
13. Seminar + Viva Voce	8 hrs	Present drone mission plan, face viva on GPS, GCS topics, tools used

Key Deliverables:

- Logged flight hours
- Completed mission plan (with screenshots)
- Video evidence of auto flight
- Orthomosaic and point cloud output
- Mapping/surveillance/agriculture inspection
- Documentation, data processing, interpretation |
- Team project report
- Mini project video documentation
- Seminar + viva score

Mapping of COs to Syllabus

	Activity 1	Activity 2	Activity 3	Activity 4	Activity 5	Activity 6	Activity 7	Activity 8	Activity 9	Activity 10	Activity 11
CO1	H	L	L	L	M	L	M	L	L	M	L
CO2	M	H	M	H	L	M	H	M	M	L	L
CO3	L	M	H	M	L	M	M	H	H	M	M
CO4	L	L	M	M	H	H	L	M	L	H	H

PSAO213L: Advanced Operations, Compliance & Industry Integration (Credit-3)

Objective: To Equip students with regulatory knowledge, project planning, and real-world drone exposure.

Course / Learning Outcomes

At the end of this course, students will be able to:

- CO1:** Understand and apply DGCA regulations, including UIN, UAOP, NPNT, and zonal maps for drone operations in India.
- CO2:** Conduct risk assessments and develop Standard Operating Procedures (SOPs) for drone missions, focusing on emergency situations.
- CO3:** Understand and demonstrate Beyond Visual Line of Sight (BVLOS) operations, including advanced drone applications such as delivery drones and drone-in-a-box systems.
- CO4:** Gain exposure to industry practices through visits and expert sessions, learning from RPTOs, survey companies, and drone startups.

Topics & Activities:

Topic	Hours	Activities
1. Drone Rules 2021 & DGCA SOP	10 hrs	Understanding UIN, UAOP, NPNT, zonal maps
2. Risk Assessment & SOP Preparation	10 hrs	Pre-mission planning, risk matrix, emergency SOP writing
3. BVLOS & Advanced Applications	10 hrs	Theory + demo simulation of BVLOS, delivery drones, drone-in-a-box
4. Industrial Visit / Expert Session	10 hrs	RPTOs, survey companies, agri-drone startup, drone show
5. Final Capstone Project (Team-based)	20 hrs	End-to-end project on an industry-relevant drone application:
6. Group Discussion	10 hrs	Drone entrepreneurship, drone careers in India
7. Final Project Demonstration	10 hrs	Team demos in front of faculty panel
8. Viva Voce + Compliance File Review	10 hrs	Students defend flight plan, risk analysis, and drone logs

Key Deliverables:

- **Capstone project report + drone video**
- **DGCA-style compliance documentation**
- **Project demo evaluation**
- **Viva on drone regulations**

CO	Activity 1	Activity 2	Activity 3	Activity 4	Activity 5
CO1	H	M	L	M	L
CO2	M	H	M	L	M
CO3	L	M	H	L	H
CO4	L	L	L	M	H

Additional Notes:

- Tools Used: Mission Planner, QGround Control, Pix4D, Drone Deploy, WebODM, DJI GS Pro, Pixhawk, ArduPilot, INAV, FLIR Tools
- Types of Drones Covered: Multirotors (Quad, Hex), Fixed-wing (demo), Hybrid (demo)
- Optional Certifications: Internal RPC-like mock assessment

Suggested Readings:

1. The Drone Pilot's Handbook, Colin J. Fisher, Outskirts Press, 2016.
2. Unmanned Aerial Vehicles, Garvit Pandya, Notion Press, 2021.
3. Aviation Law and Drones, David Hodgkinson and Rebecca Johnston, Routledge (an imprint of Taylor & Francis Group), 2018
4. Radiotelephony Guide, R.K.Bali, Sterling Book House (India), 2018.
5. Aviation Meteorology, I.C. Joshi, Himalayan Books, New Delhi, 2019

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	PSTI104L	Basics of lab tools and Instrumentation (1-0-2)	3
2	S E Course 2	PSPC105T	Basics of Programming (C/C++/Fortran) (1-0-2)	3
3	S E Course 3	PSPP210L	Computational Physics using Python (1-0-2)	3

PSTI104L: BASICS OF LAB TOOLS AND INSTRUMENTATION

(3 Credits – 75 hours) (L-T-P: 1-0-2)

Objective(s)

The objective of the course is to make students aware of the principle and working of basic lab tools and instruments. The students will develop the skills to use basic tools such as multimeters, slide calipers, and so on in day-to-day life.

Course / Learning Outcomes

At the end of this course students will be able to:

- CO 1: Explain the concepts of various performance characteristics of measuring instruments. (Remembering)
 CO 2: Demonstrate the basic concepts and working behind digital instruments. (Application)
 CO 3: Illustrate the underlying principle of CRO and its uses. (Understanding)
 CO 4: Demonstrate the underlying principle of the multimeter and its uses. (Application)

Module I: Basic of Measurement (15 hours)

Instruments accuracy, precision, sensitivity, resolution range, etc. Errors in measurements and loading effects. Slide Callipers, and Screw Gauge. Ammeter, and Voltmeter. Measurement of resistance using Colour Codes.

Module II: Digital Instruments and Electronic Voltmeter (20 hours)

Principle and working of digital meters. Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter. An advantage over conventional multimeters for voltage measurement concerning input impedance and sensitivity. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters: Amplifier- rectifier, and rectifier- amplifier. Block diagram ac millivoltmeter, specifications, and their significance.

Module III: Digital Multimeter: (20 hours)

Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current, Capacitance, and resistance. Specifications of a multimeter and their significance. Block diagram and working of a digital multimeter. Working principle of time interval, frequency, and period measurement using universal counter/ frequency counter, time- base stability, accuracy, and resolution.

Module IV: Cathode Ray Oscilloscope (20 hours)

Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing, and acceleration (Explanation only– no mathematical treatment), a brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and the principle of working.

Suggested Readings

1. A textbook in Electrical Technology, B. L. Theraja, S Chand & Co.
2. Performance and design of AC machines, M. G. Say, ELBS Edn.
3. Digital Circuits and systems, Venugopal, Tata McGraw Hill.

- Logic circuit design, Shimon P. Vingron, Springer.
- Digital Electronics, Subrata Ghoshal, Cengage Learning.
- Electronic Devices and circuits, S. Salivahanan & N. S. Kumar, Tata Mc-Graw Hill.
- Electronic circuits: Handbook of design and applications, U. Tietze, Ch. Schenk, Springer.
- Electronic Devices, Thomas L. Floyd, Pearson India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

PSPC105T: BASICS OF PROGRAMMING (C/C++/Fortran)

(3 Credits – 45 hours) (L-T-P: 1-0-2)

Objective(s)

The objective of this course is to familiarize the students about the basic concepts of FORTRAN programming language, LATEX word processor and Gnuplot.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Make use of FORTRAN programming language for solving problems (Applying)

CO 2: Utilize Gnuplot for plotting graphs. (Applying)

Module I: Basics of FORTRAN Programming (20 hours)

Prerequisites: Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates.

Some fundamental Linux Commands (Internal and External commands). Basic elements of FORTRAN: Character Set, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Operators: Arithmetic, Relational, Logical and Assignment Operators. Expressions: Arithmetic, Relational, Logical, Character and Assignment Expressions. Fortran Statements: I/O Statements (unformatted/ formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic. Examples from physics problems.

Module II: Loops, Functions, Subroutines and their applications (35 hours)

Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DO- WHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines (Arithmetic Statement Function, Function Subprogram and Subroutine), RETURN, CALL, COMMON and EQUIVALENCE Statements), Structure, Disk I/O Statements, open a file, writing in a file, reading from a file. Examples from physics problems.

Hands on exercises :

- Exercises on syntax on usage of FORTRAN.
- Usage of GUI Windows, Linux Commands, familiarity with DOS commands and working in an editor to write source codes in FORTRAN.
- To print out all natural even/ odd numbers between given limits.
- To find maximum, minimum and range of a given set of numbers.
- Calculating Euler number using $\exp(x)$ series evaluated at $x=1$.
- To find the roots of a quadratic equation.
- Motion of a projectile under gravity.

8. Numerical solution of equation of motion of simple harmonic oscillator and plot the outputs.
9. Motion of particles in a central force field and plot the output.

Module III: Gnuplot for some practical usage (20 hours)

Introduction to graphical analysis and its limitations. Introduction to Gnuplot. importance of visualization of computational and computational data, basic Gnuplot commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with Gnuplot (equations, building functions, user defined variables and functions), Understanding data with Gnuplot.

Hands on exercises:

1. To compile a frequency distribution and evaluate mean, standard deviation etc.
2. To evaluate the sum of finite series and the area under a curve.
3. To find the product of two matrices.
4. To find a set of prime numbers and Fibonacci series.
5. To write a program to open a file and generate data for plotting using Gnuplot.
6. Plotting trajectory of a projectile projected horizontally.
7. Plotting trajectory of a projectile projected making an angle with the horizontally.
8. Creating an input Gnuplot file for plotting data and saving the output for seeing on the screen. Saving it as an eps file and as a pdf file.

Suggested Readings

1. Introduction to Numerical Analysis, S. S. Sastry, PHI Learning Pvt. Ltd.
2. Computer Programming in Fortran 77, V. Rajaraman, PHI.

LaTeX–A Document Preparation System, Leslie Lamport, Addison-Wesley.

1. Gnuplot in action: understanding data with graphs, Philip K Janert, Manning.
2. Schaum's Outline of Theory and Problems of Programming with Fortran, SLipsdutz and A Poe, Mc-Graw Hill Book Co.
3. Computational Physics: An Introduction, R. C. Verma, et al., New Age International Publishers.
4. A first course in Numerical Methods, U. M. Ascher and C. Greif, PHI Learning.
5. Elementary Numerical Analysis, K. E. Atkinson, Wiley India Edition.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H	H	
CO2			H

PSPP210L: COMPUTATIONAL PHYSICS USING PYTHON

(3 Credits – 75 hours) (L-T-P: 1-0-2)

Objective(s)

The objective of the course is to familiarize the students about the basic concepts of Python programming language, its applications, and preliminaries of machine learning.

Course / Learning Outcomes

At the end of this course students will be able to:

CO 1: Outline the fundamental concepts of Python (Understanding)

CO 2: Apply Python code for solving numerical methods (Applying)

CO 3: Review the concepts of machine learning using Python (Understanding)

Module I: Elements of Python programming (25 hours)

Computer and Programming languages, types of languages, Operating system types, Python language; Data types, precision, numbers, castings strings, Booleans, Operators, variables; list: indexing, slicing, altering, appending and deleting elements, concatenation; tuples, sets and dictionaries; conditional statements; loops: if-else, while and for loops, nested-for loops; functions, arrays, lambda, classes, Inheritance, modules, Python libraries: installing packages, importing packages; NumPy arrays and matrices, example: eigenvalues and eigenvectors; basics of data handling using Pandas; introduction to SciPy; data visualization using Matplotlib and Seaborn

Module II: Numerical methods using Python I (20 hours)

Fundamental integral evaluation methods: trapezoidal rule, Simpson's rule; error estimation of integrals; Romberg integration; Gaussian quadrature; Random numbers generators and seeds; non-uniform random numbers, Gaussian random numbers; Monte Carlo integration: mean value method, integrals in many dimensions, importance sampling; importance sampling; Markov chain methods numerical differentiation: forward and backward differences, central differences, second derivatives, partial derivatives, differentiation error estimation; Linear equations:

Module III: Numerical methods using Python II (15 hours)

Gaussian elimination, back-substitution, pivoting, LU decomposition, matrix inverse, tridiagonal and banded matrices; nonlinear equations: binary search, Newton's method, secant method; First-order differential equations with one variable: Euler's method, Heun's method, 4th order Runge-Kutta method; differential equations with multiple variables; second-order differential equations; boundary value problems: shooting method, relaxation method; eigenvalue problems

Module IV: Elements of machine learning (15 hours)

Data distribution, Regression types, Scale, Train/Test, Decision Tree, Confusion Matrix, Hierarchical Clustering, Logistic Regression, K-means, Bootstrap aggregation, Cross validation, K-nearest neighbors, Artificial Neural Networks

Suggested Readings

1. Computational Physics, Newman, Mark E.J., Createspace Independent Pub, 2013
2. Computational Physics: Problem Solving with Python, Landau, Rubin H., Paez, Manuel J., Bordeianu, Cristian C. (III Edition) Wiley, 2015
3. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, McKinney, Wes, (II Edition) O'Reilly Media, 2018
4. Python Cookbook: Recipes for Mastering Python 3, Beazley, David and Jones, Brian K., (III Edition) O'Reilly Media, 2013
5. Python Data Science Handbook: Essential Tools for Working with Data, VanderPlas, Jake, (Online Free Edition) O'Reilly Media

6. Mastering Matplotlib, McGreggor, Duncan M., (I Edition) Packt Publishing, 2015

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	H	
CO3				H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	PSIN105I	Internship	4
4	Internship	PSIN211I	Internship	4
5	Internship	PSIN314I	Internship	2

PSIN105I/PSIN211I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 hours)

PSIN314I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours)

Internship Modalities for Physics Department

Objectives:

1. To create students with real-world experience in working and addressing problems.
2. To make the transition for the students from the Institute to the real world as easy as possible.
3. To improve the students' employability.

INTERNSHIP: GUIDELINES

1. Request Letter/ Email from the Department via Registrar office should go to organization/ institutions/ industries to take interns for 4-6 weeks.
2. Organization/ institutions/ industries will confirm the training slots and the number of seats allocated for interns via Confirmation Letter/ Email.
3. In case the students arrange the training for themselves the confirmation letter has to be submitted by the students to the Department.
4. Students on joining Training at the concerned organization/ institutions/ industries, submit the Joining Report/Letters / Email.
5. Students will submit their progress report to the department in every week through Report/ Email. Students will submit Training Report and Completion Certificate obtained from the organization/ institutions/ industries.
6. Students will give a presentation on their learning outcome in presence of the faculty members and the students.
7. List of students who have completed their internship successfully will be notified by the Department.

Requirement:

Students willing to exit the course after completing the first/second year are required to go for 4-6 weeks compulsory internship programme to receive their Certificate/Diploma.

RESEARCH PROJECT /DISSERTATION

BSC PHYSICS (Honours)				
Semester	Category	Course	Course Name	Credits

		Code		
7	Research Project/Dissertation	PSDI407P	Research Project Phase I	6
8	Research Project/Dissertation	PSDI408P	Research Project Phase II	6
BSC PHYSICS (Honours) with Research				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	PSDI409P	Dissertation I	18
8	Research Project/Dissertation	PSDI410P	Dissertation II	20

BSC PHYSICS (Honours)**PSDI407P: RESEARCH PROJECT PHASE I**

(6 credits – 180 hours) (L-T-P: 0-0-12)

Objective:

The aim of BSc Physics research project is to develop students' analytical, problem-solving, and critical thinking abilities. Students have the opportunity to investigate certain areas of interest in the subject of physics under the direction of knowledgeable academics or researchers.

Course Outcomes: BSc Physics programs primarily focus on building a strong foundation in theoretical and experimental physics. During this phase the student will start a project applying the knowledge acquired during the previous semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

PSDI408P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-12)

Objective:

The activities Involving research has the power to influence how students pursue their academic and professional goals. They might increase interest in a particular area of Physics. Additionally, exposure to research strengthens students' resumes and increases their ability to compete for roles in research or future employment.

Course Outcomes:

During this phase the student will complete the project started in the previous semester. The final implementation of the project and report writing shall be done in this semester. The student shall be required to make a number of presentations to report on the progress of the project. There will be a viva voce examination which shall follow the final submission of the project report. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

BSC PHYSICS (Honours) with Research**PSDI409P: DISSERTATION I**

(18 Credits -540 Hours) (L-T-P: 0-0-36)

Objective: The objective of a dissertation is to conduct original research and contribute new knowledge or insights to a specific field of study. The primary objectives of a dissertation include to showcase original thinking and creativity in the approach to the research problem. To critically evaluate existing literature, theories, and research methodologies related to the topic would be the priority in this 1st phase of this course.

Course Outcome: The outcome of a dissertation is the culmination of the research and writing process. It typically takes the form of a written document that presents the research findings, analysis, conclusions, and contributions to the field of study.

The specific outcome of a dissertation can vary depending on the nature of the research. In this 1st phase, critically evaluate existing literature, theories, and research methodologies would be the priority of the students. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

PSDI410P: Dissertation II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

Objective: The objective of this will be to contribute new knowledge, practical applications, or policy implications that can benefit the academic community, industry, or society as a whole. Additionally, it will strengthen students' resumes and increase their ability to compete for roles in research or future employment.

Course Outcome: During this phase the student will complete the project started in the previous semester. The final implementation of the project and report writing shall be done in this semester. The student shall be required to make a number of presentations to report on the progress of the project. There will be a viva voce examination which shall follow the final submission of the project report. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

SCHOOL OF LIFE SCIENCES
DEPARTMENT OF BOTANY
PROGRAMME: BACHELOR OF SCIENCE (BSC) in BOTANY (Honours/Honours with Research)
MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	BOPM100T	Phycology and Microbiology	4 (3-0-1)	444
		BOPM101L	Phycology and Microbiology Lab		446
2	Major Course 2	BOMY102T	Mycology	4 (3-0-1)	446
		BOMY103L	Mycology Lab		447
3	Major Course 3	BOBC200T	Biomolecules and Cell Biology	4 (3-0-1)	448
		BOBC201L	Biomolecules and Cell Biology Lab		449
3	Major Course 4	BOAR202T	Archegoniates	4 (3-0-1)	450
		BOAR203L	Archegoniates Lab		451
4	Major Course 5	BOPG204T	Plant Genetics	5 (3-0-2)	452
		BOPG205L	Plant Genetics Lab		453
4	Major Course 6	BOMA206T	Morphology and Anatomy of Angiosperms	5 (3-0-2)	454
		BOMA207L	Morphology and Anatomy of Angiosperms Lab		455
4	Major Course 7	BOPE208T	Plant Ecology	4 (3-0-1)	455
		BOPE209L	Plant Ecology Lab		456
5	Major Course 8	BOPP300T	Plant Physiology	5 (3-0-2)	457
		BOPP301L	Plant Physiology Lab		458
5	Major Course 9	BOPS302T	Plant Systematics	5 (3-0-2)	459
		BOPS303L	Plant Systematics Lab		460
5	Major Course 10	BORB304T	Reproductive Biology of Angiosperms	4 (3-0-1)	460
		BORB305L	Reproductive Biology of Angiosperms Lab		461
6	Major Course 11	BOPM306T	Plant Metabolism	4 (3-0-1)	462
		BOPM307L	Plant Metabolism Lab		463
6	Major Course 12	BOMO308T	Molecular Biology	4 (3-0-2)	463
		BOMO309L	Molecular Biology Lab		465
6	Major Course 13	BOEC310T	Economic Botany	4 (3-0-1)	466
		BOEC311L	Economic Botany Lab		467
6	Major Course 14	BOMP312P	Minor Project	4	
7	Major Course 15	BOAT400T	Analytical Techniques in Plant science	5 (3-0-2)	468
		BOAT401L	Analytical Techniques in Plant science Lab		469
7	Major Course 16	BOBS402T	Biostatistics	5 (3-0-2)	470
		BOBS403L	Biostatistics Lab		470
8	Major Course 17	BOPL404T	Plant Biotechnology	5 (3-0-2)	471
		BOPL405L	Plant Biotechnology Lab		472
8	Major Course 18	BOPA406T	Plant Pathology	5 (3-0-2)	472
		BOPA407L	Plant Pathology Lab		473

MINOR COURSES

Semes-ter	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	BONV104T	Introduction to non-vascular plants	4 (3-0-1)	474
		BONV105L	Introduction to non-vascular plants Lab		475
2	Minor Course 2	BOVP106T	Introduction to vascular plants	4 (3-0-1)	475
		BOVP107L	Introduction to vascular plants Lab		476
3	Minor Course 3	BOFP210T	Morphology and Anatomy of flowering plants	4 (3-0-1)	477
		BOFP211L	Morphology and Anatomy of flowering plants Lab		478
4	Minor Course 4	BOEB212T	Introduction to Economic Botany	4 (3-0-1)	478
		BOEB213L	Introduction to Economic Botany Lab		479
5	Minor Course 5	BOET313T	Ethnobotany	4 (3-0-1)	480
		BOET314L	Ethnobotany Lab		481
6	Minor Course 6	BOMD315T	Microbial diversity	4 (3-0-1)	482
		BOMD316L	Microbial diversity Lab		482
7	Minor Course 7	BOIM408T	Industrial Microbiology	3 (2-0-1)	483
		BOIM409L	Industrial Microbiology Lab		484
7	Minor Course 8	BORM410T	Research Methodology	2	
8	Minor Course 9	BOFM411T	Fundamentals of Molecular Biology	3 (2-0-1)	485
		BOFM412L	Fundamentals of Molecular Biology Lab		485

SKILL ENHANCEMENT COURSES

Semes-ter	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	BOBT108L	Biofertilizer Technology	3 (1-0-2)	486
2	S E Course 2	BOEB109L	Essentials of Bioinformatics	3 (2-0-1)	487
3	S E Course 3	BONS215L	Practical Applications of Nature-Based Solutions for Sustainable Development	3 (2-0-1)	488

INTERNSHIP

Semes-ter	Category	Course Code	Course Name	Credits	Page No
2	Internship	BOIN110I	Internship	4	490
4	Internship	BOIN215I	Internship	4	490
5	Internship	BOIN317I	Internship	2	490

RESEARCH PROJECT /DISSERTATION

BSC BOTANY (Honours)					
Semester	Category	Course Code	Course Name	Credits	Page No
7	Research Project/Dissertation	BODI413P	Research Project Phase I	6	491
8	Research Project/Dissertation	BODI414P	Research Project Phase II	6	491
BSC BOTANY (Honours) with Research					
Semester	Category	Course Code	Course Name	Credits	Page No
7	Research Project/Dissertation	BODI415P	Dissertation I	18	491
8	Research Project/Dissertation	BODI416P	Dissertation II	20	491

DEPARTMENT OF BOTANY***PROGRAMME: BACHELOR OF SCIENCE in BOTANY (BSC) DEGREE: BSC BOTANY (HONOURS)/ BSC BOTANY (HONOURS) WITH RESEARCH*****VISION:**

To motivate and encourage the students in effective ways to utilize the knowledge of 'Plant Sciences' in order to solve the future needs of Food, Fuel, Energy and Environment for the betterment of mankind and society.

MISSION:

The department endeavours to make substantial contribution in the field of 'Plant Sciences' by new research innovations and producing competent students who are not only well versed with the subject but are also better adjusted socially, emotionally and intellectually.

PROGRAM OUTCOMES (PO)

- PO 1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study.
- PO 2: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. Critically evaluate practices, policies and theories by following scientific approach to knowledge development.
- PO 3: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully; and present complex information in a clear and concise manner to different groups.
- PO 4: Social Interaction: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 5: Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 6: Moral and Ethical Awareness: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.

PO 7: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

PO 8: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio- technological changes. Critical sensibility to lived experiences, with self-awareness and reflexivity of both and society.

PO 9: Information and Digital Literacy: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.

PO 10: Research related skills: A sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause and affect relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Ability to apply one's learning to real life situations.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO 1: Acquire the basic knowledge on classical as well as advanced plant science/botany to build up a strong foundation of concepts and basics for future.

PSO 2: Equip the students with the concepts and importance of interdisciplinary fields such as Molecular Biology and Biotechnology, Computational biology, Mathematics, etc and their applications in healthcare, agriculture, environment, and industry.

PSO 3: The students would acquire hands on experience of performing experiments on basic and advanced plant science thereby gaining the knowledge of some sophisticated scientific instruments.

PSO 4: The students would be moulded and well-prepared for national and international competitive examinations through this course.

Mapping of COs to PO/PSO

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
BOPM100T	H	M	H	M				L		H	M	H	M	M
BOPM101L	H	M	L					L		H	M	H	H	M
BONV104T	H	M		M							H	L	L	H
BONV105L	H	L			L							L	M	L
MDC 1	H	H	M				M	H		H	H	M	H	H
BOBT107T	M	M	L	H	L	L	M	M	H	M	H	H	L	M
BOBT108L	H	M	L	H	L	L	M	M	H	M	H	H	H	H
BOMY102T	H	M	H	M				L		H	M	H	M	M
BOMY103L	H	M	M	M				L		H	M	H	M	M
BOVP106T	H	H					M	H	L	H	H		M	H
BOVP107L	H	H					M	H	L	H	H		M	H
MDC 2	H	H	M				M	H		H	H	M	H	H
BOEB108T	M	M	L	H	L	L	M	M	H	M	H	H	L	M
BOEB109L	H	M	L	H	L	L	M	M	H	M	H	H	H	H

BOBC200T	H	H	M				M	H		H	H	M	H	H
BOBC201L	H	H	M				M	H		H	H	M	H	H
BOAR202T	H	M		M	L						H		L	H
BOAR203L	H	L	L	M								M	M	L
BOFP210T	H	M	M	M						H	H	H	H	M
BOFP211L	H	M	M	M				M		H	H	H	H	M
MDC 2 T	H	H	M				M	H		H	H	M	H	H
MDC 2 L	H	H	M				M	H		H	H	M	H	H
SEC 3 T	H	H	M	H	H	M	H	H	H	H	L	H	H	H
BOBI214 L	H	H	M	H	H	M	M	H	H	M	L	M	M	H
BOPG204T	H	M										H	H	H
BOPG205L	H	L			L		L	M				H	H	L
BOMA206T	M	M	H	L						H	H	H	M	M
BOMA207L	M	M	H	L				M		M	H	H	M	M
BOPE208T	H	H	M			M	H	H	L	H	H	M	H	H
BOPE209L	H	H	M			M	H	H	L	H	H	M	H	H
BOEB212T	H	H	M				M	H		H	H	M	H	H
BOEB213L	H	H	M				M	H		H	H	M	H	H
BOPP300T	H	H					M	H	M	H	H		M	H
BOPP301L	H	H					M	H	M	H	H		M	H
BOPS302T	M	H	M	H				M		H	H	H	M	M
BOPS303L	M	H	M	H				M		H	H	H	M	M
BORB304T	H	H					L	H	M	H	H		M	H
BORB305L	H	H					L	H	M	H	H		M	H
BOET313T	H	H	M	L						H	H	H	M	M
BOET314L	H	H	M	L				M		H	H	H	M	L
BOPM306T	H	H					L	H	M	H	H		M	H
BOPM307L	H	H					L	H	M	H	H		M	H
BOMO308T	H	M	L	L	M	H	M	L	M	H	H	M	H	M
BOMO309L	M	M	L	L	L	M	L	L	M	M	H	M	M	M
BOEC310T	H	L	L	M	M	M	M	M	M	M	H	L	H	M
BOEC311L	L	L	L	M	M	L	M	L	L	M	M	L	M	M
BOMD315T	H	H	M				M	H		H	H	M	H	H
BOMD316L	H	H	M				M	H		H	H	M	H	H
BOAT400T	H	H	M				M	H		H	H	M	H	H
BOAT401L	H	H	M				M	H		H	H	M	H	H
BOBS402T	M	M	M	M	M	L	M	M	M	H	M	L	M	L
BOBS403L	M	M	M	M	M	M	M	H	M	H	M	L	M	L
BOIM408T	M	H	M	H	L	L		M		H	M	H	H	H
BOIM409L	M	H	M							H	M	H	H	H
BOPL404T	H	H	M				M	H		H	H	M	H	H
BOPL405L	H	H	M				M	H		H	H	M	H	H
BOPA406T	L	H				M		H				M	L	L
BOPA407L	H	H	M				M	H		H	H	M	H	H

BOFM411T	H	H	M				M	H		H	H	M	H	H
BOFM412L	H	H	M				M	H		H	H	M	H	H

DETAILED SYLLABUS MAJOR COURSES

Semes-ter	Category	Course Code	Course Name	Credits
1	Major Course 1	BOPM100T	Phycology and Microbiology	4 (3-0-1)
		BOPM101L	Phycology and Microbiology Lab	
2	Major Course 2	BOMY102T	Mycology	4 (3-0-1)
		BOMY103L	Mycology Lab	
3	Major Course 3	BOBC200T	Biomolecules and Cell Biology	4 (3-0-1)
		BOBC201L	Biomolecules and Cell Biology Lab	
3	Major Course 4	BOAR202T	Archegoniates	4 (3-0-1)
		BOAR203L	Archegoniates Lab	
4	Major Course 5	BOPG204T	Plant Genetics	5 (3-0-2)
		BOPG205L	Plant Genetics Lab	
4	Major Course 6	BOMA206T	Morphology and Anatomy of Angiosperms	5 (3-0-2)
		BOMA207L	Morphology and Anatomy of Angiosperms Lab	
4	Major Course 7	BOPE208T	Plant Ecology	4 (3-0-1)
		BOPE209L	Plant Ecology Lab	
5	Major Course 8	BOPP300T	Plant Physiology	5 (3-0-2)
		BOPP301L	Plant Physiology Lab	
5	Major Course 9	BOPS302T	Plant Systematics	5 (3-0-2)
		BOPS303L	Plant Systematics Lab	
5	Major Course 10	BORB304T	Reproductive Biology of Angiosperms	4 (3-0-1)
		BORB305L	Reproductive Biology of Angiosperms Lab	
6	Major Course 11	BOPM306T	Plant Metabolism	4 (3-0-1)
		BOPM307L	Plant Metabolism Lab	
6	Major Course 12	BOMO308T	Molecular Biology	4 (3-0-2)
		BOMO309L	Molecular Biology Lab	
6	Major Course 13	BOEC310T	Economic Botany	4 (3-0-1)
		BOEC311L	Economic Botany Lab	
6	Major Course 14	BOMP312P	Minor Project	4
7	Major Course 15	BOAT400T	Analytical Techniques in Plant science	5 (3-0-2)
		BOAT401L	Analytical Techniques in Plant science Lab	
7	Major Course 16	BOBS402T	Biostatistics	5 (3-0-2)
		BOBS403L	Biostatistics Lab	
8	Major Course 17	BOPL404T	Plant Biotechnology	5 (3-0-2)
		BOPL405L	Plant Biotechnology Lab	
8	Major Course 18	BOPA406T	Plant Pathology	5 (3-0-2)
		BOPA407L	Plant Pathology Lab	

BOPM100T: PHYCOLOGY AND MICROBIOLOGY

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

- CO 1: Compare different microorganisms and their importance (Understanding)
 CO 2: Able to identify and characterize different Algae (Applying)
 CO 3: Able to explain the morphology and life cycle of various important Algal species (Remembering)
 CO 4: To assess the importance of microbial activities in various fields (Analyzing)

Module I: Introduction to Microbial World (4 Hours)

Microbes in Our Lives; History of Microbiology; Modern Microbiology; Scope of Microbiology; Major Groups of the Microbial world. Microbial nutrition, growth and metabolism

Module II: Algae (8 Hours)

Algae General characteristics; Ecology and distribution; range of thallus organization; Cell structure and components; cell wall, pigment system, reserve food (of only groups represented in the syllabus), flagella; methods of reproduction; Classification; criteria, system of Fritsch, and evolutionary classification of Lee (only up to groups); Significant contributions of important phycologists (F.E. Fritsch, G.M. Smith, R.N. Singh, T.V. Desikachary, H.D. Kumar, M.O.P. Iyengar). Role of algae in the environment, agriculture, biotechnology and industry

Module III: Cyanophyta and Xanthophyta (5 Hours)

Cyanophyta and Xanthophyta Ecology and occurrence; Range of thallus organization; Cell structure; Reproduction, Morphology and life-cycle of *Nostoc* and *Vaucheria*

Module IV: Chlorophyta and Charophyta (6 Hours)

Chlorophyta and Charophyta General Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Chlamydomonas*, *Volvox*, *Oedogonium*, *Chara*; Evolutionary significance of *Prochloron*

Module V: Phaeophyta and Rhodophyta (6 Hours)

Phaeophyta and Rhodophyta Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Ectocarpus*, *Fucus* and *Polysiphonia*.

Module VI: Bacteria (8 Hours)

Bacteria Discovery, general characteristics; Types- archaebacterial, eubacteria, wall-less forms (mycoplasma and spheroplasts); Cell structure; Nutritional types; Reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction); Economic importance of bacteria with reference to their role in agriculture and industry (fermentation and medicine)

Module VII: Viruses (8 Hours)

Viruses Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV); Economic importance of viruses with reference to vaccine production, role in research, medicine and diagnostics, as causal organisms of plant diseases

Suggested Readings

- Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
 Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.
 Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
 Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
 Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition. II
 Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi

Mapping of COs to syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO 1	2	3	2	2	2	2	1
CO2		3	2	2	2		

CO3		1	3	3	3		
CO4		2				3	3

BOPM101L: PHYCOLOGY AND MICROBIOLOGY LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Differentiate between cell shapes and structures of microorganisms (Applying)

CO 2: Able to understand reproduction and multiplication processes in microbes (Under-

standing) CO 3: Utilize and create basic identification techniques for microbes (Creating)

Microbiology

Expt. 1: Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle

Expt. 2: Types of Bacteria to be observed from temporary/permanent slides/photographs. Electron micrographs of bacteria, binary fission, endospore, conjugation, root nodule

Expt. 3: Gram staining

Expt. 4: Endospore staining with malachite green using the (endospores taken from soil bacteria) Phycology

Expt. 5: Study of vegetative and reproductive structures of Nostoc, Chlamydomonas (electron micrographs), Volvox, Oedogonium, Coleochaete, Chara, Vaucheria, Ectocarpus, Fucus and Polysiphonia, Prochloron through electron micrographs, temporary preparations and permanent slides

Mapping of COs to syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5
CO1	1	3	2	2	2
CO2		2	1	2	3
CO3		2	1		3

BOMY102T: MYCOLOGY

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Able to tell and name different fungi, allied fungi and lichens and their classification process/criteria (Remembering)

CO 2: Able to explain fungal cell organization; illustrate their reproduction mechanisms (Understanding)

CO 3: Able to explain the life cycle with reference to various important fungal species (Remembering)

CO 4: Determine the application of fungi in food industries, pharmaceutical preparations and agriculture (Evaluating)

Module I: Introduction to Fungi (4 Hours)

General characteristics; Affinities with plants and animals; Thallus organization; Cell wall composition; Nutrition; Classification

Module II: Chytridiomycota and Zygomycota (6 Hours)Characteristic features; Ecology and significance; Thallus organization; Reproduction; Life cycle with reference to *Synchytrium*, *Rhizopus***Module III: Ascomycota (10 Hours)**General characteristics (asexual and sexual fruiting bodies); Ecology; Heterokaryosis and Para sexuality; Life cycle and classification with reference to *Saccharomyces*, *Aspergillus*, *Penicillium*, *Alternaria*, *Neurospora* and *Peziza*

Module IV: Basidiomycota (10 Hours)

General characteristics; Ecology; Life cycle and Classification with reference to black stem rust on wheat *Puccinia* (Physiological Specialization), loose and covered smut (symptoms only), *Agaricus*; Bioluminescence, Fairy Rings and Mushroom Cultivation

Module V: Allied Fungi (4 Hours)

General characteristics; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies

Module VI: Oomycota (4 Hours)

General characteristics; Ecology; Life cycle and classification with reference to *Phytophthora*, *Albugo*

Module VII: Symbiotic Associations (7 Hours)

Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization; Nature of associations of algal and fungal partners; Reproduction; Mycorrhiza- Ectomycorrhiza, Endomycorrhiza and their significance

Suggested Readings:

Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, John Wiley & Sons (Asia) Singapore. 4th edition.

Webster, J. and Weber, R. (2007). Introduction to Fungi, Cambridge University Press, Cambridge. 3rd edition

Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies, Macmillan Publishers India Ltd.

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3					2	1
CO2	3		2				
CO3		3	3	3	2	2	
CO4	3			2			

BOMY103L: MYCOLOGY LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Able to recall the general structure of fungi, allied fungi and lichens and show their reproductive structures (Remembering)

CO 2: Able to demonstrate thallus structure of different classes of fungi (Understanding)

CO 3: Examine the methods of reproduction in fungi (Analyzing)

CO 4: Able to formulate control measures of deadly plant pathogens and also develop plans for preparation of herbarium (Creating)

Practical:

Expt.1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps & basidiocarps)

Expt.2. Rhizopus: study of asexual stage from temporary mounts and sexual structures through permanent slides

Expt.3. Aspergillus and Penicillium: study of asexual stage from temporary mounts. Study of Sexual stage from permanent slides/photographs

Expt.4. Peziza: sectioning through ascocarp

Expt.5. Alternaria: Specimens/photographs and temporary mounts

Expt.6. Puccinia: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; sections/ mounts of spores on wheat and permanent slides of both the hosts

Expt.7. Agaricus: Specimens of button stage and full-grown mushroom; sectioning of gills of Agaricus, fairy rings and bioluminescent mushrooms to be shown

Expt.8. Study of phaneroplasmodium and aphanoplasmodium from actual specimens and /or photograph

Expt.9. Albugo: Study of symptoms of plants infected with Albugo; asexual phase study through section/ temporary mounts and sexual structures through permanent slides

Expt.10. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates. Study of thallus and reproductive structures (soredia and apothecium) through permanent slides. Mycorrhizae: ectomycorrhiza and endomycorrhiza
(Photographs)

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt.10
CO1	2	3	3	2	1			1	3	3
CO2	3				1		3			2
CO3	1	3	2	1		1	2	3		
CO4						3			1	

BOBC200T: BIOMOLECULES AND CELL BIOLOGY

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: To recall the properties and economic importance of enzymes (Remembering)

CO 2: To memorize the general characteristics of carbohydrates, proteins, nucleic acids and lipids and how they are imported/exported to various organelles (Remembering)

CO 3: To acquire comprehensive knowledge on the general structure of proteins (Understanding)

CO 4: To interpret the basics of mode of actions of enzymes (Understanding)

CO 5: To understand the importance of cell cycle and its regulation in controlling diseases (Understanding)

Module I: Biomolecules (20 Hours)

Types and significance of chemical bonds; Structure and properties of water; pH and buffers; Carbohydrates: Nomenclature and classification; Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Triacylglycerols structure, functions and properties; Phosphoglycerates. Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Protein denaturation and biological roles of proteins. Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA

Module II: Bioenergetics (2 Hours)

Principles of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as an energy currency molecule

Module III: Enzymes (4 Hours)

Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity

Module IV: The cell (2 Hours)

Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell
(Endosymbiotic theory)

Module V: Cell wall and Plasma Membrane (4 Hours)

Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis

Module VI: Cell Organelles (10 Hours)

Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus. Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament. Chloroplast, mitochondria and peroxisomes: Structural organization; Function; Semiautonomous nature of mitochondria and chloroplast. Endomembrane system: Endoplasmic Reticulum – Structure, targeting and insertion of proteins in the ER, protein folding, processing; Smooth ER and lipid synthesis, export of proteins and lipids; Golgi Apparatus – organization, protein glycosylation, protein sorting and export from Golgi Apparatus; Lysosomes

Module VII: Cell Division (3 Hours)

Importance of cell cycle, Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle- checkpoints, role of protein kinases

Suggested Readings

Campbell, MK (2012) Biochemistry, 7th ed., Published by Cengage Learning
 Campbell, PN and Smith AD (2011) Biochemistry Illustrated, 4th ed., Published by Churchill Livingstone
 Tymoczko JL, Berg JM and Stryer L (2012) Biochemistry: A short course, 2nd ed., W.H. Freeman
 Berg JM, Tymoczko JL and Stryer L (2011) Biochemistry, W.H. Freeman and Company
 Nelson DL and Cox MM (2008) Lehninger Principles of Biochemistry, 5th Edition., W.H. Freeman and Company.
 Karp, G. (2010). Cell Biology, John Wiley & Sons, U.S.A. 6th edition.
 Hardin, J., Becker, G., Skliensmith, L.J. (2012). Becker's World of the Cell, Pearson Education Inc. U.S.A. 8th edition.
 Cooper, G.M. and Hausman, R.E. (2009) The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA. 17
 Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009) The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3						
CO2	3	2		3	3	3	
CO3			3				
CO4			3				
CO5							3

BOBC201L: BIOMOLECULES AND CELL BIOLOGY LAB

(1 Credits-30 Hours) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: To recall the properties of carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins (Remembering)

CO 2: To memorize the common tests of carbohydrates, proteins, nucleic acids and lipids and their classification (Remembering)

CO 3: To acquire comprehensive knowledge on the logic behind the cell structure and functions (Understanding)

CO 4: To comprehend the basics of cell structure (Understanding)

Practical:

Expt. 1: Qualitative tests for carbohydrates, reducing sugars, non-reducing sugars, lipids and proteins

Expt. 2: Study of plant cell structure with the help of epidermal peel mount of Onion/Rhoeo/Crinum.

Expt. 3: Demonstration of the phenomenon of protoplasmic streaming in Hydrilla leaf.

Expt. 4: Measurement of cell size by the technique of micrometry.

Expt. 5: Counting the cells per unit volume with the help of hemocytometer (Yeast/pollen grains)

Expt. 6: Study of cell and its organelles with the help of electron micrographs.

Expt. 7: Cytochemical staining of: DNA- Feulgen and cell wall in the epidermal peel of onion using Periodic Schiff's (PAS) staining technique.

Expt. 8: Study the phenomenon of plasmolysis and deplasmolysis.

Expt. 9: Study the effect of organic solvent and temperature on membrane permeability.

Expt. 10: Study different stages of mitosis and meiosis.

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt.10
CO1	3									
CO2							2		2	
CO3			2	3	3	3		3		3
CO4		3	3			3	3			3

BOAR202T: ARCHEGONIATE

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Recall the unique features of archegoniate (Remembering)

CO 2: Summarize the different land habits and alternation of generation in archegoniates (Understanding)

CO 3: Classify the different archegoniates and demonstrate their morphology, anatomy and reproduction (Understanding)

CO 4: Illustrate the economic importance of bryophytes, pteridophytes and Gymnosperms (Understanding)

Module I: Introduction (2 Hours)

Unifying features of archegoniate; Transition to land habit; Alternation of generations

Module II: Bryophytes (12 Hours)

General characteristics; Adaptations to land habit; Classification; Range of thallus organization Classification (up to family)

Riccia, *Marchantia*, *Pellia*, *Porella*, *Anthoceros*, *Sphagnum* and *Funaria*; Reproduction and evolutionary trends in *Riccia*, *Marchantia*, *Anthoceros* and *Funaria* (developmental stages not included)

Module III: Pteridophytes (13 Hours)

General characteristics, classification, early land plants (*Cooksonia* and *Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Psilotum*, *Selaginella*, *Equisetum* and *Pteris* (Developmental details not to be included) Apogamy, and apospory, heterospory and seed habit, telome theory, stellar evolution

Module IV: Gymnosperms (15 Hours)

General characteristics, classification (up to family), morphology, anatomy and reproduction of *Cycas*, *Pinus* and *Gnetum* and *Ephedra*; (Developmental details not to be included)

Module V: Economic Importance (3 Hours)

Ecological and economic importance of bryophytes with special reference to *Sphagnum*; Ecological and economic importance of pteridophytes and gymnosperms

Suggested Readings

Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.

Bhatnagar, S.P. & Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.

Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.

Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.

Vander-Poorteri 2009 Introduction to Bryophytes. COP

Mapping of COs to syllabus

COs	Module I	Module II	Module III	Module IV	Module V
CO1	3				
CO2	3	3			
CO3			3	3	
CO4					3

BOAR203L: ARCHEGONIATE LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Infer the various morphological, anatomical and reproductive features of important bryophytes (Understanding)

CO 2: Interpret the various morphological, anatomical and reproductive features of important pteridophytes (Understanding)

CO 3: Demonstrate the various morphological, anatomical and reproductive features of important gymnosperms (Understanding)

CO 4: Develop the art of preparing slides of various archegoniate specimens and identifying them under the microscope (Applying)

CO 5: Identify different bryophytes, pteridophytes and gymnosperms in their natural habitat (Applying)

Practical:Expt. 1: *Riccia*– Study of morphology of thallus.Expt. 2: *Marchantia*- Study of morphology of thallus, whole mount of rhizoids & Scales, vertical section of thallus through Gemma cup, whole mount of Gemmae (all temporary slides), vertical section of Antheridiophore, Archegoniophore, longitudinal section of Sporophyte (all permanent slides)Expt. 3: *Anthoceros*- Study of morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoeleaters, columella) (temporary slide), vertical section of thallus (permanent slide)Expt. 4: *Pellia*, *Porella*- Study of these specimens through permanent slidesExpt. 5: *Sphagnum*- Study of morphology of plant, whole mount of leaf (permanent slide only)Expt. 6: *Funaria*- Study of morphology, whole mount of leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, longitudinal section of capsule and protonemaExpt. 7: *Psilotum*- Study of specimen, transverse section of synangium (permanent slide)Expt. 8: *Selaginella*- Study of morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide)Expt. 9: *Equisetum*- Study of morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide)Expt. 10: *Pteris*- To study the morphology, transverse section of rachis, vertical section of sporophyll, whole mount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide)Expt. 11: *Cycas*- To study the morphology (coralloid roots, bulbil, leaf), whole mount of microsporophyll, transverse section of coralloid root, transverse section of rachis, vertical section of leaflet, vertical section of microsporophyll, whole mount of spores (temporary slides), longitudinal section of ovule, transverse section of root (permanent slide)Expt. 12: *Pinus*- To study the morphology (long and dwarf shoots, whole mount of dwarf shoot, male and female cones), transverse section of Needle, transverse section of stem, longitudinal section of /transverse section of male cone, whole mount of microsporophyll, whole mount of Microspores (temporary slides), longitudinal section of female cone, tangential longitudinal section and radial longitudinal sections stem (permanent slide)

Expt. 13: *Gnetum*- Study of morphology (stem, male & female cones), transverse section of stem, vertical section of ovule

(permanent slide)

Expt. 14: Botanical excursion

Mapping of COs to Syllabus:

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10	Expt. 11	Expt. 12	Expt. 13	Expt. 14
CO 1	3	3	3	3	3	3								
CO 2							3	3	3	3				
CO 3											3	3	3	
CO 4	2	2	2	2										
CO 5						2		2	2		2			3

BOPG204T: PLANT GENETICS

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Summarize the concepts of Mendelian genetics (Understanding)

CO 2: Infer the ideas behind extrachromosomal inheritance, linkage and crossing over, numerical and structural chromosomal aberrations (Understanding)

CO 3: Compare the various genetic mutations and explain DNA repair (Understanding)

CO 4: Demonstrate the fine structure of the gene including complementation test (Understanding) CO 5: Rephrase the Hardy Weinberg Law (Understanding)

Module I: Mendelian Genetics and Its Extension (12 Hours)

Mendelism: History; Principles of inheritance; Chromosome theory of inheritance; Autosomes and sex chromosomes; Probability and pedigree analysis; Incomplete dominance and codominance; Multiple alleles, lethal alleles, Epistasis, Pleiotropy, Recessive and Dominant traits, Penetrance and Expressivity, Numericals; Polygenic inheritance

Module II: Extrachromosomal Inheritance (6 Hours)

Chloroplast mutation: Variegation in Four o'clock plant; Mitochondrial mutations in yeast; Maternal effects - shell coiling in snail; Infective heredity - Kappa particles in *Paramecium*

Module III: Linkage, Crossing Over and Chromosome Mapping (10 Hours)

Linkage and crossing over-Cytological basis of crossing over; Recombination frequency, two factor and three factor crosses; Interference and coincidence; Numericals based on gene mapping; Sex Linkage

Module IV: Variation in Chromosome Number and Structure (5 Hours)

Deletion, Duplication, Inversion, Translocation, Position effect, Euploidy and Aneuploidy

Module V: Gene Mutations (5 Hours)

Types of mutations; Molecular basis of Mutations; Mutagens – physical and chemical (Base analogs, deaminating, alkylating and intercalating agents); Detection of mutations: CIB method. Role of transposons in mutation DNA repair mechanisms

Module VI: Fine Structure of Gene (3 Hours)

Classical vs molecular concepts of gene; Cis-Trans complementation test for functional allelism; Structure of Phage T4, rII Locus

Module VII: Population and Evolutionary Genetics (4 Hours)

Allele frequencies, Genotype frequencies, Hardy – Weinberg Law, role of natural selection mutation, genetic drift
Genetic variation and Speciation

Suggested Readings

Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, John Wiley & sons, India. 8th edition.
Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. 5th edition.
Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. Benjamin Cummings, U.S.A. 10th edition.
Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3						
CO2		3	3	3			
CO3					3		
CO4						3	
CO5							3

BOPG205L: PLANT GENETICS LAB

(2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

- CO 1: Experiment with meiosis through slide preparation (Applying)
CO 2: Solve problems related to Mendel's laws, probability and chi-square analysis (Applying)
CO 3: Examine test cross data for chromosome mapping and pedigree charts (Analyzing)
CO 4: Demonstrate incomplete dominance and gene interaction (Evaluating)
CO 5: Interpret blood typing, chromosomal aberrations and human genetic traits (Understanding)

Practical:

- Expt. 1: Meiosis through temporary squash preparation
Expt. 2: Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square analysis
Expt. 3: Chromosome mapping using test cross data
Expt. 4: Pedigree analysis for dominant and recessive autosomal and sex-linked traits
Expt. 5: Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4)
Expt. 6: Blood Typing: ABO groups & Rh factor
Expt. 7: Study of aneuploidy: Down's, Klinefelter's and Turner's syndromes
Expt. 8: Photographs/Permanent Slides showing Translocation Ring, Laggards and Inversion Bridge
Expt. 9: Study of human genetic traits: Sick cell anemia, Xeroderma Pigmentosum, Albinism, red-green Colour blindness, Widow's peak, rolling of tongue, Hitchhiker's thumb and Attached ear lobe

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Exp.8	Expt.9
CO1	3								
CO2		3							
CO3			3	3					
CO4					3				
CO5						3	3	3	3

BOMA206T: MORPHOLOGY AND ANATOMY OF ANGIOSPERMS

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Compare the general morphology and distinguishing characteristics of angiospermic plants (Understanding)

CO 2: Examine the concepts and fundamentals of plant anatomy (Analyzing)

CO 3: Comprehend the concepts of organization and development of shoot and root apices (Understanding)

CO 4: Evaluate the secretory systems in plants (Evaluating)

Module I: Plant morphology (3 hours)

Introduction; Vegetative Characters: Modified Roots and Stems; Leaf (Phyllotaxy), Venation; Trichomes. Reproductive

Characters: Floral parts, Arrangements of flowers on the floral axis, Unisexual and Bisexual Flowers, Variation in fruit surface, Placentation, Variation in seed coats

Module II: Tissues (8 Hours)

Classification of tissues; Simple and complex tissues (no phylogeny); cyto-differentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, encrustation and incrustation, Ergastic substances

Module III: Stem, Leaves and Roots (13 Hours)

Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure of dicot and monocot stem; Structure of dicot and monocot leaf, Kranz anatomy, Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root

Module IV: Vascular Cambium, Periderm and Wood (13 Hours)

Structure, function and seasonal activity of cambium; Secondary growth in root and stem, Development and composition of periderm, rhytidome and lenticels, Axially and radially oriented elements; Types of rays and axial parenchyma; Cyclic aspects and reaction wood; Sapwood and heartwood; Ring and diffuse porous wood; Early and late wood, tyloses; Dendrochronology

Module V: Adaptive and Protective Systems (8 Hours)

Epidermal tissue system, cuticle, epicuticular waxes, trichomes (uni and multicellular, glandular and non-glandular, two examples of each), stomata (classification); Adcrustation and incrustation; Anatomical adaptations of xerophytes and hydrophytes; Secretory system

Suggested Readings

Dickison, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.

Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.

Mauseth, J.D. (1988). Plant Anatomy. The Benjammin/Cummings Publisher, USA.

Esau, K. (1977). Anatomy of Seed Plants. John Wiley & Sons, Inc., Delhi

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V
CO1	3	1			
CO2		2	3	3	1
CO3			3		
CO4					3

BOMA207L: MORPHOLOGY AND ANATOMY OF ANGIOSPERMS LAB

(2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Prepare permanent slides, temporary stain mounts, macerations and museum specimens (Creating)

CO 2: Gain the knowledge about apical meristem of root, shoot and vascular system (Understanding)

CO 3: Apprehend the ideas of the distribution and types of tissues (Understanding)

CO 4: Examine the different aspects of plant adaptations and plant secretory systems (Analyzing) **Practical:**

Expt. 1: Study of anatomical details through permanent slides/temporary stain mounts/ macerations/ museum specimens with the help of suitable examples

Expt. 2: Apical meristem of root, shoot and vascular cambium

Expt. 3: Distribution and types of parenchyma, collenchyma and sclerenchyma

Expt. 4: Xylem: Tracheary elements- tracheids, vessel elements; thickenings; perforation plates; xylem fibres

Expt. 5: Wood: ring porous; diffuse porous; tyloses; heart-and sapwood

Expt. 6: Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres

Expt. 7: Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular

Expt. 8: Root: monocot, dicot, secondary growth

Expt. 9: Stem: monocot, dicot. - Primary and secondary growth; periderm; lenticels

Expt. 10: Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy)

Expt. 11: Adaptive Anatomy: xerophytes, hydrophyte

Expt. 12: Secretory tissues: cavities, lithocysts and laticifers

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt.10	Expt.11	Expt.12
CO1	3											
CO2		3		1		1						
CO3		2	3	3		3	3					3
CO4				1	2	1		3	3			3

BOPE208T: PLANT ECOLOGY

(3 Credits: 45Hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Illustrate the concepts of ecology of individual, population, community and ecosystem (Understanding)

CO 2: Extend the knowledge of various factors of environment, its interaction and the structural and functional aspects of ecosystem (Understanding)

CO 3: Apply the concepts of population dynamics and community succession in understanding the composition of a particular area (Applying)

CO 4: Illustrate the principle and concept of phytogeography (Understanding)

Module I: Introduction (4 Hours)

Basic concepts of ecology, Levels of organization, Inter-relationships between the living world and the environment, the components and dynamism, homeostasis

Module II: Abiotic and Biotic Components of Ecosystem (10 Hours)

Importance; Origin; Formation; Composition; Physical; Chemical and Biological components; Soil profile; Role of climate in soil development, Importance: States of water in the environment; Atmospheric moisture; Hydrological

Cycle; Water in soil; Water table. Variations; adaptations of plants to their variation in Light, temperature, wind and fire, Host-Pathogen interaction

Module III: Ecosystem, Its Structural and Functional Aspects (8 Hours)

Structure; Processes; trophic organization, Food chains and Food webs; Ecological pyramids, Principles and models of energy flow; Production and productivity; Ecological efficiencies; Biogeochemical cycles; Cycling of Carbon, Nitrogen and Phosphorus

Module IV: Population Ecology (8 Hours)

Characteristics and Dynamics of population ecology, ecological Speciation

Module V: Plant Communities (8 Hours)

Concept of ecological amplitude; Habitat and niche; Characters: analytical and synthetic; Ecotone and edge effect; Dynamics: succession – processes, types; climax concepts

Module VI: Phytogeography (7 Hours)

Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phytogeographical division of India; Local Vegetation

Suggested Readings

Odum, E.P. (2005) Fundamentals of ecology, 5th edition Cengage Learning India Pvt. Ltd., New Delhi

Singh, J.S., Singh, S.P., Gupta, S. (2006) Ecology Environment and Resource Conservation, Anamaya Publications, New Delhi, India

Sharma, P.D. (2010) Ecology and Environment, 8th edition Rastogi Publications, Meerut, India

Wilkinson, D.M. (2007) Fundamental Processes in Ecology: An Earth Systems Approach, Oxford University Press. USA

Kormondy, E.J. (1996) Concepts of ecology, 4th edition, PHI Learning Pvt. Ltd., Delhi, India

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	3		3	3	3	
CO2	2	3	3			
CO3			3			
CO4						3

BOPE209L: PLANT ECOLOGY LAB

(1 Credit: 30 Hours) (L-T-P: 0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Recall their basic knowledge on ecology in order to use instruments to measure microclimatic variables (Remembering)

CO 2: Illustrate the various physico-chemical properties of soil and water (Understanding)

CO 3: Estimate the DO of water samples from polluted and unpolluted sources (Evaluating)

CO 4: Utilize their knowledge to demonstrate and calculate the plant communities (Applying)

CO 5: Adapt the concepts of ecology and inculcating these ideas in their young minds through field visits (Creating)

Practical

Expt. 1: Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, hygrometer, rain gauge and lux meter.

Expt. 2: Determination of pH of various soil and water samples

Expt. 3: Analysis for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency from two soil samples by rapid field tests.

Expt. 4: Determination of organic matter of different soil samples by Walkley & Black rapid titration method.

Expt. 5: Comparison of bulk density, porosity and rate of infiltration of water in soils of three habitats.

Expt. 6: Determination of dissolved oxygen of water samples from polluted and unpolluted sources.

Expt. 7: Study of morphological adaptations of hydrophytes and xerophytes (four each).

Expt. 8: Determination of minimal quadrat size for the study of herbaceous vegetation by species area curve method.

Expt. 9: Quantitative analysis of herbaceous vegetation for frequency and comparison with Raunkiaer's frequency distribution law.

Expt. 10: Quantitative analysis of herbaceous vegetation for density, abundance and IVI

Expt. 11: Field visit

Mapping of COs to Syllabus

COs	Mod- ule 1	Mod- ule 2	Mod- ule 3	Mod- ule 4	Mod- ule 5	Mod- ule 6	Mod- ule 7	Mod- ule 8	Mod- ule 9	Mod- ule 10	Mod- ule 11
CO1	H	L									
CO2	L	L	H	L	M	L					
CO3						H					
CO4							H	H	H	H	
CO5							L	L	L	L	H

BOPP300T: PLANT PHYSIOLOGY

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Explain the concepts of plant water relation, mineral nutrition, nutrient uptake and translocation (Understanding)

CO 2: Interpret the concepts of photoperiodism, phytochrome and vernalization (Understanding)

CO 3: Analyze the functions of growth regulators (Analyzing)

CO 4: Formulate methods to test actions of Plant Growth Regulators in vitro/in vivo (Creating)

Module I: Plant Water Relationship (10 Hours)

Water Potential and its components, water absorption by roots, aquaporins, and pathway of water movement, symplast, apoplast, transmembrane pathways, root pressure, and guttation. Ascent of sap—cohesion-tension theory, transpiration and factors affecting transpiration, antitranspirants, mechanism of stomatal movement

Module II: Mineral Nutrition (4 Hours)

Essential and beneficial elements, macro and micronutrients, methods of study and use of nutrient solutions, criteria for essentiality, mineral deficiency symptoms, roles of essential elements, chelating agents

Module III: Nutrient Uptake (4 Hours)

Soil as a nutrient reservoir, transport of ions across cell membrane, passive absorption, electrochemical gradient, facilitated diffusion, active absorption, role of ATP, carrier systems, proton ATPase pump and ion flux, uniport, co-transport, symport, antiport

Module IV: Translocation in the Phloem (4 Hours)

Experimental evidence in support of phloem as the site of sugar translocation, Pressure–Flow Model; Phloem loading and unloading; Source–sink relationship

Module V: Plant Growth Regulators (12 Hours)

Discovery, chemical nature (basic structure), bioassay and physiological roles of Auxin, Gibberellins, Cytokinin, Absciscic acid, Ethylene, Brassinosteroids and Jasmonic acid, biosynthesis

Module VI: Physiology of Flowering (6 Hours)

Photoperiodism, flowering stimulus, florigen concept, vernalization, dormancy and germination of seeds

Module VII: Phytochrome (5 Hours)

Discovery, chemical nature, role of phytochrome in photomorphogenesis, low energy responses (LER) and high irradiance responses (HIR), mode of action

Suggested Readings

Hopkins, W.G. and Huner, A. (2008) Introduction to Plant Physiology, 4th edition, John Wiley and Sons, USA
 Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A. (2015) Plant Physiology and Development, 6th edition, Sinauer Associates Inc. USA
 Bajracharya D. (1999) Experiments in Plant Physiology- A Laboratory Manual, Narosa Publishing House, New Delhi

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3	3	3	3			
CO2						3	3
CO3					3		
CO4					3		

BOPP301L: PLANT PHYSIOLOGY LAB

(2 CREDIT-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

At the end of this course, student will be able to:

CO 1: Memorize the basic concept of transpiration and stomata (Remembering)

CO 2: Interpret the concepts of osmotic and water potential (Understanding)

CO 3: Infer the ideas behind seed germination, amylase activity and the effect of different concentrations of plant growth hormones like IAA (Understanding)

CO 4: Calculate stomatal index and frequency and also area and percentage of stoma using the basic knowledge on stomata (Applying)

CO 5: Examine suction pressure due to transpiration, fruit ripening or rooting from cuttings and bolting (Analyzing) **Practical:**

Expt. 1: Determination of osmotic potential of plant cell sap by plasmolytic method

Expt. 2: Determination of water potential of given tissue (potato tuber) by weight method

Expt. 3: Study of the effect of wind velocity and light on the rate of transpiration in excised twig/leaf

Expt. 4: Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte

Expt. 5: To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and xerophyte (both surfaces)

Expt. 6: To study the phenomenon of seed germination (effect of light)

Expt. 7: To study the effect of different concentrations of IAA on *Avena* coleoptile elongation (IAA Bioassay)

Expt. 8: To study the induction of amylase activity in germinating barley grains

Demonstration experiments

Expt. 1: Demonstration of suction due to transpiration

Expt. 2: **Expt.2:** Fruit ripening/Rooting from cuttings (Demonstration)

Expt. 3: **Expt.3:** Bolting experiment/*Avena* coleoptile bioassay (demonstration)

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Demo Expts.
CO1	3	3							
CO2		3							
CO3				3	3				
CO4						3	3		

CO5								3	3

BOPS302T: PLANT SYSTEMATICS

(L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Summarize the concepts of plant identification, classification, nomenclature and biosystematics (Understanding)

CO 2: Summarize botanical nomenclature and various systems of classification (Understanding)

CO 3: Explain biometrics, numerical taxonomy and cladistics (Understanding)

CO 4: Summarize the phylogeny in angiosperms (Understanding)

Module I: Introduction to Plant Systematics and Identification (10 Hours)

Plant identification, Classification, Nomenclature; Biosystematics; Evidence from palynology, cytology, phytochemistry and molecular data; Field inventory; Functions of Herbarium; Important herbaria and botanical gardens of the world and India; Virtual herbarium; Eflora; Documentation: Flora, Monographs, Journals; Keys: Single access and Multi-access

Module IV: Taxonomic Hierarchy (4 Hours)

Concept of taxa (family, genus, species); Categories and taxonomic hierarchy; Species concept (taxonomic, biological, evolutionary)

Module V: Botanical Nomenclature (6 Hours)

Principles and rules (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations; Names of hybrids

Module VI: Systems of Classification (10 Hours)

Major contributions of Theophrastus, Bauhin, Tournefort, Linnaeus, Adanson, de Candolle, Bessey, Hutchinson, Takhtajan and

Cronquist; Classification systems of Bentham and Hooker (upto series) and Engler and Prantl (upto series); Brief reference of Angiosperm Phylogeny Group (APG III) classification

Module VII: Biometrics, Numerical Taxonomy and Cladistics (5 Hours)

Characters; Variations; OTUs, character weighting and coding; cluster analysis; Phenograms, cladograms (definitions and differences)

Module VIII: Phylogeny of Angiosperms (10 Hours)

Terms and concepts (primitive and advanced, homology and analogy, parallelism and convergence, monophyly, Paraphyly, polyphyly and clades). Origin & evolution of angiosperms; co - evolution of angiosperms and animals; methods of illustrating evolutionary relationship (phylogenetic tree, cladogram)

Suggested ReadingsSingh, G. (2012) Plant Systematics: Theory and Practice, 3rd edition, Oxford & IBH Pvt. Ltd., New Delhi

Jeffrey, C. (1982) An introduction to Plant Taxonomy, Cambridge University Press, Cambridge.

Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002) Plant Systematics-A Phylogenetic Approach, 2nd edition, Sinauer Associates Inc., USA

Maheshwari, J.K. (1963) Flora of Delhi, CSIR, New Delhi

Radford, A.E. (1986) Fundamentals of Plant Systematics Harper and Row, New York

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	3	2	2		1			
CO2		3		3				1
CO3			3				2	

CO4					2	3		

BOPS303L: PLANT SYSTEMATICS LAB

(2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course outcomes

At the end of this course, student will be able to:

CO 1: Interpret the vegetative characters and systematic position of various angiospermic plants (Understanding)

CO 2: Utilize their knowledge on angiosperms to study the floral characters through slide preparation (Applying)

CO 3: Apply the ideas of plant taxonomy and systematics in identifying different plant specimens in their natural habitat (Applying)

CO 4: Develop the art of preparing herbarium of plant specimens (Creating)

Practical:

Expt. 1: Expt.1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification): Ranunculaceae- *Ranunculus*, *Delphinium*, Brassicaceae- *Brassica*, *Alyssum* / *Iberis*, Myrtaceae- *Eucalyptus*, *Callistemon*, Umbelliferae- *Coriandrum* / *Anethum* / *Foeniculum*, Asteraceae- *Sonchus* / *Launaea*, *Vernonia* / *Ageratum*, *Eclipta* / *Tridax*, Solanaceae- *Solanum nigrum* / *Withania*, Lamiaceae- *Salvia* / *Ocimum*, Euphorbiaceae- *Euphorbia hirta* / *E. milii*, *Jatropha*, Liliaceae- *Asphodelus* / *Lilium* / *Allium*, Poaceae- *Triticum* / *Hordeum* / *Avena*

Expt. 2: **Expt.2.** Field visit (local) – Subject to grant of funds from the university.Expt. 3: **Expt.3.** Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book)**Mapping of COs to Syllabus**

COs	Expt.1	Expt.2	Expt.3
CO1	3		
CO2	3		
CO3		3	
CO4			3

BORB304T: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

(3 CREDITS - 45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Categorize different reproductive mechanisms in Angiosperm (Analyzing)

CO 2: Explain the concepts of anther, pollen biology and ovule (Understanding)

CO 3: Evaluate the methods for studying pollination, fertilization and self-incompatibility (Evaluating)

CO 4: Infer the concepts of embryo development in monocot and dicot plants (Understanding) CO 5: Design and improve protocols for transformation (Creating)

Module I: Introduction to Reproductive Biology in Angiosperms (2 Hours)

History (contributions of G.B. Amici, W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.M. Johri, W.A. Jensen, J. Heslop-Harrison) and scope. Types of reproduction and regeneration in plants: Sexual, asexual / vegetative reproduction.

Module II: Anther and Pollen Biology (12 Hours)

Anther wall: Structure and functions, microsporogenesis, callose deposition and its significance, Microgametogenesis; Pollen wall structure, MGU (male germ unit) structure, NPC system; Palynology and scope (a brief account); Pollen wall proteins; Pollen viability, storage and germination; abnormal features: Pseudomonads, polyads, massulae, pollinia

Module III: Ovule (8 Hours)

Structure; Types; Special structures—endothelium, obturator, aril, caruncle and hypostase; Female gametophyte—megasporeogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (details of Polygonum type); Organization and ultrastructure of mature embryo sac

Module IV: Pollination and Fertilization (6 Hours)

Pollination types and significance; adaptations; structure of stigma and style; path of pollen tube in pistil; double fertilization

Module V: Self Incompatibility (8 Hours)

Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic, GSI and SSI); Methods to overcome self-incompatibility: mixed pollination, bud pollination, stub pollination; Intraovarian and in vitro pollination; Modification of stigma surface, parasexual hybridization; Cybrids, in vitro fertilization

Module VI: Endosperm and Embryo (16 Hours)

Types, development, structure and functions, Six types of Embryogeny; General pattern of development of dicot and monocot embryo; Suspensor: structure and functions; Embryo-endosperm relationship; Nutrition of embryo; Unusual features; Embryo development in Paeonia, polyembryony and apomixes

Module VII: Seed and Germline Transformation (4 Hours)

Structure, importance and dispersal mechanisms, Pollen grain and ovules through pollen tube pathway method/ Agrobacterium/ electrofusion/ floral dip/ biolistic

Suggested Readings

Bhojwani, S.S. and Bhatnagar, S.P. (2011) The Embryology of Angiosperms, 5th edition, Vikas Publishing House, Delhi

Shivanna, K.R. (2003) Pollen Biology and Biotechnology, Oxford and IBH Publishing Co. Pvt. Ltd., Delhi

Raghavan, V. (2000) Developmental Biology of Flowering plants, Springer, Netherlands

Johri, B.M. (1984) Embryology of Angiosperms, Springer-Verlag, Netherlands

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3						
CO2		3	3				
CO3		2	2	3	3		
CO4						3	
CO5							3

BORB305L: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS LAB

(1 CREDIT-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Identify parts of anther and develop pollen viability test and calculation of germination percentage (Applying)

CO 2: Examine various types of ovules, the female gametophyte and intra-ovarian pollination (Evaluating)

CO 3: Explain and infer endosperm and embryogenesis (Understanding)

CO 4: Dissect developing seeds to determine stages of growth (Analyzing)

Practical:

Expt. 1: Anther: Wall and its ontogeny; Tapetum (amoeboid and glandular); MMC, spore tetrads, uninucleate, bicelled and dehiscent anther stages through slides/micrographs, male germ unit (MGU) through photographs and schematic representation

Expt. 2: Pollen grains: Fresh and acetolyzed showing ornamentation and aperture, pseudomonads, polyads, pollinia (slides/photographs, fresh material), ultra-structure of pollen wall (micrograph); Pollen viability:

Tetrazolium test germination: Calculation of percentage germination in different media using hanging drop method

Expt. 3: Ovule: Types-anatropous, orthotropous, amphitropous / campylotropous, circinotropous, unitegmic, bitegmic; tenuinucellate and crassinucellate; Special structures: Endothelium, obturator, hypostase, caruncle and aril (permanent slides/specimens/photographs)

Expt. 4: Female gametophyte through permanent slides/ photographs: Types, ultrastructure of mature egg apparatus

Expt. 5: Intra-ovarian pollination; Test tube pollination through photographs

Expt. 6: Endosperm: Dissections of developing seeds for endosperm with free-nuclear haustoria

Expt. 7: Embryogenesis: Study of development of dicot embryo through permanent slides; dissection of developing seeds for embryos at various developmental stages; Study of suspensor through electron micrographs

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7
CO1	3	3					
CO2			3	3	3		
CO3						3	3
CO4							3

BOPM306T: PLANT METABOLISM

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Interpret the concepts of metabolism- carbohydrates, nitrogen and lipids (Understanding)

CO 2: Understand the process of photosynthesis and carbon assimilation (Understanding)

CO 3: Explain the pathways involved in respiration and ATP synthesis (Understanding)

CO 4: Rephrase the structure and properties of amino acids and proteins (Understanding)

Module I: Concept of Metabolism (6 Hours)

Introduction, anabolic and catabolic pathways, regulation of metabolism, role of regulatory enzymes (allosteric, covalent modulation and Isozymes)

Module II: Carbon Assimilation (10 Hours)

Historical background, role of photosynthetic pigments (chlorophylls and accessory pigments), photosystems (PSI, PSII), antenna molecules and reaction centers, photochemical reactions, electron transport chain and photophosphorylation, mechanism of ATP synthesis

CO₂ reduction: C₃ and C₄ pathways, Crassulacean acid metabolism, photorespiration, Factors affecting CO₂ reduction

Module III: Carbohydrate Metabolism (4 Hours)

Structure, properties and importance of mono-, di- and polysaccharides, synthesis and catabolism of sucrose and starch

Module IV: Carbon Oxidation (8 Hours)

Glycolysis and its regulation, oxidative pentose phosphate pathway, oxidative decarboxylation of pyruvate, TCA cycle and its regulation, mitochondrial electron transport, oxidative phosphorylation, substrate level phosphorylation, mechanism of ATP synthesis, ATP synthase, cyanide-resistant respiration, anaerobic conversion of pyruvate into ethanol or lactate, factors affecting respiration

Module V: Lipid Metabolism (6 Hours)

Classification, structure and functions of fatty acids and triglycerides, synthesis and breakdown of triglycerides, α oxidation, β oxidation, glyoxylate cycle, gluconeogenesis

Module VI: Nitrogen Metabolism (6 Hours)

Nitrogen cycle, nitrate assimilation, ammonium assimilation and transamination, biological nitrogen fixation (examples of legumes and non-legumes), physiology and biochemistry of nitrogen fixation

Module VII: Proteins and Amino acids (5 Hours)

Classification, structure and properties of amino acids and proteins

Suggested Readings

Hopkins, W.G. and Huner, A. (2008) Introduction to Plant Physiology, 4th edition, John Wiley and Sons, USA

Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A. (2015) Plant Physiology and Development, 6th edition, Sinauer Associates Inc., USA

Harborne, J.B. (1973) Phytochemical Methods, John Wiley & Sons, New York

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	3		3		3	3	
CO2		3					
CO3				3			
CO4							3

BOPM307L: PLANT METABOLISM LAB

(1 CREDIT-30 HOURS) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Utilize the knowledge to separate photosynthetic pigments (Applying)

CO 2: Demonstrate Hill's reaction, fluorescence and absorption spectrum of photosynthetic pigments (Understanding).

CO 3: Interpret the effects of light and carbon dioxide on photosynthesis

CO 4: Compare the rate of respiration in various plant materials (Understanding)

CO 5: Infer the activity of nitrate reductase and lipases (Understanding)

Practical:

Expt. 1: Expt.1. Chemical separation of photosynthetic pigments

Expt. 2: Expt.2. Experimental demonstration of Hill's reaction

Expt. 3: Expt.3. Study of the effect of light intensity on the rate of photosynthesis

Expt. 4: Expt.4. Effect of carbon dioxide on the rate of photosynthesis

Expt. 5: Expt.5. Comparison of the rate of respiration in different parts of a plant

Expt. 6: Expt.6. Demonstration of activity of Nitrate Reductase in germinating leaves of different plant sources

Expt. 7: Expt.7. To study the activity of lipases in germinating oilseeds and demonstrate mobilization of lipids during germination

Expt. 8: Expt.8. Demonstration of fluorescence by isolated chlorophyll pigments

Expt. 9: Expt.9. Demonstration of absorption spectrum of photosynthetic pigments

Mapping of COs to Syllabus

Cos	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9
CO1	3								
CO2		3						3	3
CO3			3	3					
CO4					3				
CO5						3	3		

BOMO308T: MOLECULAR BIOLOGY

(3 Credit-45 Hours)(L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

- CO 1: Define the molecular structure of DNA and RNA. (Remembering)
- CO 2: Explain the mechanism of DNA replication of both linear and circular DNA as well as protein synthesis including transcription and translation in both prokaryotes and eukaryotes. (Understanding)
- CO 3: Illustrate the post-translational modifications and processing of eukaryotic mRNA and prokaryotic and eukaryotic gene regulation. (Understanding)
- CO 4: Distinguish the different DNA repair mechanisms with their significance. (Analyzing)
- CO 5: Summarize the interdependence of these molecular mechanisms in providing a holistic environment for the smooth functioning of a cell/organism. (Understanding)

Module I: Nucleic Acids (3 Hours)

Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment RNA and its significance in evolution.

Module II: The Structures of DNA and RNA (7 Hours)

DNA Structure: Miescher to Watson and Crick-historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation, cot curves; Org-anization of DNA-Prokaryotes, Viruses, Eukaryotes. RNA: Types and Structure, Organelle DNA-mito chondria and chloroplast DNA. The nucleosome, chromatin structure-Euchromatin, Heterochromatin – Constitutive and Facultative heterochromatin.

Module III: DNA Replication (6 Hours)

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres, Enzymes for replication, process of prokaryotic and eukaryotic replication

Module IV: Central Dogma and Genetic Code (4 Hours)

Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features).

Module V: Transcription (6 Hours)

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors.

Module VI: Translation (Prokaryotes and eukaryotes) (6 Hours)

Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation.

Module VII: Post Transcriptional Modifications and Processing of Eukaryotic RNA (4 Hours)

Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Module VIII: Regulation of Transcription in prokaryotes and Eukaryotes (5 Hours)

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting.

Module IX: DNA Repair Mechanisms (4 Hours)

Pyrimidine dimerization and mismatch repair, Regulatory RNAs 3 Ribo-switches, RNA interference, miRNA, siRNA

Suggested Readings

Becker, W.M., Kleinsmith, L.J., Hardin. J. and Berton, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.

- Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R (2007) Molecular Biology of the Gene, 6th edition, Pearson Benjamin Cummings, CSHL Press, New York, USA
- Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V Edition, ASM Press and Sinauer Associates.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
- Lewin B. (2008). Gene XI, Jones and Bartlett
- McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV Edition. GS, Taylor and Francis Group, New York and London.

Mapping of COs to syllabus

COs	M 1	M 2	M 3	Mo 4	M 5	M 6	M 7	M 8	M 9
CO1	3	3							
CO2		2	3	2					
CO3					3	3	3		
CO4									3
CO5							2	3	

BOMO309L: MOLECULAR BIOLOGY LAB

(2 Credit-60 Hours) (L-T-P:0-0-2)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Explain the structure of chromosome. (Understanding)

CO 2: Design the growth medium and estimate growth kinetics. (Creating)

CO 3: Estimation of DNA and RNA using different analytical tools. (Evaluating)

CO 4: Interpret the micrographs of DNA replication and split genes. (Understanding)

CO 5: Prepare LB medium for growing bacterial cultures (Creating)

Practical:

Expt. 1: Preparation of LB medium and raising E.Coli and Isolation of genomic DNA from E.Coli

Expt. 2: DNA estimation by diphenylamine reagent/UV Spectrophotometry

Expt. 3: Estimation of the growth kinetics of E. coli by turbidity method

Expt. 4: Preparation of solid culture medium (LB) and growth of E. coli by spreading and streaking

Expt. 5: Quantitative estimation of RNA using Orcinol reaction.

Expt. 6: Study and interpretation of electron micrographs/ photograph showing (a) DNA replication (b) Transcription (c) Split genes

Expt. 7: Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi discontinuous replication)

Expt. 8: Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)

Expt. 9: Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing

Expt. 10: Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs

Mapping of Cos to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1								3	3	3
CO2		3		3						
CO3					3		3			
CO4			3			3				

CO5	3									

BOEC310T: ECONOMIC BOTANY

(3 Credit-45 Hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 6: Understanding different dimensions of plant identification as a resource for self-sustenance, their domestication, commercialization etc. (Understanding)

CO 7: Understand the cultivation, extraction processes of different economically useful plants. (Understanding)

CO 8: Execute the concepts developed in the class in their daily activities (Applying)

CO 9: Survey the uses of economically important plants. (Analyzing)

CO 10: Induction of modern techniques and processing methods for useful crops (Creating)

Module I: Origin of Cultivated Plants (5 Hours)

Concept of Centres of Origin; their importance with reference to Vavilov's work examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity and commercialization

Module II: Introduction to Nature of Plant Products (7 Hours)

Importance and Nature of Plant Products: Protoplasm and its Activities; Photosynthesis; Plant skeleton; Reserved food (Carbohydrates, Fats and Proteins); Secretions and Excretions (Essential Oils, Pigments, Tannins, Latex, Waxes, Alkaloids, Glycosides, Organic Acids, Enzymes, Vitamins, Hormones). Different Aspects of Economic Botany; Classification of Economically Important Plants

Module III Cereals, legumes and Pulses (5 Hours)

Wheat and Rice (origin, morphology, processing & uses), brief account of millets, General account of legumes, importance to man and ecosystem

Module IV: Oil, Essential oil and Fats (4 Hours)

General account with special reference to Drying oils, semi drying oils; Non-drying oils, essential oil and Vegetables Fats, extraction methods and uses.

Module V: Fibre and rubber yielding Plants (4 Hours)

Classification based on the origin of fibres, Cotton and Jute (morphology, extraction and uses). Para-rubber: tapping, processing and uses

Module VI: Sugars and starches yielding Plants (5 Hours)

Morphology and processing of sugarcane, products and by-products of sugarcane industry. Potato – morphology, propagation & uses

Module VII: Spices (4 Hours)

Listing of important spices, their family and part used, economic importance with Special reference to fennel, saffron, clove and black pepper

Module VIII: Beverages (4 Hours)

Tea, Coffee (morphology, processing & uses)

Module IX: Forest Products and Resources (4 Hours)

Importance and Structures of Wood; Mechanical Properties and Factors of Wood; General account with special reference to Teak, Sal, Pine and Bamboos.

Module X: Other economically Important Plants (3 Hours)

A general accounts on Poisonous Plants, Ceremonial Plants, Herbal Plants, medicinal Plants.

Suggested Readings

Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
 Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.
 Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Mapping of COs to syllabus

COs	Mod- ule I	Mod- ule II	Module III	Module IV	Mod- ule V	Module VI	Module VII	Module VIII	Module IX	Mod- ule X
CO1	2									
CO2	2	3	3	3	3	3	3	3	3	3
CO3	2									
CO4		3	2		2	2		2		3
CO5						2	2	2	2	2

BOEC311L: ECONOMIC BOTANY LAB

(1 Credit-30 Hours) (L-T-P:0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Recollect the morphology and anatomy of various economically important plants. (Remembering)

CO 2: Explain the economic importance of crop plants. (Understanding)

CO 3: Execute various micro-chemical tests of cereals, legumes, sugars and starches. (Applying)

CO 4: Able to carry out qualitative and quantitative checking of crop plant products. (Evaluating)

Practical:

Expt. 1: Cereals: Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests)

Expt. 2: Legumes: Soya bean, Groundnut, (habit, fruit, seed structure, micro-chemical tests)

Expt. 3: Sugars & Starches: Sugarcane (habit sketch; cane juice-micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w. m. starch grains, micro-chemical tests)

Expt. 4: Spices: Black pepper, Fennel and Clove (habit and sections)

Expt. 5: Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans)

Expt. 6: Oils & Fats: Coconut-T.S. Nut, Mustard-plant specimen, seeds; tests for fats in crushed seeds

Expt. 7: Essential oil-yielding plants: Habit sketch of Rosa, Vetiveria, Santalum and Eucalyptus (specimens/photographs).

Expt. 8: Rubber: specimen, photograph/model of tapping, samples of rubber products

Expt. 9: Drug-yielding plants: Specimens of *Digitalis*, *Papaver* and *Cannabis*

Expt. 10: Tobacco: specimen and products of Tobacco

Expt. 11: Woods: Tectona, Pinus: Specimen, Section of young stem.

Expt. 12: Fibre-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fibre and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fibre)

Mapping of Cos to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10	Expt. 11	Expt.12
CO1	3			3				3	3	3	3	3

CO2		3			3	3						
CO3			3				3					
CO4							2	2	2	2	2	2

BOAT400L: ANALYTICAL TECHNIQUES IN PLANT SCIENCES

(3 Credit-45 Hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Interpret various microscopic techniques (Understanding)

CO 2: Compare the different centrifugation techniques (Understanding)

CO 3: Apply radioisotopes and spectrophotometry in biological research (Applying)

CO 4: Illustrate the various chromatographic and molecular techniques (Understanding) CO 5: Application of digitization technologies in plant Science

Module I: Imaging and Related Techniques (12 Hours)

Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS): Genome estimation (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching, Digital image processing.

Module II: Radioisotopes and Spectrophotometry (7 Hours)

Use in biological research, auto-radiography, pulse chase experiment, Principle and its application in biological research.

Module III: Chromatography (8 Hours)

Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography

Module IV: Characterization of Proteins and Nucleic Acids (6 Hours)

Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis:

AGE, PAGE, SDS-PAGE, native PAGE

Module V: Implication of digitization in Plant Science (12 Hours)

Use of Internet of things, Big Data in Plant study and conservations, Application of spectral signatures in plant distribution, taxonomy, biochemical estimation, vegetation index (NDVI, PVI, SVI), characterize by its size, shape, boundaries and internal structure ETC

Suggested Readings

Plummer, D.T. (1996) An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi

Ruzin, S.E. (1999) Plant Microtechnique and Microscopy, Oxford University Press, New York. USA

Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995) Short Protocols in Molecular Biology, 3rd edition, John Wiley & Sons

C Sudhakar Reddy. (2015) Application of remote sensing in plant Sciences. An Overview. SpringerIndia.

Charis, G., Danha, G., Muzenda, E., 2019. A review of the application of gis in biomass and solid waste supply chain optimization: gaps and opportunities for developing nations. Waste management 6; 1-11.

IoT in Agriculture Investigation on Plant Diseases and Nutrient Level Using Image Analysis Techniques

Sathiya S. , Cecil, A., Ghodke. P.K., 2022. Plant disease identification using IoT and deep learning algorithms. Artificial Intelligence for Signal Processing and Wireless Communication. doi.org/10.1515/9783110734652-002.

Advanced Remote sensing and GIS. Training Manual Developed by CEGIS, USFS and BFD, 2014-15

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5

CO1	3	3	3	3	
CO2		2			
CO3		2		3	
CO4					3

BOAT401L: ANALYTICAL TECHNIQUES IN PLANT SCIENCES LAB

(1 Credit-30 Hours)(L-T-P:0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Infer the various blotting techniques as well as PCR (Understanding)

CO 2: Utilize paper chromatography and TLC to separate sugars and nitrogenous bases (Applying)

CO 3: Apply radioisotopes and spectrophotometry in biological research (Applying)

CO 4: Illustrate the various microscopic, biochemical and molecular techniques (Understanding)

CO 5: Application of digitization technologies in plant Sciences (Evaluating)

Practical

Expt. 1: Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs

Expt. 2: Separation of sugars, chloroplast by thin layer/paper chromatography

Expt. 3: Isolation of chloroplast by differential centrifugation

Expt. 4: Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and FISH)

Expt. 5: Study of DNA/protein separation by using AGE/PAGE

Expt. 6: Preparation of permanent slides (double staining)

Expt. 7: Estimation of protein concentration through Lowry's methods

Expt. 8: Study of different spatial imagery, vegetation index and digital image processing through photograph

Expt. 9: Study of different parts and functions of Sensors used in GIS and IOTs

Suggested Readings

Plummer, D.T. (1996) An Introduction to Practical Biochemistry, 3rd edition, Tata McGraw-Hill Publishing Co. Ltd., New Delhi

Ruzin, S.E. (1999) Plant Microtechnique and Microscopy, Oxford University Press, New York. USA

Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995) Short Protocols in Molecular Biology, 3rd edition, John Wiley & Sons

C Sudhakar Reddy. (2015) Application of remote sensing in plant Sciences. An Overview. Springer India.

Chloroplast Isolation by differential Centrifugation. <https://www.youtube.com/watch?v=6JJBvh-NQZA>.

Charis, G., Danha, G., Muzenda, E., 2019. A review of the application of gis in biomass and solid waste supply chain optimization: gaps and opportunities for developing nations. Waste management 6; 1-11.

IoT in Agriculture Investigation on Plant Diseases and Nutrient Level Using Image Analysis Techniques

Sathiya S. , Cecil, A., Ghodke. P.K., 2022. Plant disease identification using IoT and deep learning algorithms. Artificial Intelligence for Signal Processing and Wireless Communication. doi.org/10.1515/9783110734652-002.

Advanced Remote sensing and GIS. Training Manual Developed by CEGIS, USFS and BFD, 2014-15

Mapping of COs to Syllabus

COs	Expt 1	Expt 2	Expt 3	Expt 4	Expt 5	Expt 6	Expt 7	Expt 8	Expt 9
CO1	3								
CO2		3							
CO3			3						
CO4				3	3	3	3		

CO5								3	3

BOBS402T: BIOSTATISTICS

(3 Credit-45 Hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Define basic terminologies in Biostatistics. (Remembering)

CO 2: Explain the concepts of biostatistics and its use in biology. (Understanding)

CO 3: Apply the statistics tools for data analysis. (Applying)

CO 4: Design sampling methods to generate significant data. (Creating)

Module I: Introduction (8 Hours)

Biostatistics - definition - statistical methods - basic principles Variables - measurements, functions, limitations and uses of statistics

Module II: Collection of Data (8 Hours)Collection of data primary and secondary - types and methods of data collection procedures - merits and demerits
Classification - tabulation and presentation of data - sampling methods**Module III: Measures of Central Tendency (10 Hours)**

Measures of central tendency - mean, median, mode, geometric mean - merits & demerits. Measures of dispersion - range, standard deviation, mean deviation, quartile deviation -merits and demerits; Co- efficient of variations

Module IV: Correlation & Regression (10 Hours)

Correlation - types and methods of correlation, regression, simple regression equation, fitting prediction, similarities and dissimilarities of correlation and regression

Module V: Statistical Inference and Experimental design (9 Hours)

Statistical inference - hypothesis - simple hypothesis - student's t' test - chi square test, Experimental design softwares.

Suggested Readings

Danniel, W.W. (1987) Biostatistic, New York, John Wiley Sons

Sundarrao, P.S.S, Richards, J. An introduction to Biostatistics, 3rd edition, Christian Medical College, Vellore

Selvin, S. (1991) Statistical Analysis of epidemiological data, New York University Press

Bishop, O. N. Houghton, Mifflin Statistics for Biology, Boston

Freedman, P. The Principles of scientific research, New York, Pergamon Press

Campbell, R.C. (1998) Statistics for Biologists, Cambridge University Press

Mapping of Cos to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	3	3	3	3	
CO2		2			
CO3		2		3	
CO4					3

BOBS403L: BIOSTATISTICS LAB

(2 CREDITS-60 HOURS) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Tell the definitions and formulae of various statistical terms (Remembering)

CO 2: Make use of statistical calculations for data interpretation (Applying)

CO 3: Analyse any given biological data to see their accuracy and importance (Analyzing)

Practical

Expt. 1: Calculation of mean, standard deviation and standard error

Expt. 2: Calculation of correlation coefficient values and finding out the probability

Expt. 3: Calculation of 'F' value and finding out the probability value for the F value

Expt. 4: Demonstration of an experimental trial and statistical optimization using MINITAB/Design Expert.

Mapping of COs to Syllabus

COs	Expt.1	Expt. 2	Expt. 3	Expt. 4
CO1	3	3	3	
CO2	3	3	3	3
CO3	3	3	3	3

BOPL404T: PLANT BIOTECHNOLOGY

(3 Credits-45 HOURS) (3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Define the terms and concepts of plant tissue culture (Remembering)

CO 2: Explain Plant tissue culture & recombinant DNA Technology (Understanding)

CO 3: Utilize the knowledge of plant tissue culture techniques in their future research works (Applying)

CO 4: Develop/improve protocols for better transgenic products (Creating)

Module I: Plant Tissue Culture (10 Hours)

Historical perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Embryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation)

Module II: Recombinant DNA Technology (20 Hours)

Restriction Endonucleases (History, Types, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC and briefly PAC, MAC, HAC). Gene Cloning (Recombinant DNA, Bacterial Transformation and selection of recombinant clones, PCR-mediated gene cloning); Gene Construct; construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; Probes-oligonucleotide, heterologous, PCR; Methods of gene transfer- Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectile bombardment; Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP)

Module III: Applications of Biotechnology (15 Hours)

GMOs, Pest resistant (Bt-cotton); herbicide resistant plants (Roundup Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products–Human Growth Hormone; Humulin; Biosafety concerns.

Suggested Readings

Bhojwani, S.S. and Razdan, M. K. (1996) Plant Tissue Culture: Theory and Practice, Elsevier Science Amsterdam, the Netherlands

Glick, B.R., Pasternak, J. J. (2003) Molecular Biotechnology- Principles and Applications of recombinant DNA, ASM Press, Washington

Bhojwani, S.S. and Bhatnagar, S.P. (2011) The Embryology of Angiosperms, 5th edition, Vikas Publication House Pvt. Ltd., New Delhi

Snustad, D.P. and Simmons, M. J. (2010) Principles of Genetics, 5th edition, John Wiley and Sons, UK
 Stewart, C.N. Jr. (2008) Plant Biotechnology & Genetics: Principles, Techniques and Applications, John Wiley & Sons Inc. USA

Mapping of Cos to Syllabus

COs	Module 1	Module 2	Module 3
CO1	3	2	2
CO2	2	3	1
CO3	2	2	2
CO4	1	2	3

BOPL405L: PLANT BIOTECHNOLOGY LAB

(2 Credits-60 HOURS) (0-0-2)

Course outcomes

At the end of this course, student will be able to:

CO 1: Study various media used in Plant tissue culture Laboratory (Remembering)

CO 2: Explain/demonstrate different molecular biology techniques in tissue culture (Understanding).

CO 3: Analyze modern DNA techniques used in plant improvement (Analyzing)

CO 4: Evaluate and compare techniques in plant tissue culture

(Evaluating)

Practical

Expt. 1: **a)** Preparation of MS medium **b)** Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc

Expt. 2: Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs

Expt. 3: Isolation of protoplasts

Expt. 4: Construction of restriction map of circular and linear DNA from the data provided

Expt. 5: Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, microprojectile bombardment.

Expt. 6: Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs

Expt. 7: Isolation of plasmid DNA

Expt. 8: Restriction digestion and gel electrophoresis of plasmid DNA

Mapping of Cos to syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8
CO1	3	2	1	1	1	1	1	1
CO2		1	2	3	3	3	2	2
CO3	1	1	2	1	3	3	3	3
CO4	1	2	2	2	3	3	3	3

BOPA406T: PLANT PATHOLOGY

(3 Credits-45 HOURS) (3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Classify various microorganisms and explain their properties (Understanding)

CO 2: Identify and detect microbial plant diseases and plan control strategies (Applying)

CO 3: Assess and recommend post-harvest controls measures and techniques (Evaluating)

Module I: Plant Microbial diversity (8 Hours)

Bacteria & Archaeobacteria: general properties, classification, economic importance; Viruses- general properties, classification and economic importance, nematodes and Mycoplasma-general properties and importance

Module II: An insight into Plant Pathology (10 Hours)

Historical and developmental aspects of plant pathology, mode of infection and role of enzymes and toxins in plant disease, defense mechanisms of plants against infection

Module III: Plant diseases and effects on physiological functions (15 Hours)

Study of plant diseases caused by fungi, bacteria, viruses, nematodes and mycoplasma; identifications and characterizations. Environmental factors on disease development and epidemiology. Effects of diseases on physiological functions of plants.

Module IV: Plant diseases control measures (12 Hours)

Plant disease control measures: cultural, chemical, biological, bio pesticides, breeding for resistant varieties, plant quarantine, integrated pest management; molecular and transgenic approach for crop protection

Suggested readings:

Pelczar MJ. Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.

Prescott L, Harley JP, Klein DA. Microbiology, McGraw Hill, India. 6th edition.

Mehrotra RS, Aggarwal A. Plant Pathology, 2 nd Edition, Tata McGraw-Hill Publishing Company Ltd.

Singh RP. Plant Pathology, 2nd Edition, Kalyani Publishers.

Mehrotra RS, Aggarwal A. Fundamentals of Plant Pathology, Tata McGraw-Hill Publishing Company Ltd.

Sambamurthy AVSS. A textbook of Plant Pathology, Dreamtech Press, Wiley.

Gour HN. Physiological and Molecular Plant Pathology, Scientific Publishers India.

George N Agrios. Plant Pathology, Fifth Editions. Elsevier Academic Press. 2005.

Mapping of Cos to Syllabus

COs	Module I	Module 2	Module 3	Module IV
CO1	3	1	1	1
CO2	1	3	3	1
CO3	1	2	2	3

BOPA407L: PLANT PATHOLOGY LAB

(2 Credits-60 HOURS) (0-0-2)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Prepare different media used in microorganism isolation (Applying)

CO 2: Identify various plant pathogens and symptoms in plants (Applying)

CO 3: Formulate control strategies of plant diseases (Creating)

Syllabus

Expt. 1: Preparation of nutrient media (solid/liquid) for microorganisms' isolation

Expt. 2: Staining techniques (Gram's staining, Fungal staining)

Expt. 3: Detailed study of symptoms of representative diseases of plantation crops, Collection and dry preservation of diseased specimens of important crops

Expt. 4: Isolation and characterization of pathogens from diseased plants

Expt. 5: Test of plant disease control using chemicals agent, biological and mechanical

means **Mapping of Cos to Syllabus**

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5
CO1	3	1			
CO2		3	2	3	1
CO3	1	2	2	2	3

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	BONV104T	Introduction to non-vascular plants	4 (3-0-1)
		BONV105L	Introduction to non-vascular plants Lab	
2	Minor Course 2	BOVP106T	Introduction to vascular plants	4 (3-0-1)
		BOVP107L	Introduction to vascular plants Lab	
3	Minor Course 3	BOFP210T	Morphology and Anatomy of flowering plants	4 (3-0-1)
		BOFP211L	Morphology and Anatomy of flowering plants Lab	
4	Minor Course 4	BOEB212T	Introduction to Economic Botany	4 (3-0-1)
		BOEB213L	Introduction to Economic Botany Lab	
5	Minor Course 5	BOET313T	Ethnobotany	4 (3-0-1)
		BOET314L	Ethnobotany Lab	
6	Minor Course 6	BOMD315T	Microbial diversity	4 (3-0-1)
		BOMD316L	Microbial diversity Lab	
7	Minor Course 7	BOIM408T	Industrial Microbiology	3 (2-0-1)
		BOIM409L	Industrial Microbiology Lab	
7	Minor Course 8	BORM410T	Research Methodology	2
8	Minor Course 9	BOFM411T	Fundamentals of Molecular Biology	3 (2-0-1)
		BOFM412L	Fundamentals of Molecular Biology Lab	

BONV104T: INTRODUCTION TO NON-VASCULAR PLANTS

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Recall the unique features of non-vascular plants (Remembering)

CO 2: Classify and demonstrate the morphology and reproduction of algae (Understanding)

CO 3: Classify and demonstrate their morphology, anatomy and reproduction of bryophytes (Understanding) CO 4: Illustrate the economic importance of algae and bryophytes (Understanding)

Module I: Introduction (2 Hours)

Introduction to non-vascular plants; Transition to land habit, Classification of algae and bryophytes.

Module II: Chlorophyta and Charophyta (8 Hours)General Characteristics of Chlorophyta and Charophyta; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Chlamydomonas*, *Volvox*, *Oedogonium*, *Chara*.**Module III: Phaeophyta and Rhodophyta (10 Hours)**Phaeophyta and Rhodophyta Characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction; Morphology and life-cycles of *Ectocarpus*, *Fucus* and *Polysiphonia***Module IV: Bryophytes (20 Hours)**General characteristics; Adaptations to land habit; Classification; Range of thallus organization; Classification (up to family) reproduction of *Riccia*, *Marchantia*, *Anthoceros* and *Sphagnum***Module V: Economic importance of algae and bryophytes (5 Hours)**

Role of algae in the environment, agriculture, biotechnology and industry.

Ecological and economic importance of bryophytes with special reference to *Sphagnum***Suggested Readings.**

Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.

Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition. II

Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.

Vander-Poorteri 2009 Introduction to Bryophytes. COP

Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.

Mapping of COs to syllabus

Cos	Module 1	Module II	Module III	Module IV	Module V
CO1	3				
CO2		3	3		
CO3				3	
CO4					3

BONV105L: INTRODUCTION TO NON-VASCULAR PLANTS LAB

(1 CREDIT-30 HOURS) (L-T-P: 0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Differentiate the vegetative and reproduction structures in algae (Applying)

CO 2: Able to understand reproduction and multiplication processes in bryophytes (Understanding)

CO 3: Utilize and create basic identification techniques for non-vascular plants (Creating)

Practical:

Expt. 1: Study of vegetative and reproductive structures of *Chlamydomonas* (electron micrographs)

Expt. 2: Study the reproduction of *Volvox*, *Oedogonium*, *Coleochaete*, *Chara*, *Vaucheria*, *Ectocarpus*, *Fucus* and *Polysiphonia*, *Prochloron* through electron micrographs, temporary preparations and permanent slides

Expt. 3: *Riccia*– Study of morphology of thallus (temporary/ permanent slides)

Expt. 4: *Anthoceros*- Study of morphology of thallus, dissection of sporophyte (to show stomata, spores, pseudoelaters, columella) (temporary slide), vertical section of thallus (permanent slide).

Expt. 5: *Sphagnum*- Study of morphology of plant, whole mount of leaf (permanent slide only)

Mapping of COs to syllabus

Cos	Expt. 1	Expt.2	Expt. 3	Expt.4	Expt. 5
CO1	3	3			
CO2			3	3	3
CO3	2			2	

BOVP106T: INTRODUCTION TO VASCULAR PLANTS (PTERIDOPHYTES, GYMNOSPERMS, ANGIO-SPERMS)

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes:

At the end of this course, students will be able to:

CO 1: Classify Pteridophytes based on their morphology, anatomy, reproduction and life cycles.

CO 2: Classify Gymnosperms based on their morphology, anatomy, reproduction and life cycles.

CO 3: Understand various taxonomical aids for identification of Angiosperms.

CO 4: Analyze the systematic description and economic value of common Angiosperms

Module I: Pteridophytes (12 Hours)

General characteristics of Pteridophytes, classification of Smith (1955) upto division; Occurrence, morphology, anatomy, reproduction (developmental details not to be included); life history of (a) Lycopodium (Lycopsidea) and (b) Marsilea (Filicopsida); Stellar evolution, heterospory and seed habit; Ecological and economic importance of Pteridophytes

Module II: Gymnosperms (14 Hours)

General characteristics of Gymnosperms; classification upto class; Occurrence, morphology, anatomy, reproduction

(developmental details not to be included) and life history of (a) *Cycas*, (Cycadopsida), (b) *Pinus* (Coniferopsida) and (c) *Gnetum* (Gnetopsida); Ecological and economic importance of Gymnosperms

Module III: Basic aspects of Angiosperm Taxonomy (8 Hours)

Aim and scope of taxonomy; Species concept: Taxonomic hierarchy, species, genus and family; Plant nomenclature: Binomial system, ICBN-rules for nomenclature; Bentham and Hooker system of classification

Module IV: Systematic Taxonomy (11 hours)

Systematic description and economic importance of the following families: (a) Brassicaceae (b) Curcubitaceae (c) Rutaceae (d) Fabaceae (e) Asteraceae (f) Solanaceae (g) Lamiaceae (h) Euphorbiaceae (i) Orchidaceae and (j) Poaceae

Suggested readings:

Sharma, O.P. (2012) Pteridophyta. Tata McGraw-Hill, New Delhi

Kramer, K.U. & P. S. Green (1990) The Families and Genera of Vascular Plants, Volume –I: Pteridophytes and Gymnosperms (Ed. K. Kubitzki) Springer-Verlag, New York

Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, New 4. Delhi

Coulter, J.M. & C.J. Chamberlain (1910) Morphology of Gymnosperms, The University of Chicago Press, Chicago, Illinois

Govil, C.M. (2007) Gymnosperms: Extinct and Extant. KRISHNA Prakashan Media (P) Ltd. Meerut & Delhi

Sporne, K.R. (1971) The Morphology of Gymnosperms. Hutchinsons Co. Ltd., London Lawrence, George H.M.

(1951) Taxonomy of Vascular Plants. The McMillan Co., New York

Heywood, V. H. and D. M. Moore (1984) Current Concepts in Plant Taxonomy. Academic Press, London.

Jeffrey, C. (1982) An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London. 10.

Sambamurthy, A.V.S.S. (2005) Taxonomy of Angiosperms I. K. International Pvt. Ltd., New Delhi

Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd. New Delhi.

Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV
CO1	3			
CO2		3		
CO3			3	2
CO4			2	3

BOVP107L: INTRODUCTION TO VASCULAR PLANTS LAB

(1 CREDIT-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Infer the concepts of classification system and identification of few important pteridophytes (Understanding)

CO 2: Summarize the concepts of classification system and identification of few important gymnosperms (Understanding) CO 3: Differentiate between monocots and dicots (Understanding)

CO 4: Collect, prepare and document herbarium specimens through non-destructive field collection method so as to get acquainted with herbarium technique (Applying)

Practical

Expt. 1: Study of morphology and reproductive structures of the following pteridophytes: *Lycopodium*, *Selaginella*, *Equisetum*, *Adiantum* and *Marsilea*.

Expt. 2: To study the morphology and reproductive features of the following gymnosperms: *Cycas* and *Pinus*.

Expt. 3: Taxonomic study of selected families of dicots and monocots of angiospermic plants (three of each).

Expt. 4: Collection, preparation and documentation of herbarium specimens through non-destructive field collection method so as to get acquainted with herbarium technique.

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4
CO1	3			
CO2		3		
CO3			3	
CO4				3

BOFP210T: MORPHOLOGY AND ANATOMY OF FLOWERING PLANTS

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Develop an understanding of concepts and fundamentals of plant morphology and anatomy (Understanding)

CO 2: Examine the morphology and internal anatomy of plant systems and organs (Remembering)

CO 3: Comprehend the concepts of organization and development of shoot and root apices (Understanding)

CO 4: Examine the structure and role of cambium (Analyzing)

CO 5: Evaluate the adaptive, protective and secretory systems of plants (Evaluating)

Module I: Plant morphology (4 hours)

Introduction; Vegetative Characters: Modified Roots and Stems; Leaf (Phyllotaxy), Venation; Trichomes.

Module II: Reproductive Characters (7 hours)

Floral parts, Arrangements of flowers on the floral axis, Unisexual and Bisexual Flowers, Variation in fruit surface, Placentation,

Variation in seed coats

Module III: Tissues (14 Hours)

Classification of tissues; Simple and complex tissues (no phylogeny); cyto-differentiation of tracheary elements and sieve elements; Pits and plasmodesmata; Wall ingrowths and transfer cells, encrustation and incrustation, Ergastic substances

Module IV: Stem, Leaves and Roots (20 Hours)

Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory, continuing meristematic residue, cytohistological zonation); Types of vascular bundles; Structure, function and seasonal activity of cambium; Structure of dicot and monocot stem; Structure of dicot and monocot leaf, Kranz anatomy, Development and composition of periderm, rhytidome and lenticels; Organization of root apex (Apical cell theory, Histogen theory, Korper- Kappe theory); Secondary growth in root and stem; Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root

Suggested Readings

Dickson, W.C. (2000). Integrative Plant Anatomy. Harcourt Academic Press, USA.

Fahn, A. (1974). Plant Anatomy. Pergmon Press, USA.

Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.

Esau, K. (1977). Anatomy of Seed Plants. John Wiley & Sons, Inc., Delhi

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV
CO 1	3	1	2	2
CO 2	3	2	3	3
CO 3				3
CO 4	1			3

CO 5				3

BOFP211L: MORPHOLOGY AND ANATOMY OF FLOWERING PLANTS LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Prepare permanent slides, temporary stain mounts, macerations and museum specimens (Creating)

CO 2: Gain the knowledge about apical meristem of root, shoot and vascular system (Understanding)

CO 3: Apprehend the ideas of the distribution and types of tissues (Understanding)

CO 4: Gain an understanding on secondary growth and wood anatomy in plants

(Applying) CO 5: Scrutinize the different aspects of plant adaptations (Analyzing)

Practical:

Expt. 1: Study of anatomical details through permanent slides/temporary stain mounts/ macerations/ museum specimens with the help of suitable examples

Expt. 2: Apical meristem of root, shoot and vascular cambium

Expt. 3: Distribution and types of parenchyma, collenchyma and sclerenchyma

Expt. 4: Xylem: Tracheary elements- tracheids, vessel elements; thickenings; perforation plates; xylem fibres

Expt. 5: Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres

Expt. 6: Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular

Expt. 7: Root: monocot, dicot, secondary growth

Expt. 8: Stem: monocot, dicot. - Primary and secondary growth; periderm; lenticels

Expt. 9: Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy)

Expt. 10: Adaptive Anatomy: xerophytes, hydrophyte

Mapping of COs to Syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt. 10
CO1	3									
CO2		3								
CO3		2	3	3		3	3			
CO4			2	3	3	1	2	3	3	
CO5										3

BOEB212T: INTRODUCTION TO ECONOMIC BOTANY

(3 Credit-45 Hours)(L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Understanding different dimensions of plant identification as a resource for self-sustenance, their domestication, commercialization etc. (Understanding)

CO 2: Understand the cultivation, extraction processes of different economically useful plants. (Understanding)

CO 3: Execute the concepts developed in the class in their daily activities. (Applying)

CO 4: Survey the uses of economically important plants. (Analyzing)

CO 5: Induction of modern techniques and processing methods for useful crops. (Creating)

Module I: Origin of Cultivated Plants (5 Hours)

Concept of Centres of Origin; their importance with reference to Vavilov's work examples of major plant introductions; Crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity and commercialization

Module II: Introduction to Nature of Plant Products (7 Hours)

Importance and Nature of Plant Products: Protoplasm and its Activities; Photosynthesis; Plant skeleton; Reserved food

(Carbohydrates, Fats and Proteins); Secretions and Excretions (Essential Oils, Pigments, Tannins, Latex, Waxes, Alkaloids,

Glycosides, Organic Acids, Enzymes, Vitamins, Hormones). Different Aspects of Economic Botany; Classification of Economically Important Plants

Module III Cereals, legumes and Pulses (5 Hours)

Wheat and Rice (origin, morphology, processing & uses), brief account of millets, General account of legumes, importance to man and ecosystem

Module IV: Oil, Essential oil and Fats (4 Hours)

General account with special reference to Drying oils, semi drying oils; Non-drying oils, essential oil and Vegetables Fats, extraction methods and uses.

Module V: Fibre and rubber yielding Plants (4 Hours)

Classification based on the origin of fibres, Cotton and Jute (morphology, extraction and uses). Para-rubber: tapping, processing and uses

Module VI: Sugars and starches yielding Plants (5 Hours)

Morphology and processing of sugarcane, products and by- products of sugarcane industry. Potato – morphology, propagation & uses

Module VII: Spices (4 Hours)

Listing of important spices, their family and part used, economic importance with Special reference to fennel, saffron, clove and black pepper

Module VIII: Beverages (4 Hours)

Tea, Coffee (morphology, processing & uses)

Module IX: Forest Products and Resources (4 Hours)

Importance and Structures of Wood; Mechanical Properties and Factors of Wood; General account with special reference to Teak, Sal, Pine and Bamboos.

Module X: Other economically Important Plants (3 Hours)

A general accounts on Poisonous Plants, Ceremonial Plants, Herbal Plants, medicinal Plants.

Suggested Readings

Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.

Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.

Chrispeels, M.J. and Sadava, D.E. (2003). Plants, Genes and Agriculture. Jones & Bartlett Publishers.

Mapping of COs to syllabus

COs	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX	Module X
CO1	2									
CO2	2	3	3	3	3	2	3	3	3	3
CO3	2									
CO4		3	2		2	2		2		3
CO5					2		2			3

BOEB213L: INTRODUCTION TO ECONOMIC BOTANY LAB

(1 Credit-30 Hours) (L-T-P:0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Recollect the morphology and anatomy of various economically important plants. (Remembering)

CO 2: Explain the economic importance of crop plants. (Understanding)

CO 3: Execute various micro-chemical tests of cereals, legumes, sugars and starches.

(Applying) CO 4: Able to carry out qualitative and quantitative checking of crop plant products. (Evaluating) **Practical:**

Expt. 1: Cereals: Wheat (habit sketch, L. S/T.S. grain, starch grains, micro-chemical tests) Rice (habit sketch, study of paddy and grain, starch grains, micro-chemical tests)

Expt. 2: Legumes: Soya bean, Groundnut, (habit, fruit, seed structure, micro-chemical tests)

Expt. 3: Sugars & Starches: Sugarcane (habit sketch; cane juice-micro-chemical tests), Potato (habit sketch, tuber morphology, T.S. tuber to show localization of starch grains, w. m. starch grains, micro-chemical tests)

Expt. 4: Spices: Black pepper, Fennel and Clove (habit and sections)

Expt. 5: Beverages: Tea (plant specimen, tea leaves), Coffee (plant specimen, beans)

Expt. 6: Oils & Fats: Coconut-T.S. Nut, Mustard—plant specimen, seeds; tests for fats in crushed seeds

Expt. 7: Essential oil-yielding plants: Habit sketch of Rosa, Vetiveria, Santalum and Eucalyptus (specimens/photographs).

Expt. 8: Rubber: specimen, photograph/model of tapping, samples of rubber products

Expt. 9: Drug-yielding plants: Specimens of *Digitalis*, *Papaver* and *Cannabis*

Expt. 10: Tobacco: specimen and products of Tobacco

Expt. 11: Woods: Tectona, Pinus: Specimen, Section of young stem.

Expt. 12: Fibre-yielding plants: Cotton (specimen, whole mount of seed to show lint and fuzz; whole mount of fibre and test for cellulose), Jute (specimen, transverse section of stem, test for lignin on transverse section of stem and fibre)

Mapping of Cos to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10	Expt. 11	Expt. 12
CO1	3			3				3	3	3	3	3
CO2		3			3	3						
CO3			3				3					
CO4							2	2	2	2	2	2

BOET313T: ETHNOBOTANY

(3 CREDITS-45 HOURS) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Demonstrate the concept, scope and objectives of ethnobotany with reference to tribal lifestyle (Understanding)

CO 2: Interpret different ethnobotanical methodologies (Understanding)

CO 3: Examine the role of various plants in traditional and modern medicine (Analyzing)

CO 4: Infer the legal aspects of ethnobotany (Understanding)

CO 5: Evaluate the different conservational strategies of medicinal plants (Evaluating)

Module I: Ethnobotany (7 Hours)

Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science; the relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses

Module II: Methodology of Ethnobotanical Studies (4 Hours)

a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places

Module III: Role of Ethnobotany in Modern Medicine (14 Hours)

Medico-ethno botanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadirachta indica* b) *Ocimum sanctum* c) *Vitex negundo* d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauwolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*; Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management)

Module IV: Ethnobotany and Legal Aspects (8 Hours)

Ethnobotany as a tool to protect interests of ethnic groups; Sharing of wealth concept with few examples from India; Biopiracy, Intellectual Property Rights and Traditional Knowledge

Module V: Conservation Strategies (12 Hours)

Conservation of endangered and endemic medicinal plants Definition: endemic and endangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves, sacred groves, National Parks; ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding

Suggested Readings

- S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
 S.K. Jain (ed.) Glimpses of Indian Ethnobotany, Oxford and I B H, New Delhi – 1981
 S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
 S.K. Jain, 1990. Contributions of Indian ethnobotany. Scientific publishers, Jodhpur.
 Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons- Chichester
 Rama Rao, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India.
 Howrah, 8) Rajiv K. Sinha – Ethnobotany the Renaissance of Traditional Herbal Medicine – INA – SHREE Publishers, Jaipur 1996_9)

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V
CO 1	3				
CO 2		3			
CO 3			3		
CO 4				3	
CO 5					3

BOET314L: ETHNOBOTANY LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course Outcome

At the end of this course, student will be able to:

- CO 1: Execute various collection methods for specimen collection (Applying)
 CO 2: Knowledge on preparing and labelling herbarium specimen (Understanding)
 CO 3: Able to extract crude extracts from important plants (Applying)
 CO 4: Collect information of Ethnobotanically important plants (Evaluating)

Practical

- Expt. 1: Collection method of plants from the field
 Expt. 2: Preparation and labelling of herbarium specimens (minimum 10 plants)
 Expt. 3: Extraction of crude extracts from various ethnobotanically important plant material (minimum 3 plants)
 Expt. 4: Field survey and collection of information on ethnobotanical uses from traditional healers
 Expt. 5: Knowledge of some plants used in various ceremonies and rituals

Mapping of COs to syllabus

COs	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5

CO1	3	1			
CO2	2	3			
CO3			3		
CO4	1			3	3

BOMD315T: MICROBIAL DIVERSITY

(3 Credits-45 HOURS) (3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Tell the differences between microbes (Remembering)

CO 2: Classify various microorganisms and explain their properties (Understanding)

CO 3: Evaluate the importance of microbes in environment and agriculture (Evaluating)

Module I: Introduction to Microorganisms (10 Hours)

Historical developments: Discovery of microorganisms, Spontaneous Generation Controversy, Germ theory of fermentation, Germ theory of disease. Classification of microorganisms

Module II: Prokaryotic Microbes (10 Hours)

Eubacteria, Archaeobacteria, Cyanobacteria—General comparison, Morphology and structures; cell wall chemistry and internal organelles, role in environment

Module III: Eukaryotic Microbes (15 Hours)

Algae and Fungi- General characteristics and classification, cellular structures, modes of reproductions, economic importance and role in environment and agriculture.

Module IV: Viruses (10 Hours)

Origin, classification and nomenclature of viruses, general structures of viruses, bacteriophages- types and uses; prions and viroids-nature and importance

Suggested reading:

Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.

Wiley JM, Sherwood LM and Woolverton CJ. (2013) Prescott's Microbiology. 9th Edition. McGraw Hill International.

Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi. 3. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.

Campbell, N.A., Reece J.B., Urry L.A., Cain M.L., Wasserman S.A. Minorsky P.V., Jackson R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.

Pelczar, M.J. (2001) Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV
CO1	3	3	3	3
CO2	3	3	3	3
CO3	1	3	3	3

BOMD316L: MICROBIAL DIVERSITY LAB

(1 Credit-30 Hours) (0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Differentiate between cell shapes and structures of microorganisms (Applying)

CO 2: Able to understand reproduction and multiplication processes in microbes (Understanding) CO 3: Utilize and create basic identification techniques for microbes (Creating) **Practical**

Expt. 1: Types of Bacteria to be observed from temporary/permanent slides/photographs.

Expt. 2: Electron micrographs/Models of viruses and bacteriophages

Expt. 3: Staining of prokaryotic and eukaryotic microbes

Expt. 4: Study of vegetative and reproductive structures of Algae and Fungi through electron micrographs, temporary preparations and permanent slides

Mapping of COs to Syllabus

COs	Expt.1	Expt. 2	Expt. 3	Expt. 4
CO1	3	3	3	3
CO2	1	1	2	3
CO3	1	2	2	2

BOIM408T: INDUSTRIAL MICROBIOLOGY

(2 CREDITS-30 HOURS) (L-T-P:2-0-0)

Course outcomes

At the end of this course, student will be able to:

CO 1: Tell the basics of bioreactors and fermentation process (Remembering)

CO 2: Explain the role of microbes in industry, agriculture and environment (Understanding)

CO 3: Compare various techniques used in waste water treatment (Analyzing)

CO 4: Assess and evaluate pollutants in environment (Evaluating)

Module I: Bioreactors/Fermenters and Fermentation Processes (8 Hours)

Types of Fermentation: Solid-state and liquid-state (stationary and submerged) fermentations; Batch and continuous fermentations, components of a typical bioreactor, Types of bioreactors-laboratories, pilot scale and production fermenters; constantly stirred tank fermenter, tower fermenter, fixed bed and fluidized bed bioreactors and air-lift fermenter

Module II: Microbial Production of Industrial Products (8 Hours)

Scope of microorganisms in Industries; Microorganisms involved, media, fermentation conditions, downstream processing and uses; Filtration, centrifugation, cell disruption, solvent extraction, precipitation and ultrafiltration, lyophilization, spray drying; Industrial process of fermentations for the production Enzyme: amylase, Organic acid (citric acid), alcohol (Ethanol) and antibiotic (Penicillin)

Module III: Microbial Enzymes of Industrial Interest and Enzyme Immobilization (5 Hours)

Microorganisms for industrial applications and hands on screening microorganisms for casein hydrolysis; starch hydrolysis; cellulose hydrolysis. Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase)

Module IV: Microbial Flora of Water (4 Hours)

Water pollution, role of microbes in sewage and domestic waste water treatment systems; Determination of BOD, COD, TDS and TOC of water samples; Microorganisms as indicators of water quality, check coliform and faecal coli form in water samples

Module V: Microbes in Agriculture and Environment and Remediation of Contaminated Soils (5 Hours)

Distribution of microbes in air; Isolation of microorganisms from soil, air and water; Biological fixation; Mycorrhizae;

Bioremediation of contaminated soils, isolation of root nodulating bacteria, arbuscular mycorrhizal colonization in plant roots

Suggested Readings

Pelzar, M.J. Jr., Chen E.C. S., Krieg, N.R. (2010) Microbiology: An application based approach, Tata McGraw Hill Education Pvt. Ltd., Delhi

Tortora, G.J., Funke, B.R., Case, C.L. (2007) Microbiology 9th edition, Pearson Benjamin Cummings, San Francisco, USA **Mapping of COs to Syllabus:**

COs	Module I	Module II	Module III	Module IV	Module V
CO1	3				
CO2		3	3	2	1
CO3				3	
CO4				3	3

BOIM409L: INDUSTRIAL MICROBIOLOGY LAB

(1 CREDIT-30 HOURS) (L-T-P:0-0-1)

Course outcomes

At the end of this course, student will be able to:

CO 1: Tell the principles of laboratory instruments (Remembering)

CO 2: Explain different sterilization techniques and culture media preparation (Understanding) CO 3: Compare and select best sterilization methods (Evaluating)

Practical:

Expt. 1: Principles and functioning of instruments in microbiology laboratory

Expt. 2: Hands on sterilization techniques and preparation of culture media

Mapping of COs to Syllabus:

COs	Expt.1	Expt.2
CO1	3	
CO2		3
CO3		3

BOFM411T: FUNDAMENTALS OF MOLECULAR BIOLOGY

(3 Credit-45 Hours) (L-T-P:3-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Define the molecular structure of DNA and RNA. (Remembering)

CO 2: Explain the mechanism of DNA replication of both linear and circular DNA as well as protein synthesis including transcription and translation in both prokaryotes and eukaryotes. (Understanding)

CO 3: Illustrate the post-translational modifications and processing of eukaryotic mRNA and prokaryotic and eukaryotic gene regulation. (Understanding)

CO 4: Distinguish the different DNA repair mechanisms with their significance. (Analyzing)

CO 5: Summarize the interdependence of these molecular mechanisms in providing a holistic environment for the smooth functioning of a cell/organism. (Understanding)

Module I: Nucleic Acids (3 Hours)

Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty, Fraenkel-Conrat's experiment RNA and its significance in evolution.

Module II: The Structures of DNA and RNA (7 Hours)

DNA Structure: Miescher to Watson and Crick-historic perspective, DNA structure, Salient features of double helix, Types of

DNA, Types of genetic material, denaturation and renaturation, cot curves; Organization of DNA-Prokaryotes, Viruses, Eukaryotes. RNA: Types and Structure, Organelle DNA—mitochondria and chloroplast DNA. The nucleosome, chromatin structure—Euchromatin, Heterochromatin – Constitutive and Facultative heterochromatin.

Module III : DNA Replication (6 Hours)

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Semi-conservative, bidirectional and semi discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres, Enzymes for replication, process of prokaryotic and eukaryotic replication

Module IV: Central Dogma and Genetic Code (4 Hours)

Key experiments establishing-The Central Dogma (Adaptor hypothesis and discovery of mRNA template), Genetic code (deciphering & salient features).

Module V: Transcription (6 Hours)

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors.

Module VI: Translation (Prokaryotes and eukaryotes) (6 Hours)

Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation.

Module VII: Post Transcriptional Modifications and Processing of Eukaryotic RNA (4 Hours)

Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Module VIII: Regulation of Transcription in prokaryotes and Eukaryotes (5 Hours)

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements; Gene silencing, Genetic imprinting.

Module IX: DNA Repair Mechanisms (4 Hours)

Pyrimidine dimerization and mismatch repair, Regulatory RNAs 3 Ribo-switches, RNA interference, miRNA, siRNA

Suggested Readings

- Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
- Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R (2007) Molecular Biology of the Gene, 6th edition, Pearson Benjamin Cummings, CSHL Press, New York, USA
- Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V Edition, ASM Press and Sinauer Associates.
- De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
- Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
- Lewin B. (2008). Gene XI, Jones and Bartlett
- McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV Edition. GS, Taylor and Francis Group, New York and London.

Mapping of COs to syllabus

COs	M 1	M 2	M 3	Mo 4	M 5	M 6	M 7	M 8	M 9
CO1	3	3							
CO2		2	3	2					
CO3					3	3	3		
CO4									3
CO5							2	3	

BOFM412L: FUNDAMENTALS OF MOLECULAR BIOLOGY LAB

(1 Credit-30 Hours) (L-T-P:0-0-1)

Course Outcomes

CO 1: At the end of this course, student will be able to:

CO 2: Explain the structure of chromosome. (Understanding)

CO 3: Design the growth medium and estimate growth kinetics. (Creating)

CO 4: Estimation of DNA and RNA using different analytical tools. (Evaluating)

CO 5: Interpret the micrographs of DNA replication and split genes. (Understanding)

CO 6: Prepare LB medium for growing bacterial cultures (Creating)

Practical:

Expt. 1: Preparation of LB medium and raising E.Coli and Isolation of genomic DNA from E.Coli

Expt. 2: DNA estimation by diphenylamine reagent/UV Spectrophotometry

Expt. 3: Estimation of the growth kinetics of E. coli by turbidity method

Expt. 4: Preparation of solid culture medium (LB) and growth of E. coli by spreading and streaking

Expt. 5: Quantitative estimation of RNA using Orcinol reaction.

Expt. 6: Study and interpretation of electron micrographs/ photograph showing (a) DNA replication (b) Transcription (c) Split genes

Expt. 7: Study of DNA replication mechanisms through photographs (Rolling circle, Theta replication and semi discontinuous replication)

Expt. 8: Photographs establishing nucleic acid as genetic material (Messelson and Stahl's, Avery et al, Griffith's, Hershey & Chase's and Fraenkel & Conrat's experiments)

Expt. 9: Study of the following through photographs: Assembly of Spliceosome machinery; Splicing mechanism in group I & group II introns; Ribozyme and Alternative splicing.

Expt. 10: Study of structures of prokaryotic RNA polymerase and eukaryotic RNA polymerase II through photographs

Mapping of Cos to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1								3	3	3
CO2		3		3						
CO3					3		3			
CO4			3			3				
CO5	3									

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	BOBT108L	Biofertilizer Technology	3 (1-0-2)
2	S E Course 2	BOEB109L	Essentials of Bioinformatics	3 (2-0-1)
3	S E Course 3	BONS215L	Practical Applications of Nature-Based Solutions for Sustainable Development	3 (2-0-1)

BOBT108L: BIOFERTILIZER TECHNOLOGY

(1 CREDITS-15 HOURS) (L-T-P: 1-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Explain different microorganisms used as biofertilizers (Understanding)

CO 2: Select microorganisms for making biofertilizers (Applying)

CO 3: Develop strategies for organic farming (Applying)

Module I: Introduction of microbes as fertilizers (10 Hours)

General account about the microbes used as biofertilizer – Rhizobium, Azotobacter, Azospirillum, Azolla and Anabaena, VAM fungi – isolation, identification, mass multiplication, and carrierbased inoculants, influence on growth and yield of crop plants

Module II: Organic Farming (5 Hours)

Organic farming – Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and Industrial wastes – bio compost making methods, types and method of vermi-composting – field Applications

Suggested Readings

Sathe, T.V. Vermiculture and Organic Farming. Daya publishers, 2004

Subha Rao, N.S., Soil Microbiology, Oxford & IBH Publishers, New Delhi, 2000

Vayas, S.C, Vayas, S. and Modi, H.A., Bio-fertilizers and organic Farming AktaPrakashan, Nadiad 55, 1998

Mapping of COs to Syllabus

COs	Module I	Module II
CO1	3	2
CO2	2	2
CO3	1	3

BOBT108L: BIOFERTILIZER TECHNOLOGY LAB

(2 CREDITS-60 HOURS) (L-T-P: 1-0-2)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Develop microbes based biofertilizers (Applying)

CO 2: Formulate bio compost for organic farming (Creating)

Syllabus

Expt. 1: Isolation/selection of microorganisms (Rhizobium, Azotobacter, Azospirillum, BGA, VAM fungi)

Expt. 2: Multiplication/scale up of microorganisms to be used as biofertilizer

Expt. 3: Processing and packing of microorganisms

Expt. 4: Field trials/applications of biofertilizers

Expt. 5: Preparation of bio-compost using microbes and other sources and packaging

Mapping of COs to syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5
CO1	3	3	3	3	1
CO2	2	2	2	1	3

BOEB109L: ESSENTIALS OF BIOINFORMATICS

(2 CREDITS-30 HOURS) (L-T-P: 2-0-0)

Course Outcomes

At the end of this course, student will be able to:

CO 1: Interpret the basic terminology of bioinformatics (Understanding)

CO 2: Illustrate the significance of the biological databases in managing biological data. (Understanding)

CO 3: Apply different bioinformatics tools and software in decoding sequences, their structure and interactions and to correlate these data amongst different species. (Applying)

CO 4: Evaluate various statistical methods in data analysis and interpretation. (Evaluating)

Module I: Introduction to Bioinformatics (7 Hours)

Importance, Goal, Scope; Genomics, Transcriptomics, Functional Genomics, Metabolomics, Systems Biology, Molecular Phylogeny; Applications and Limitations of Bioinformatics.

Module II: Biological Databases (8 Hours)

Introduction to biological databases; Primary, secondary and composite databases; Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB); Metabolic pathway database (KEGG, EcoCyc, and MetaCyc); Small molecule databases (PubChem, Drug Bank, ZINC, CSD)

Module III: Data Generation and Data Retrieval (8 Hours)

Generation of data (Gene sequencing, Protein sequencing, Mass spectrometry, Microarray), Sequence submission tools (BankIt, Sequin, Webin); Sequence file format (flat file, FASTA, GCG, EMBL, Clustal, Phylip, Swiss-Prot); Sequence annotation; Data retrieval systems (SRS, Entrez)

Module IV: Applications of Bioinformatics software (7 Hours)

Structural Bioinformatics (3-D protein, PDB), CN3D, BLAST, Functional genomics (genome wide and high throughput approaches to gene and protein function), Drug discovery method (Basic concepts)

Suggested Readings

COs	Module 1	Module 2	Module 3	Module 4
CO1	3	2		
CO2		3	2	
CO3			3	
CO4				2

BOEB109L: ESSENTIALS OF BIOINFORMATICS LAB

(1 CREDITS-30 HOURS) (L-T-P: 0-0-1)

Course Outcomes

At the end of this course, student will be able to:

CO 1: To developed the understanding of using different software's and database. (Understanding)

CO 2: To execute sequence alignment, primer designing, gene prediction phylogenetic tree construction by utilizing the various biological database and tools (Evaluating)

CO 3: To study 3D Structure of Protein using available softwares. (Applying)

CO 4: Apply bioinformatics tools to archive, retrieve, and analyze biological data. (Analyzing)

Practical

Expt. 1: Introduction to various databases available, their usage in sequence searching, retrieval available in databases and Sequence alignment

Expt. 2: Introduction to Gene prediction tools

Expt. 3: Primer designing and analysis

Expt. 4: Phylogenetic Analysis based on sequence alignment data and RAPD/ protein profile data

Expt. 5: Study 3D Structure using available software's.

Suggested Readings

Bioinformatics. A Practical Approach. Shui Qing Ye, Chapman and Hall/CRC

A Practical Guide for Basic Bioinformatics and Biostatistics (English, Paperback, Pooja Tiwari, Pallavi Pandey)

Mapping COs to Syllabus

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5
CO1	3				
CO2		3	3	3	3
CO3					
CO4					3

BONS215L: PRACTICAL APPLICATIONS OF NATURE-BASED SOLUTIONS FOR SUSTAINABLE DEVELOPMENT

(3 credits-75 hours) (L-T-P:0-0-3)

Course Outcomes

At the end of this course, student will be able to:

CO1: Develop practical skills in designing and implementing nature-based solutions.

CO2: Gain hands-on experience in ecosystem management and sustainable agricultural practices.

CO3: Analyze and evaluate the effectiveness of NBS projects in mitigating environmental and social challenges. CO4: Engage with communities to promote and implement NBS initiatives.

Module I: Introduction to Practical Nature-Based Solutions (10 hours)

Practical Workshop on Ecosystem Services: Hands-on activities to identify and assess ecosystem services.

Community Engagement Exercises: Techniques for involving local communities in NBS projects.

Case Study Analysis: Group discussion and analysis of successful NBS projects.

Mapping and Assessment Tools: Training in the use of GIS and other tools for mapping ecosystem services.

Module II: Sustainable Agriculture Management (20 hours)

Fieldwork on Sustainable Agriculture: Visits to urban farms, community gardens, and regenerative agriculture sites.

Practical Exercises in Agroecology and Permaculture: Implementing sustainable farming practices.

Soil Health Assessment: Techniques for testing and improving soil health.

Monitoring and Evaluation Techniques: Practical exercises in monitoring and evaluating NBS projects.

Module III: Climate Resilience and Disaster Risk Reduction (15 hours)

Field Trip to Local Ecosystems: Introduction to local ecosystems and their services.

Field Exercises in Wetland Restoration: Practical activities in restoring and managing coastal and wetland areas.

Flood Management Projects: Designing a green infrastructure solution for flood mitigation.

Carbon Sequestration Techniques: Hands-on activities in carbon storage and sequestration in forests and wetlands. □ Climate-Resilient Infrastructure: Building and evaluating climate-resilient structures using natural materials,

Policy and Advocacy Workshop: Strategies for promoting NBS at local, regional, and national levels.

Module IV: NBS in Energy and Economy (15 hours)

Renewable Energy Sources and Ecosystem Integration: Exploring the integration of renewable energy sources such as solar, wind, and biomass with natural ecosystems to enhance ecological benefits.

Bioenergy and Biomass Production: Hands-on activities and field visits related to bioenergy and biomass production techniques through industrial visit

Green Economy and Sustainable Finance: Understanding the principles of a green economy and exploring sustainable finance models.

Case Studies: Analysis of real-world projects including solar, biomass, and wind energy projects with ecological benefits, as well as eco-tourism and sustainable business models.

Suggested Reading:

"Nature-Based Solutions to Climate Change Adaptation in Urban Areas: Linkages between Science, Policy and Practice" by Nadja Kabisch, Horst Korn, Jutta Stadler, and Aletta Bonn

"Ecosystem-Based Disaster Risk Reduction and Adaptation in Practice" by Fabrice G. Renaud, Karen Sudmeier-Rieux, Marisol Estrella

"The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations" edited by Pushpam Kumar

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H		M	
CO2	M	H		M
CO3	L			M
CO4			H	H

INTERNSHIP/APPRENTICESHIP/MINOR PROJECT

Semester	Category	Course Code	Course Name	Credits
2	Internship	BOIN110I	Internship	4
4	Internship	BOIN215I	Internship	4
5	Internship	BOIN317I	Internship	2

BOIN110I/ BOIN215I: INTERNSHIP (Exit of 1st Year or 2nd Year)
(4 CREDITS: 120 HOURS)

BOIN317I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester) (2 CREDITS-60 HOURS)

BOMP312P: MINOR PROJECT
(4 CREDITS-120 HOURS)

GUIDELINES FOR INTERNSHIP/APPRENTICESHIP/MINOR PROJECT

Internship/Apprenticeship/Minor project may be carried out in any reputed and recognized Institutions/Laboratories/Industries/Companies recommended/recognized by Assam Don Bosco University. A written permission for Internship/Apprenticeship/Minor project must be obtained from the Head of the Department/Registrar of the University. All interns will be under the mentorship of the department faculty members and co-mentored by any regular employee (Assistant Professor and above) of the Institutes where the student(s) is/are undergoing internship. All interns must abide by the rules and regulations of the host Institutions/Laboratories/Industries/Companies. After the completion of the Internship/Apprenticeship/Minor project, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in Letterhead clearing mentioning the starting and completion dates of Internship/Apprenticeship/Minor project. A report about the Internship/Apprenticeship/Minor project undertaken by the student will have to be submitted to the concerned department at the end of the Internship/Apprenticeship/Minor project.

Duration: Internship/Apprenticeship/Minor project will be of 8 weeks duration (during summer breaks).

Attendance: Co-mentors of the Institutions/Laboratories/Industries/Companies where the student is undergoing Internship/Apprenticeship/Minor project will have to maintain regular attendance records of the intern.

Assessment: Assessment would be carried out by the mentor and co-mentors based on the regularity of the student; submission of progress report followed by seminar presentation of the report.

Assessment criteria:

Sl no	Criteria	Weightage/Mark	Assessor/Members
1	Attendance	20% (20 marks)	Co-supervisor & supervisor
2	Internship/Project report submission	50% (50 marks)	Co-supervisor & supervisor
3	Seminar presentation of internship/project	30% (30 marks)	Panel constituted by the HoD

	Total marks	100% (100 marks)	

RESEARCH PROJECT /DISSERTATION

BSC BOTANY (Honours)				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	BODI413P	Research Project Phase I	6
8	Research Project/Dissertation	BODI414P	Research Project Phase II	6
BSC BOTANY (Honours) with Research				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	BODI415P	Dissertation I	18
8	Research Project/Dissertation	BODI416P	Dissertation II	20

BSC BOTANY (Honours)**BODI413P: RESEARCH PROJECT PHASE I**

(6 credits – 180 hours) (L-T-P: 0-0-12)

BODI414P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-12)

BSC BOTANY (Honours) with Research**BODI415P: DISSERTATION I**

(18 Credits -540 Hours) (L-T-P: 0-0-36)

BODI416P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

GUIDELINES FOR RESEARCH PROJECT/DISSERTATION (7th and 8th semesters)

Research Project/Dissertation must be carried out in the department under the supervision of faculty members. In case of inter-disciplinary Research Project/Dissertation, a co-supervisor may be opted from within the school or from any other departments within the University for better quality data generation and results. If a student wants to carry out a portion of the Research Project/Dissertation in any Institutions/Laboratories/Industries/Companies outside the University, a written permission has to be obtained by the student from the appropriate authorities of the University. The student involved in the Research Project/Dissertation and Assam Don Bosco University would be the sole proprietor of any publications/patents/commercialization generated out of the Research Project/Dissertation works but due acknowledgement must be given to other faculties involved in the project from partner Departments/Institutions/Laboratories. All Research Project/Dissertation students must abide by the rules and regulations of the host Institutions/Laboratories/Industries/Companies. After the completion of the Research Project/Dissertation, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in letterhead clearing mentioning the starting and completion dates of Research Project/Dissertation. A detail report of the

project/works carried out by the student will have to be submitted to the concerned department at the end of the project period.

Duration: Research Project/Dissertation will be carried out for 2 semesters (7th and 8th semester). Written permission from the University authorities must be obtained for extension of the Research Project/Dissertation if need arises.

Attendance: Faculty supervisor/Co-supervisor of the Institutions where the student is carrying out the Research Project/Dissertation will have to maintain regular attendance records of the student.

Assessment: The B. Sc student undergoing research project/dissertation would be assessed by the Departmental Research Committee by conducting a progress report seminar. A final report will have to be submitted to the department/University.

Final assessment would be carried out at the end of 8th semester by the supervisor/Co-supervisor based on the regularity of the student and submission of regular progress reports. The student will have to submit a final Research Project/Dissertation thesis in proper formats to the Department, followed by seminar presentation of the project report. The final assessment may be conducted in the presence of an External examiner

Assessment criteria:

Sl no	Criteria	Weightage/Mark	Assessor/Members
1	Attendance	20% (20 marks)	Co-supervisor & supervisor
2	Internship/Project report submission	40% (40 marks)	Co-supervisor & supervisor
3	Seminar presentation of internship/project	40% (40 marks)	Panel constituted by the Departmental Research Committee. Minimum one external examiner will be part of the panel members
	Total marks	100% (100 marks)	

DEPARTMENT OF ZOOLOGY

PROGRAMME: BACHELOR OF SCIENCE in ZOOLOGY (BSC)

DEGREE: BSC ZOOLOGY (HONOURS)/ BSC ZOOLOGY (HONOURS) WITH RESEARCH

VISION:

To develop the Department as an interdisciplinary centre for learning, research, and innovation
To develop the Department into a hub of biodiversity research while making the surrounding a natural laboratory

MISSION:

To provide a better understanding of Zoological Sciences through interaction with the natural environment and sensitizing the students about their social responsibilities
To expose the learners to recent advances in Zoology and to provide high quality education with an emphasis on learning and research.

PROGRAM OUTCOMES (POs)

- PO 1: Disciplinary Knowledge: Capable of demonstrating comprehensive knowledge and understanding of one or more other disciplines that form a part of an undergraduate programme of study.
- PO 2: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives. Critically evaluate practices, policies and theories by following a scientific approach to knowledge development.
- PO 3: Communication Skills: Ability to express thoughts and ideas effectively in writing and orally; communicate with others using appropriate media; confidently share one's views and express herself/ himself; demonstrate the ability to listen carefully; and present complex information in a clear and concise manner to different groups.
- PO 4: Social Interaction: Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO 5: Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO 6: Moral and Ethical Awareness: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
- PO 7: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
- PO 8: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context of socio- technological changes. Critical sensibility to lived experiences, with self-awareness and reflexivity of both and society.
- PO 9: Information and Digital Literacy: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.
- PO 10: Research related skills: A sense of inquiry and capability for asking relevant/ appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause and affect relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Ability to apply one's learning to real life situations.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: Knowledge and Concept: Acquire detailed knowledge on the extensive diversity of organisms inhabiting varied ecological niches of the earth as well as understand the complexity of the various life-systems operating in these organisms.

PSO 2: Applying knowledge for self-sustenance: Build foundations for novel thinking through application-based studies such as sericulture and aquarium fish keeping, thus ensuring better opportunities for self-sustenance in future.

PSO 3: Skills in handling scientific instruments: Develop interest as well as proficiency in handling scientific instruments introduced as part of practical courses, thereby warranting all-around growth.

PSO 4: Conservation strategies: Recognize the importance of conservation and encourage designing effective strategies to address present conservation issues with preference to sustainable development.

MAPPING OF COURSES TO PO and PSO

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO110	PSO1	PSO2	PSO3	PSO4
ZGDN100T		L		L					L	H		L	H	H
ZGDN101L					L		L			H		M	H	
ZGAN104T		L				L		L		H		M		H
ZGAN105L							L		M	H		H		H
MDC 1				H	H	H	M				L	L		
ZGAC108L				L	L		L			H		H	M	H
ZGDC102T				L	L			L		H	H		M	H
ZGDC103L		L					L		M	H	M	H		H
ZGAD106T					L			L		H		H	M	H
ZGAD107L							L			H		H	M	H
MDC 2				H	H	H	M	L				H		L
ZGSC109L	H	L		L	M	H		H		H	H	H	H	M
ZGCB200T	M									M	H		M	
ZGCB201L	M									H	H		H	
ZGBS202T	H	H	H	M	H	H	H	H	H	M	H	H	H	H
ZGBS203L	H	H	M	L	H	H	H	H	H	H	H	H	H	M
ZGPH210T				L		L	H	M						M
ZGPH211L						L	H			H		H		L
MDC-3	M					L	H		L	H	H	H	M	H
ZGAK214L	H	H	M	M	H	H	H	H	H	H	H	H	H	H
ZGCC204T	H									M	H		M	
ZGCC205L	M									H	M		H	
ZGPE206T	H	M	L	L	M	M	H	L		H	H	H	H	H
ZGPE207L	H						H				H		H	H
ZGPG208T	H									M	H		M	
ZGPG209L	M									H	M		H	
ZGAZ212T	H	H		M			H	M		H	H			H
ZGAZ213L	H	H		M			H	M		H	H			H
ZGFB300T	M									H	H		M	
ZGFB301L	M									H	H		M	
ZGLS302T	M									H	H		M	
ZGLS303L	M									H	M		H	

ZGDB304T	M						M			H	H			
ZGDB305L	M						M			H	H			
ZGAY313T	H	H		M			H	M		H	H			H
ZGAY314L	H	H					H	M		H	H			H
ZGMB306T	M									H	H	M	H	
ZGMB307L	M									H	H	H	H	
ZGIM308T	H									H	H		M	
ZGIM309L	M									H	M		H	
ZGBT310T	M						H			H	H	H	H	
ZGBT311L	M						H			H	H	H	H	
ZGMP312P														
ZGPE315T	H	M	L	L	M	M	H	L		H	H	H	H	H
ZGPE316L	H						H					H	H	H
ZGEB400T						L	H			H		H		H
ZGEB401L						L	H			H		H		H
ZGEZ402T	H	H	M	M	H	H	M	H	H	M	H	H	M	M
ZGEZ403L	H	H	M	L	H	M	H	H	H	H	M	H	H	M
ZGAB408T	M						H			H	H	H	H	M
ZGAB409L	M						H			H	H	H	H	M
ZGRM410T	H	H	H	H	M	H	L	H	H	H	H	H	L	M
ZGCA404T		L		L						H	H	H	L	
ZGCA405L		L			L					H	H	H		
ZGMP406T	M									H	H		M	
ZGMP407L	M									H	M		H	
ZGWC411T				H	H	H				H	L			H
ZGWC412L				M	M	H				H	L			H

DETAILED SYLLABUS MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	ZGDN100T	Diversity of Non-Chordates	4 (3-0-1)
		ZGDN101L	Diversity of Non-Chordates Lab	
2	Major Course 2	ZGDC102T	Diversity of Chordates	4 (3-0-1)
		ZGDC103L	Diversity of Chordates Lab	
3	Major Course 3	ZGCB200T	Cell Biology	4 (3-0-1)
		ZGCB201L	Cell Biology Lab	
3	Major Course 4	ZGBS202T	Biosystematics	4 (3-0-1)
		ZGBS203L	Biosystematics Lab	
4	Major Course 5	ZGCC204T	Animal Physiology: Controlling and Coordinating System	5 (3-0-2)
		ZGCC205L	Animal Physiology: Controlling and Coordinating System Lab	

4	Major Course 6	ZGPE206T	Perspectives in Ecology	5 (3-0-2)
		ZGPE207L	Perspectives in Ecology Lab	
4	Major Course 7	ZGPG208T	Principles of Genetics	4 (3-0-1)
		ZGPG209L	Principles of Genetics Lab	
5	Major Course 8	ZGFB300T	Fundamentals of Biochemistry	5 (3-0-2)
		ZGFB301L	Fundamentals of Biochemistry Lab	
5	Major Course 9	ZGLS302T	Animal Physiology: Life-Sustaining Systems	5 (3-0-2)
		ZGLS303L	Animal Physiology: Life-Sustaining Systems Lab	
5	Major Course 10	ZGDB304T	Developmental Biology	4 (3-0-1)
		ZGDB305L	Developmental Biology Lab	
6	Major Course 11	ZGMB306T	Molecular Biology	4 (3-0-1)
		ZGMB307L	Molecular Biology Lab	
6	Major Course 12	ZGIM308T	Immunology	4 (3-0-1)
		ZGIM309L	Immunology Lab	
6	Major Course 13	ZGBT310T	Biotechnology	4 (3-0-1)
		ZGBT311L	Biotechnology Lab	
6	Major Course 14	ZGMP312P	Minor Project	4
7	Major Course 15	ZGEB400T	Evolutionary Biology	5 (3-0-2)
		ZGEB401L	Evolutionary Biology Lab	
7	Major Course 16	ZGEZ402T	Economic Zoology	5 (3-0-2)
		ZGEZ403L	Economic Zoology Lab	
8	Major Course 17	ZGCA404T	Comparative Anatomy	5 (3-0-2)
		ZGCA405L	Comparative Anatomy Lab	
8	Major Course 18	ZGMP406T	Biochemistry of Metabolic Processes	5 (3-0-2)
		ZGMP407L	Biochemistry of Metabolic Processes Lab	

ZGDN100T: DIVERSITY OF NON-CHORDATES

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To know the general characters and classification of Non-chordates and understand the increasing complexity of body forms.

Course/ Learning Outcomes:

CO 1: Interpret the evolution of body cavity in non-Chordates. (Understanding)

CO 2: Illustrate the morphological structure different larval forms of important representative organisms belonging to these phyla. (Understanding)

CO 3: Identify the distinguishing characters of the pseudocoelomates and coelomates. (Applying)

CO 4: Distinguish the unique physiology of selected representative non-chordates. (Analyzing)

Module I: Protista, Parazoa and Metazoa (4 Hours)

General characteristics and Classification up to classes Study of Euglena, Amoeba and Paramecium Life cycle and pathogenicity of Plasmodium vivax and Entamoeba Histolytica.

Module II: Porifera (3 Hours)

General characteristics and Classification up to classes; Canal system and spicules in sponges

Module III: Cnidaria (4 Hours)

General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals and coral reefs.

Module IV: Ctenophora (2 Hours)

General characteristics and Classification up to Classes.

Module V: Platyhelminthes (4 Hours)

General characteristics and Classification up to classes. Life cycle and pathogenicity of Fasciola hepatica and Taeniasolium

Module VI: Nematelminthes (4 Hours)

General characteristics and Classification up to classes. Life cycle, and pathogenicity of Ascaris lumbricoides and Wuchereria bancrofti.

Module VII: Annelida (4 Hours)

General characteristics and Classification up to classes. Reproduction, Regeneration and Locomotion of Annelida.

Module VIII: Arthropoda (4 Hours)

General characteristics and Classification up to classes. Metamorphosis in Insects; Social life in bees and termites.

Module IX: Onychophora (4 Hours)

General characteristics and Classification up to classes.

Module X: Mollusca (4 Hours)

General characteristics and Classification up to classes, Pearl formation in bivalves; Trochophore larva.

Module XI: Echinodermata (4 Hours)

General characteristics and Classification up to classes, Water-vascular system in Asteroidea, Larval forms in Echinodermata

Module XII: Hemichordata (4 Hours)

General characteristics and classification of Hemichordata up to classes; Study of Balanoglossus.

Note: Classification to be followed from “Ruppert and Barnes (2006) Invertebrate Zoology, 8th edition, Holt Saunders International Edition” CBCS Undergraduate Program in Zoology 2015

Suggested Readings

Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition

Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science

Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

Mapping of COs to Syllabus

Course Outcomes	M-I	M-II	M-III	M-IV	M-V	M-VI	M-VII	M-VIII	M-IX	M-X	M-XI	M-XII
CO 1	M			M			H			M	L	L
CO 2	H	H	H	H	H	H		H	H	H	M	M
CO 3	L				L	L			L		H	M
CO 4	H				H				M		M	H

ZGDN101L: DIVERSITY OF NON-CHORDATES LAB

(1 Credits: 30 Hours) (L-T-P: 0-0-1)

Objectives

To know the general characters and classification of Non-chordates and understand the increasing complexity of body forms by doing practical and at field level.

Course/ Learning Outcomes:

CO 1: Examine and investigate different species of non-chordate (Analyzing).

CO 2: Examine various systems of non-chordate species (Analyzing).

CO 3: Differentiate different parts of body through prepared slides (Analyzing).

CO 4: Design a project for any related topic (Creating).

Syllabus:

Study of whole mount of Euglena, Amoeba and Paramecium

Study of the following Specimens- Porifera: *Sycon* (T.S. and L.S.), *Hyalonema*, *Euplectella*, *Spongilla*; Cnidaria:*Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Gorgonia*, *Metridium*, *Pennatula*, *Fungia*; Ctenophora: *Pleuro-**brachia*, *Ctenoplana*; Platyhelminthes: *Fasciola hepatica*, *Taeniasolium*; Nematelminthes: *Ascaris lum-**breoides*; Annelida- *Aphrodite*, *Nereis*, *Heteronereis*, *Pheretima*, *Hirudinaria*; Arthropoda: *Limulus*, *Pala-**naeus*, *Palaemon*, *Daphnia*, *Philosamia*, *Periplaneta*, *Termites* and honey bees; Onychophora-*Peripatus*,Molluscs - *Chiton*, *Dentalium*, *Pila*, *Unio*, *Sepia*, *Octopus*, *Nautilus*;Echinodermates-*Asterias*, *Ophiura*, *Echinus*, *Cucumaria*; Hemichordata- *Balanoglossus*

Examination of pond water collected from different places for diversity in protists

Dissection of the mouth parts of Cockroach

Dissection of digestive system of Cockroach

Suggested Readings

Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition

Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New

Synthesis, III Edition, Blackwell Science

Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

Mapping of COs to Syllabus

Course comes	Out-	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
CO 1		H				
CO 2			H		H	
CO 3				H		
CO 4						H

ZGDC102T: DIVERSITY OF CHORDATES

(3 Credits: 45 Hours)(L-T-P:3-0-0)

Objective(s)*To know the Diversity of Chordata from lower to higher Chordates and their geographical distribution***Course/ Learning Outcomes**

Understand the origin and evolution of the phylum Chordata. (Understanding)

CO 1: Distinguish the unique characteristics as well as life functions of different chordate subphylum. (Analyzing)

CO 2: Evaluate the varied morphological, anatomical and physiological complexity in selected chordate organisms. (Evaluating)

CO 3: Analyze the various theories of animal distribution and their geographical realms. (Analyzing)

Module I: Introduction to Chordates (8 Hours)

General characteristics and outline classification

Module II: Protochordata (8 Hours)

General characteristics of Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

Module III: Origin of Chordata (3 Hours)

Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

Module IV: Agnatha (2 Hours)

General characteristics and classification of cyclostomes up to class

Module V: Pisces (8 Hours)

General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes

Module VI: Amphibia (8 Hours)

Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians

Module VII: Reptilia (7 Hours)

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes

Module VIII: Aves (8 Hours)

General characteristics and classification up to order Archaeopteryx- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds

Module IX: Mammals (8 Hours)

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Suggested readings

Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.

Pough H. Vertebrate life, VIII Edition, Pearson International.

Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.

Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

T.C. Majupuria. Introduction to Chordates, Pradeep Publications.

Veerbala Rastogi. Vertebrate Zoology, Kedar Nath Ram Nath Publications

Mapping of Cos to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX
CO 1	M	L	M	L					
CO 2		H		H	H	H	H	H	H
CO 3				H	H	H	H	H	H
CO 4	M								

ZGDC103L: DIVERSITY OF CHORDATES LAB

(1 Credits: 30 hours) (L-T-P: 0-0-1)

Objective(s)

To demonstrate the different Chordates from lower to higher Chordates with help of the laboratory specimen.

Course/ Learning Outcomes:

CO 1: Identify distinguishing characteristics of representative museum specimens belonging to different phyla. (Applying)

CO 2: Determine their affinities and evolutionary relationships. (Evaluating)

CO 3: Examine specific organ structures through dissections. (Analyzing)

CO 4: To compare the anatomical structure of different vertebrates. (Applying)

Syllabus

Protochordata: Herdmania, Branchiostoma, Colonial Urochordata Sections of Balanoglossus through proboscis and branchiogenital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmania spicules

Agnatha: Petromyzon, Myxine

Pieces: Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echineis, Anguilla, Hippocampus, Tetodon/ Diodon, Anabas, Flat fish

Amphibia: Ichthyophis/Uraeotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra

Reptilia: Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus Key for Identification of poisonous and non-poisonous snakes

Aves: Study of six common birds from different orders. Types of beaks and claws

Mammalia: Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceus. Mount of weberian ossicles of Mystus, pecten from Fowl head Dissection of Fowl head (Dissections and mounts subject to permission) Powerpoint presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)

Suggested readings

Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.

Pough H. Vertebrate life, VIII Edition, Pearson International.

Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.

Hall B.K. and Hallgrímsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

T.C. Majumuria. Introduction to Chordates, Pradeep Publications.

Veerbala Rastogi. Vertebrate Zoology, Kedar Nath Ram Nath Publication

Mapping of Cos to syllabus

Course Outcomes	M 1	2	3	4	5	6	7
CO 1	H	H	H	H	H	H	H
CO 2	M	M	M	M	M	M	M
CO 3							H

ZGCB200T: CELL BIOLOGY

(3 credits: 45 Hours)(L-T-P: 3-0-0)

Objective(s)

To appreciate how cell the structural & functional unit of life works.

Course/ Learning Outcomes:

CO 1: Define the composition and function of membrane structure; cytoskeleton and their role in affecting cell shape, function and movement (Remembering).

CO 2: Distinguish the different cell types viz prokaryotes, eukaryotes and infectious agents viz. virus, viroids, prions & mycoplasma. (Understanding)

CO 3: Evaluate the complexity and interaction of the varied organelles, including endoplasmic reticulum, golgi apparatus, mitochondria, nucleus and peroxisomes (Evaluating).

CO 4: Analyze the importance of nucleus in cell division and signaling (Analyzing).

Module I: Overview of Cells (4 Hours)

Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions

Module II: Plasma Membrane (6 Hours)

Models of plasma membrane structure; Transport across membranes: Active and Passive transport, Facilitated transport; Cell junctions: Tight junctions, Desmosomes, Gap junctions

Module III: Endomembrane System (6 Hours)

Structure and Functions: Endoplasmic Reticulum, Golgi apparatus, Lysosomes

Module IV: Mitochondria and Peroxisomes (7 Hours)

Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis, Mitochondrial Respiratory Chain, Chemiosmotic hypothesis Peroxisomes

Module V: Cytoskeleton (5 Hours)

Structure and Functions: Microtubules, Microfilaments and Intermediate filaments

Module VI: Nucleus (7Hours)

Structure of Nucleus: Nuclear envelope, nuclear pore complex, Nucleolus Chromatin: Euchromatin and Heterochromatin and packaging (nucleosome)

Module VII: Cell Division (7 Hours)

Mitosis, Meiosis, Cell cycle and its regulation

Module VIII: Cell Signaling (3 Hours)

GPCR and Role of second messenger (cAMP)

Suggested Readings

Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.
 De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
 Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.
 Becker, W.M., Kleinsmith, L.J., Hardin, J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.
 Bruce Albert, Bray Dennis, Lewis Julian, Raff Martin, Roberts Keith and Watson
 James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc. New York and London.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1		H			H			
CO 2	H							
CO 3			H	H		H		
CO 4						M	H	H

ZGCB201L: CELL BIOLOGY LAB

(2 Credits: 60 Hours) (L-T-P:0-0-2)

Objective(s)

To visualise and learn the dynamics of intracellular components of cell while undergoing several vital functions including cell division.

Course/ Learning Outcomes:

CO 1: Create the temporary stained slides of different stages of cell division. (Creating)
 CO 2: Investigate various stages of meiotic cell division. (Analyzing)
 CO 3: Create the permanent slides to investigate various structural components inside the cell. (Analyzing)
 CO 4: Create temporary slides to demonstrate Barr body. (Evaluating)

Syllabus

1. Preparation of temporary stained squash of onion root tip to study various stages of mitosis
 2. Study of various stages of meiosis.
 Preparation of permanent slide to show the presence of Barr body in human female blood cells/cheek cells.
 Preparation of permanent slide to demonstrate:
 DNA by Feulgen reaction
 DNA and RNA by MGP
 Mucopolysaccharides by PAS reaction
 Proteins by Mercurobromophenol blue/Fast Green

Suggested Readings

Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.

De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.

Cooper, G.M. and Hausman, R.E. (2009). The Cell: A Molecular Approach. V Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.

Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.

Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.

Mapping of COs to Syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4
CO 1	H			
CO 2		H		
CO 3				H
CO4			H	

ZGBS202T: BIOSYSTEMATICS

(3 Credits -45 Hours) (L-T-P: 3-0-0)

Objective(s):

To acquaint the student with different taxonomic procedures and its application in faunal identification.

To enable the students to identify, classify and name the organisms according to international code of zoological nomenclature.

Course/ Learning Outcomes:

CO 1: Explain the concept of Biosystematics, Taxonomy and Species. (Understanding)

CO 2: Apply Taxonomy to solve the species problem and construction of a phylogenetic tree. (Applying and Creating)

CO 3: Identify species on the basis of taxonomic keys and utilize the nomenclature codes. (Applying)

CO 4: Apply the techniques of specimen collection and preservation. (Applying)

Module I: Science of Biosystematics (8 hours)

Concept of Biosystematics, Terms used in systematic biology, Historical review of taxonomic philosophies, Future of taxonomic studies, stages of taxonomy, Tasks of taxonomist, Systematics as a profession, Significance of taxonomy.

Module II: Concept of Species (8 hours)

Historical perspective of species concept (Typological, Biological, Nominalistic, Evolutionary & recognition), Difficulties in the application of different species concepts; Kinds of species – sibling, sympatric, allopatric, syntopic, ring species, polytypic and monotypic species; Intraspecific groups (variety, morphs, subspecies, temporal subspecies, race and clines).

Module III: Classification and Phylogenetic analysis (8 hours)

Taxonomic Classification; components, procedure (phenetic & cladistic), and presentation of classification (Linnaean/ Taxonomic hierarchy); Ways of constructing a phylogenetic tree. Phylogenetic analysis – Purpose, terminology, methods of phylogenetic analysis (phenetic method, dendrogram method, pairwise distance; Cladistic method, parsimony, maximum likelihood); phylogenetic lineage

Module IV: Taxonomical publications & Techniques (8 hours)

Taxonomic collection – Purpose, value, scope of collection, content of collection, significance of museum collection, legal aspects of collecting animals, post collection processes.

Techniques of preservation – Methods, taxidermy, plastination, factors responsible for the deterioration of museum specimens. Curating of collection – museum collection policy, preparation of material of study, housing and cataloging, exchangeable and expendable materials and loans.

Identification – Systematic process of sorting and labeling, procedure of identification of species.

Module V: Recent trends in modern taxonomy (7 hours)

Different approaches of taxonomy viz. Morphotaxonomy, Cytotaxonomy, Chemotaxonomy, Numerical taxonomy, Molecular taxonomy etc.

Module VI: Application of Zoological Nomenclature (6 hours)

Taxonomic keys – types and their significance; taxonomic publication – types and procedures; Nomenclature (Binomial and Trinomial Nomenclature); International code of Zoological Nomenclature (ICZN) and its recent amendments; Process of typification and Zoological types.

Suggested Readings

Blackwelder, R.E. (1967): Taxonomy. John Wiley & Sons Inc., New York.

Dalela, R.C. & Sharma, R.S. (2017): Animal taxonomy and Museology, Jai Prashnath & company.

Kapoor V.C. (1998): Principles and Practice of Animal Taxonomy. Science Publisher

a. Kapoor, V.C (2008): Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co. Pvt Ltd 4. Mayer, E. (1991): Principles of Systematic Zoology. Tata Mc Graw Hill Publishing Co. Ltd., USA: New Delhi

5. Quicke, D.L.J. (1992): Principles and techniques of Contemporary taxonomy. Blackie Academic and Professional, London 6. Simpson, G. G. (2012): Principle of animal taxonomy. Scientific Publisher (India)

Tripathi, R.C.: Biosystematics and Taxonomy, University Book House, Jaipur.

Verma, A. (2015): Principles of Animal Taxonomy, Alpha Science International Ltd, Delhi.

Online Tools and Web Resources:

Animal Diversity (<https://swayam.gov.in/courses/5686-animal-diversity>), Advances in Animal diversity, Systematics and Evolution (<https://swayam.gov.in/courses/5300-zoology>) Swayam (MHRD) Portal

ePG Pathshala (MHRD) Module 184 of the paper on taxonomy (<https://epgp.inflibnet.ac.in/ahl.php?csrno=35>) 3. International Commission on Zoological Nomenclature (<https://www.iczn.org/the-code/the-code-online/>)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H					
CO2		H	H			H
CO3						
CO4				H		

ZGBS203L: BIOSYSTEMATICS LAB

(1 Credits -30 Hours) (L-T-P: 0-0-1)

Objective(s):

To develop the student on skill of taxonomic identification, classification and nomenclature of fauna.

To acquaint the student on skill of taxonomic sampling and preservation, and analysis through construction of taxonomic keys and phylogenetic tree.

Course/ Learning Outcomes:

CO 1: Apply the morphometric study and identify different animals. (Applying)

CO 2: Develop the systematic position of different animals. (Applying)

CO 3: Compare various techniques of taxonomic sampling and preservation techniques. (Understanding)

CO 4: Construct taxonomic keys and phylogenetic trees of known species. (Applying)

Syllabus:

Recent classification of animals with the help of museum specimens.

Identification of animal species with the help of taxonomic keys (identification up to order).

Demonstrate the methods of Taxonomic collection and preservations in various taxa.

Construction of different types of Taxonomic keys for the identification of animals.

Biosystematic position of specimens: 1. Phylum Protozoa to Echinodermata; 2. Cyclostomata to mammals.

Morphometric measurements of some locally available fish/ frog.

Construction of phylogenetic trees of groups of known species from the museum specimens.

Mapping of COs to Syllabus:

Course Outcomes	CO 1	CO 2	CO 3	CO 4
E1	H			
E2		H		
E3			H	
E4				H
E5		H		
E6	H			
E7				H

ZGCC204T: ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

(3 CREDITS: 45 HOURS) (L-T-P: 3- 0-0)

Objective(s)

To understand the high degree of control and coordination in complex multicellular organism through nervous, endocrine regulation which in turn also help to achieved vital functions like reproduction.

Course/ Learning Outcomes:

CO 1: Define the structure and function of different animal tissues, and the endocrine glands. (Understanding)

CO 2: Distinguish the unique physiological aspects at both the cellular and system levels. (Analyzing)

CO 3: Assess the complexity and co-ordination exhibited by the nervous, muscle and reproductive system. (Evaluating)

CO 4: Compare the histological intricacy of the endocrine glands, their mechanism of action and the coordination demonstrated by the neuroendocrine system. (Analysing)

Module I: Tissues (4 Hours)

Structure, location, classification and functions of epithelial tissue, connective tissue, muscular Tissue and nervous tissue

Module II: Bone and Cartilage (4 Hours)

Structure and types of bones and cartilages, Ossification, bone growth and resorption

Module III: Nervous System (7 Hours)

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; Types of synapse, Synaptic transmission and, Neuromuscular junction; Reflex action and its types - reflex arc; Physiology of hearing and vision.

Module IV: Muscle (8 Hours)

Histology of different types of muscles; Ultrastructure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit, summation and muscle tetany.

Module V: Reproductive System (9 Hours)

Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female

Module VI: Endocrine System (13 Hours)

Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; hormones secreted by them and their mechanism of action; Classification of hormones; Regulation of their secretion; Mode of hormone action, Signal transduction pathways for steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine

gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system; Placental hormones.

Suggested Readings:

Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hecourt Asia PTE Ltd. /W.B. Saunders Company.

Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons

Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1		H			H			
CO 2	H							
CO 3			H	H		H		
CO 4						M	H	H

ZGCC205L: ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS LAB

(2 Credits: 60 Hours) (L-T- P: 0-0-2)

Objective(s)

To visualize the structural architecture of cells, tissues that form various vital organs, glands etc. which in turn will help understanding their functions.

Course/ Learning Outcomes:

CO 1: Estimate specific physiological functions of muscle tissues (Applying)

CO 2: Compare structural organization of various tissue through temporary and permanent slides. (Evaluating)

CO 3: Utilize the process of microtomy to visualize histological structures in different mammalian tissues.

(Applying) CO 4: Elaborate how neural activity responsible for condition and unconditioned reflex works (Understanding)

Syllabus:

*Recording of simple muscle twitch with electrical stimulation (or Virtual)

Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)

Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells

Study of permanent slides of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell,

Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid

Microtomy: Preparation of permanent slide of any five mammalian (Goat/white rat) tissues (*Subject to UGC guidelines)

Mapping of Cos to Syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
CO 1	H				H
CO 2		H			
CO 3				H	
CO 4			H		

ZGPE206T: PERSPECTIVES IN ECOLOGY

(3 Credits: 45 Hours; L-T-P: 3-0-0)

Objective(s)

To understand concepts and the Principles in ecology and wildlife management

Course Outcomes:

- CO 1: Distinguish the mechanism of various biological interactions (Understanding).
 CO 2: Analyze different population dynamics and interactions (Analysing).
 CO 3: Evaluate ecosystem energetics with reference to food chain, food web (Evaluating).
 CO 4: Apply conservation and management strategies for local endangered species (Applying)

Module I: Introduction to Ecology (3 Hours)

History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Module II: Population (20 Hours)

Unitary and Modular populations Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors Population interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical responses

Module III: Community (10 Hours)

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example Theories pertaining to climax community

Module IV: Ecosystem (10 Hours)

Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with one example of Nitrogen cycle Human modified ecosystem

Module V: Applied Ecology (2 Hours)

Ecology in Wildlife Conservation and Management

Suggested Readings:

Colinvaux, P. A. (1993). Ecology.II Edition. Wiley, John and Sons, Inc.
 Krebs, C. J. (2001). Ecology.VI Edition. Benjamin Cummings.
 Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
 Robert Leo Smith Ecology and field biology Harper and Row publisher
 Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Pres

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	M	E	
CO2		H	M	M	
CO3		E	H		
CO4			E		H

ZGPE207L: PERSPECTIVES IN ECOLOGY LAB

(2 Credit: 60 Hours) (L-T-P: 0-0-2)

Objective(s)

To gain knowledge and understand about the status and the diversity of the different ecosystem

Course Outcomes:

- CO 1: Investigate life tables and survivorship curves of different types (Analyzing).
 CO 2: Estimate and analyse different population dynamics and interactions (Analyzing).
 CO 3: Evaluate the aquatic ecosystem (Evaluating).
 CO 4: Design a project for any related topic (Creating).

Syllabus

Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided

Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon-Weiner diversity index for the same community
 Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO₂, alkalinity and hardness of water
 Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

SUGGESTED READINGS

Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
 Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
 Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
 Robert Leo Smith Ecology and field biology Harper and Row publisher
 Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press

Mapping of COs to Syllabus

Course Outcomes	Experiment I	Experiment II	Experiment III	Experiment IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

ZGPG208T: PRINCIPLES OF GENETICS

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To understand how characters or traits are being inherited in a wide range of organisms & to appreciate how even the minute changes in hereditary material can bring about variation, thereby enriching diversity.

Course outcomes:

- CO 1: Define the concept of genes, genomics and inheritance with special reference to Mendelian heredity and inheritance. (Remembering)
 CO 2: Describe the mechanism of linkage and crossing-over with models of recombination in prokaryotes, eukaryotes and viruses. (Understanding)
 CO 3: Illustrate the different types of mutations and their molecular mechanisms. (Understanding)
 CO 4: Analyze and interpret the diverse inheritance patterns. Compare the methods of generation of transposons in bacteria, drosophila, maize and humans. (Understanding, Analyzing)

Module I: Mendelian Genetics and its Extension (6 Hours)

Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, lethal alleles, Epistasis, Pleiotropy, Sexlinked, sex-influenced and sex-limited characters inheritance.

Module II: Linkage, Crossing Over and Chromosomal Mapping (8 Hours)

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.

Module III: Mutations (8 Hours)

Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB methods, attached X method.

Module IV: Sex Determination (4 Hours)

Chromosomal mechanisms of sex determination in Drosophila and Man

Module V: Extra-chromosomal Inheritance (4 Hours)

Criteria for extra-chromosomal inheritance, Mitochondrial mutations in *Saccharomyces*, Infective heredity in *Paramecium* and Maternal effects

Module VI: Polygenic Inheritance (3 Hours)

Polygenic inheritance with suitable examples; simple numerical based on it.

Module VII : Recombination in Bacteria and Viruses (7 Hours)

Conjugation, Transformation, Transduction, Complementation test in Bacteriophage

Module VIII: Transposable Genetic Elements (5 Hours)

Transposons in bacteria, Ac-Ds elements in maize and P elements in *Drosophila*, Transposons in humans

Suggested Readings:

Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India
 Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc
 Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings
 Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition Benjamin Cummings
 Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co
 Fletcher H. and Hickey I. (2015). Genetics. IV Edition. GS, Taylor and Francis Group, New York and London.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO 1	H	M				M		
CO 2		H						
CO 3			H		M			
CO 4	H			H	H	H	H	H

ZGPG209L: PRINCIPLES OF GENETICS LAB

(1 Credits: 30 Hours) (L-T-P: 0-0-1)

Objective(s)

To appreciate the use of genetic experimental data in explaining some of the key concepts of genetics viz. linkage map construction, gene interactions as well as analysis of inheritance pattern of certain human trait.

Course Outcomes:

CO 1: Explain the laws of Inheritance. (Evaluating)
 CO 2: Analyze organisms trait using Chi Square test. (Analyzing)
 CO 3: Construct linkage maps and human karyotype (Applying)
 CO 4: Constructing and analyzing pedigree for inherited traits. (Applying)

Syllabus:

To study the Mendelian laws and gene interactions.
 To study the traits using Chi-square analyses [seeds/beads/*Drosophila*].
 Linkage maps based on data from conjugation, transformation and transduction.
 Linkage maps based on data from *Drosophila* crosses.
 Study of human karyotype (normal and abnormal).
 Pedigree analysis of some human inherited traits.

Suggested Readings:

Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India
 Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc
 Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics. X Edition. Benjamin Cummings
 Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition Benjamin Cummings

Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. Introduction to Genetic Analysis. IX Edition. W. H. Freeman and Co

Mapping of Cos to Syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5	Experiment 6
CO 1	H					
CO 2		H				
CO 3			H	H	H	
CO 4						H

ZGFB300T: FUNDAMENTALS OF BIOCHEMISTRY

(3 CREDITS; 45 HRS) (L-T-P: 3-0-0)

Objective(s)

To acquire knowledge on the building blocks of life and their significance

Course Outcomes:

CO 1: Define the structural and functional aspects of different biomolecules.(understanding)

CO 2: Describe and draw the chemical structures of different biomolecules.(understanding)

CO 3: Evaluate their inter-relationship as evident in the living system.(evaluating)

CO 4: Analyze the mechanism and regulation of enzyme action and their kinetics with reference to bi-substrate, multisubstrate and allosteric enzymatic reactions.(analysing)

Module I: Carbohydrates (5 Hours)

Structure and Biological importance: Monosaccharides, Disaccharides,

Module II: Lipids (6 Hours)

Structure and Significance: Physiologically important saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids

Module III: Proteins (10 Hours)

Amino acids: Structure, Classification and General properties of α -amino acids; Physiological importance of essential and nonessential α -amino acids Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation of protein

Module IV: Nucleic Acids (12 Hours)

Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic Denaturation and Renaturation of DNA
Types of DNA and RNA

Module V: Enzymes (12 Hours)

Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affecting rate of enzyme-catalyzed reactions; Derivation of Michaelis-Menten equation, Concept of K_m and V_{max}

SUGGESTED READING

Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.

Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.

Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw- Hill Companies Inc.

Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.

Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008). Molecular Biology of the Gene, VI Edition, Cold Spring Harbor Lab. Press, Pearson Pub

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO 2	M	M	M	M	
CO 3				H	H
CO 4				M	H

ZGFB301L: FUNDAMENTALS OF BIOCHEMISTRY LAB

(2 CREDIT: 60 HOURS) (L-T-P: 0-0-2)

Objective(s)*To learn different estimation techniques of biological molecules***Course Outcomes**

CO 1: Estimate biochemical functional groups of different macromolecules. (Evaluating)

CO 2: Develop chromatography skills for separation of amino acids (Evaluating)

CO 3: Determine the enzyme kinetics of given enzyme: salivary amylase. (Evaluating)

CO 4: Learn basic laboratory techniques like buffer preparation, solutions and working of instruments (learning)

Syllabus:

Study of working principles of different laboratory instruments

Preparation of Buffers: phosphate and citrate

Preparation of normal and molar solutions

Qualitative tests of functional groups in carbohydrates, proteins and lipids.

Paper chromatography of amino acids.

Effect of Different Temperatures, pH on the Activity of Salivary Amylase on Starch.

Suggested readings:

S. Chaykin (1966), Biochemistry Laboratory Techniques, 169 pages. John Wiley & Sons Inc., New York.

S. Sadasivam (1996). Biochemical Methods Edition, revised; Publisher, New Age International, ISBN, 8122409768 3.

Geetha K Damodaran (2010). Practical Biochemistry. Jaypee Brothers Medical Publishers Pvt. Limited**Mapping of CO's to syllabus**

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6
CO 1				H	M	
CO 2					H	
CO 3						H
CO 4	H	H	H	M		

ZGLS302T: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

(3 CREDITS: 45 HOURS) (L-T-P: 3-0-0)

Objectives*To understand how vital metabolic activities like digestion, respiration, excretion, circulation of blood which responsible for life sustenance works.***Course Outcomes:**

CO 1: Define the organ systems responsible for maintaining a balanced physiological functioning of the mammalian body (Remembering)

CO 2: Summarize the structure and function of the gastrointestinal tract, the lungs, the kidneys, the heart and other related organs (Understanding)

CO 3: Determine basic blood parameters as a measure of a vigorous physiological system; evaluate the effects of organ systems compromised due to infection, disease or injury (Evaluating)

CO 4: Correlate the inter-relationship of these organ systems to maintain a stable homeostasis in the body (Understanding)

Module I: Physiology of Digestion (9 Hours)

Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

Module II: Physiology of Respiration (9 Hours)

Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it; Carbon monoxide poisoning; Control of respiration

Module III: Renal Physiology (9 Hours)

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance

Module IV: Blood (9 Hours)

Components of blood and their functions; Structure and functions of haemoglobin, Haemostasis: Blood clotting system, Kallikrein- Kininogen system, Complement system Fibrinolytic system, Haematopoiesis Blood groups: Rh factor, ABO and MN

Module V: Physiology of Heart (9 Hours)

Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, Frank-Starling Law of the heart, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation

Suggested Readings:

Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. W.B. Saunders Company.

Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,

Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.

Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

https://onlinecourses.nptel.ac.in/noc20_bt42/preview

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M	M		H	H
CO 2	H		H		H
CO 3				H	
CO 4		H	M	M	M

ZGLS303L: ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS LAB

(2 CREDITS: 60 Hours) (L-T-P: 0-0-2)

Objective(s)

To appreciate the concept and skill set required for measurement or analysis of certain physiological parameters viz. RBC count WBC count, haemoglobin % etc. which can reflect health status of the individual.

Course Outcomes:

- CO 1: Develop skills to determine basic blood parameters as a measure of a vigorous physiological system (Applying)
- CO 2: Examine the anatomy of various internal organs. (Analyzing)
- CO 3: Determine the percentage of haemoglobin in blood. (Applying)
- CO 4: Illustrate the presence of haemoglobin in RBC through preparation of haemin crystal. (Analyzing)

Syllabus

Determination of ABO Blood group
 Enumeration of red blood cells and white blood cells using haemocytometer
 Estimation of haemoglobin using Sahli's haemoglobinometer
 Preparation of haemin and haemochromogen crystals
 Recording of frog's heart beat under in situ and perfused conditions*
 Recording of blood pressure using a sphygmomanometer
 Examination of sections of mammalian oesophagus, stomach, duodenum, ileum, rectum liver, trachea, lung, kidney (*Subject to UGC guidelines)

Suggested Readings:

- Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Hercourt Asia PTE Ltd. W.B. Saunders Company.
- Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition John Wiley & sons,
- Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional correlations. XII Edition. Lippincott W. & Wilkins.
- Vander A, Sherman J. and Luciano D. (2014). Vander's Human Physiology: The Mechanism of Body Function. XIII Edition, McGraw Hills

Mapping of COs to Syllabus:

Course Outcomes	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp. 6	Exp. 7
CO 1	H	H			M	H	
CO 2							H
CO 3			H				
CO 4				H			

ZGDB304T: DEVELOPMENTAL BIOLOGY

(3 CREDITS: 45 HOURS) (L-T-P: 3-0-0)

Objective(s)

To understand the developmental process of different organism and their gradual evolution

Course Outcomes:

- CO 1: Understand the mechanisms underlying the process of development (Understanding)
- CO 2: To determine the evolutionary history of living species inferred through the phylogenetic molecular and morphological information using models. (Evaluating)
- CO 3: Correlate the effects of different natural and artificial factors leading to developmental anomalies or congenital defects in humans.(Analyzing)
- CO 4: Interpret the different stages of development of frog, chick and culture preparation of Drosophila. (Analyzing)

Module 1: Introduction (4 Hours)

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation,

Module 2: Early Embryonic Development (20 Hours)

Gametogenesis: Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula; Fate maps

Module 3: Late Embryonic Development (6 Hours)

Early development of frog and chick up to gastrulation; Embryonic induction and organizers

Fate of Germ Layers; Extra-embryonic membranes in birds; Placenta (Structure, types and functions of placenta)

Module 4: Post Embryonic Development (10 Hours)

Metamorphosis: Changes, hormonal regulations in amphibians and insects; Regeneration: Modes of regeneration, Role of maternal genes in development

Module 5: Implications of Developmental Biology (5 Hours)

Teratogenesis: Teratogenic agents and their effects on embryonic development; In vitro fertilization, Stem cell (ESC), Amniocentesis

Suggested Readings:

Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA

Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press

Carlson, R. F. Patten's Foundations of Embryology

Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers

Lewis Wolpert (2002). Principles of Development. II Edition, Oxford University Press

Mapping of CO's to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H		
CO 2			M		
CO 3				H	H
CO 4				M	

ZGDB305L: DEVELOPMENTAL BIOLOGY LAB

(1 CREDIT: 30 HOURS) (L-T-P: 0-0-1)

Objective(s)

To gather hands on knowledge on different developmental process

Course outcomes:

CO 1: To demonstrate the mechanisms underlying the process of development. (Understanding).

CO 2: To explain different histological structure of placenta. (Understanding)

CO 3: To prepare drosophila culture media or make a proper environment to study the chick embryo development. (Creating) CO 4: To apply the knowledge of developmental biology in different fields (Applying)

Syllabus:

Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)

Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)

Study of the developmental stages and life cycle of Drosophila from stock culture

Study of different histological structures of placenta (photomicrograph/ slides)

Study of different types of eggs : chicken, lizard, insect, frog

Study of chick embryo by vital staining method

Phylogenetic tree construction to study the development of animal germinal layers

Suggested Readings:

Marí-Beffa, M., & Knight, J. (Eds.). (2005). Key Experiments in Practical Developmental Biology. Cambridge: Cambridge University Press.

Gibbs, Melissa A. A practical guide to developmental biology(2003) Oxford ; New York : Oxford University Press

Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA

Mapping of CO's to syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
1	H	H		M	M	M	M
2			H				
3				H			
4				M	H	H	H

ZGMB306T: MOLECULAR BIOLOGY

(3 CREDITS: 45 HOURS) (L-T-P: 3-0-0)

Objective(s)

To understand the biology of organisms at molecular, nucleic acid level and acquire knowledge on their modification and mechanism of action

Course Outcomes:

CO 1: Define the molecular structure of DNA and RNA (Understanding)

CO 2: Describe the mechanism of DNA replication of both linear and circular DNA as well as protein synthesis including transcription and translation in both prokaryotes and eukaryotes. (Understanding)

CO 3: Illustrate the post-translational modifications and processing of eukaryotic mRNA and prokaryotic and eukaryotic gene regulation. (Analyzing)

CO 4: Distinguish the different DNA repair mechanisms with their significance. (Analyzing)

Module I: Nucleic Acids (4 Hours)

Salient features of DNA and RNA Watson and Crick model of DNA and molecular structure of DNA

Module II: DNA Replication (8 Hours)

DNA Replication in prokaryotes and eukaryotes, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear ds-DNA, replication of telomeres

Module III: Transcription and Translation (12 Hours)

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes, Difference between prokaryotic and eukaryotic translation

Module 4: Post Transcriptional Modifications and Processing of Eukaryotic RNA (8 Hours)

Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing, Processing of tRNA

Module 5: Gene Regulation (8 Hours)

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from lac operon and trp operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencer elements

Module 6: DNA Repair Mechanisms (5 Hours)

Pyrimidine dimerization and mismatch repair Regulatory RNAs 3 Ribo-switches, RNA interference, miRNA, siRNA

Suggested Readings:

Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. (2009). The World of the Cell. VII Edition. Pearson Benjamin Cummings Publishing, San Francisco.

Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, □ Peter Walter: Molecular Biology of the Cell, IV Edition.

Cooper G. M. and Robert E. Hausman R. E. The Cell: A Molecular Approach, V Edition, ASM Press and Sinauer Associates.

De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.

Karp, G. (2010) Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley and Sons. Inc.

Lewin B. (2008). Gene XI, Jones and Bartlett

McLennan A., Bates A., Turner, P. and White M. (2015). Molecular Biology IV Edition. GS, Taylor and Francis Group, New York and London.

Mapping of CO's to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M		M	M	M
CO 2	H	H	H			
CO 3			H	H	H	
CO 4				H	H	H

ZGMB307L: MOLECULAR BIOLOGY LAB

(1 CREDIT: 30 HOURS) (L-T-P: 0-0-1)

Objective(s)

To learn the usage of different analytical tools and techniques

Course Outcome:

CO 1: Explain the structure of chromosome. (Understanding)

CO 2: Preparation and analysis of different growth medium. (Creating)

CO 3: Estimation of DNA and RNA using different analytical tools. (Evaluating)
CO 4: Interpret the micrographs of DNA replication and split genes. (Understanding)

Syllabus:

Study of Polytene chromosomes from Chironomous / Drosophila larvae

Preparation of liquid culture medium (LB) and raise culture of Ecoli

Estimation of the growth kinetics of E. coli by turbidity method

Preparation of solid culture medium (LB) and growth of Ecoli by spreading and streaking

Demonstration of antibiotic sensitivity/resistance of E. coli to antibiotic pressure and interpretation of results

Quantitative estimation of DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A260 measurement)

Quantitative estimation of RNA using Orcinol reaction Isolation of gDNA

Agarose gel electrophoresis of sample DNA

RNA purification from blood using TriZol

Study and interpretation of electron micrographs/ photograph showing (a) DNA replication (b) Transcription (c) Split genes

Suggested readings:

Robert F. Schleif, Pieter C. Wensink (1981). Practical Methods in Molecular Biology

Paddock SW (ed) (1999) Methods in Molecular Biology, vol 122: Confocal Microscopy Methods and Protocols. Totowa, NJ:

Humana Press.

Celis JE (ed) (1998) Cell Biology: A Laboratory Handbook, 2nd edn. San Diego: Academic Press.

Mapping of CO's to syllabus

Course Outcomes	Expt 1	Expt 2	Expt 3	Expt 4	Expt 5	Expt 6	Expt 7	Expt 8	Expt 9	Expt 10
CO 1	H				M					

CO 2		H	H	H						
CO 3			H	H	H	H	H	H	H	
CO 4				H	H					H

ZGIM308T: IMMUNOLOGY

(3 CREDITS; 45 HRS) (L-T-P: 3-0-0)

Objective(s)

To understand and appreciate the intricate and robust mechanism by which components of innate and adaptive immunity works to neutralized, killed or eliminate the pathogens or their products.

Course Outcomes:

CO 1: Define the basic concepts of immunology and distinguish the two important facets of immunity, innate and adaptive; how different components of innate and adaptive collaborate to neutralize or eliminate pathogen. (Understanding)

CO 2: Develop critical definition of the antigen and the self, Immunoglobulin, antigen-antibody interactions, complement, hypersensitivity, cytokines; (Understanding)

CO 3: Apply the concepts of immunology through various laboratory techniques and vaccine development; (Applying)

CO 4: Analyze the importance of the Major Histocompatibility Complex proteins and their role in transplantation immunology. (Analyzing)

Module I: Overview of Immune System (5 Hours)

Historical perspective of Immunology, Early theories of Immunology, Cells and organs of the Immune system

Module II: Innate and Adaptive Immunity (10 Hours)

Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral), Passive: Artificial and natural Immunity, Active: Artificial and natural Immunity, Immune dysfunctions (brief account of autoimmunity with reference to Rheumatoid Arthritis and tolerance, AIDS).

Module III: Antigens (5 Hours)

Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes

Module IV: Immunoglobulins (6 Hours)

Structure and functions of different classes of immunoglobulins, Antigenantibody interactions, Immunoassays (ELISA and RIA),

Polyclonal sera, Hybridoma technology: Monoclonal antibodies in therapeutics and diagnosis

Module V: Major Histocompatibility Complex (5 Hours)

Structure and functions of MHC molecules. Endogenous and exogenous pathways of antigen processing and presentation

Module

Module VI: Cytokines (4 Hours)

Properties and functions of cytokines, Therapeutics Cytokines

Module VI: Complement System (4 Hours)

Components and pathways of complement activation.

Module VIII: Hypersensitivity (3 Hours)

Gell and Coombs' classification and brief description of various types of hypersensitivities

Module IX: Vaccines (3 Hours)

Vaccine preparations and types of vaccines.

Suggested Readings

Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition. W.H. Freeman and Company.

David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VII Edition, Mosby, Elsevier Publication.
 Abbas, K. Abul and Lichtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.

Mapping of Cos to Syllabus:

Course Outcomes	Mod I	Mod II	Mod III	Mod IV	Mod V	Mod VI	Mod VII	Mod VIII	Mod IX
CO 1	H	H							
CO 2			H	H		H	H	H	
CO 3				M					H
CO 4					H				

ZGIM309L: IMMUNOLOGY LAB

(1 CREDITS: 30 HRS) (L-T-P: 0-0-1)

Objective(s)

To learn and develop skill to carried out some of the key immunotechniques having wide clinical applications.

Course Outcomes:

CO 1: To describe the structure and function of the lymphoid organ, spleen, thymus, lymph node. (Understanding)

CO 2: To prepare blood smear for various blood cell studies and develop methods for blood group determination. (Creating)

CO 3: Demonstration of cell viability test. (Creating)

CO 4: Demonstration of various immunological techniques. (Creating)

Syllabus

*Demonstration of lymphoid organs.

Histological study of spleen, thymus and lymph nodes through slides/ photographs

Preparation of stained blood film to study various types of blood cells.

Ouchterlony's double immuno-diffusion method.

ABO blood group determination.

*Cell counting and viability test from splenocytes of farm bred animals/cell lines.

Demonstration of:

ELISA

Immunoelectrophoresis

*The experiments can be performed depending upon usage of animals in UG courses.

Mapping of Cos to Syllabus:

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
CO1	M	H					
CO2			H		H		
CO3						H	
CO4				H			H

ZGBT310T: BIOTECHNOLOGY

(3 CREDITS: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To gather knowledge on the concept, techniques and applications of Biotechnology

Course Outcomes:

CO 1: Define the concept and scope of biotechnology. (Understanding)

CO 2: Understand the basic molecular technique for gene manipulation. (Understanding)

CO 3: Analyze animal cell culture and gene therapy procedure in molecular diagnosis of various genetic diseases. (Analysing) CO 4: Apply the practical concepts of basic techniques in biotechnology. (Applying)

Module I: Introduction (8 Hours)

Concept and scope of biotechnology

Module II: Molecular Techniques in Gene manipulation (18 Hours)

Outline of Recombinant DNA technology, Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage

Restriction enzymes: Nomenclature, types of restriction enzymes

Transformation techniques: Calcium chloride method and electroporation, Construction of genomic and cDNA libraries, screening by colony and plaque hybridization Southern, Northern and Western blotting

DNA sequencing: Sanger method, Pyro-sequencing

Polymerase Chain Reaction, DNA Finger Printing and DNA micro array

Module III: Genetically Modified Organisms (12 Hours)

Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knock-out mice.

Module IV: Applications of Biotechnology (7 Hours)

Animal cell culture, Molecular diagnosis of genetic diseases (Cystic fibrosis, Sickle cell anemia)

Recombinant DNA in medicines: Recombinant insulin and human growth hormone, Gene therapy.

Suggested Readings:

Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.

Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA.

Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.

Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.

Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- Genes and Genomes- A Short Course. III Edition, Freeman and Co., N.Y., USA.

Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.

Mapping of CO's to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	L	L
CO 2		H		
CO 3			H	
CO 4				H

ZGBT311L: BIOTECHNOLOGY LAB

(1 CREDIT: 60 HOURS) (L-T-P: 0-0-1)

Objective(s)

To learn different tools and techniques of basic research in Biotechnology

Course Outcomes:

CO 1: Explain and perform the process of DNA isolation (Understanding, Applying)

CO 2: Experiment with DNA with different enzymes (Applying)
 CO 3: Construct restriction maps and analyse transformation efficiency (Creating)
 CO 4: Explain and interpret different biological techniques (Understanding)

Syllabus:

Dry Lab: Retrieval of Gene/Protein sequences from the databases.

Wet Lab: Genomic DNA isolation from sample.

Wet Lab: Plasmid DNA isolation from *E. coli* 4.

Wet Lab: Restriction digestion of plasmid DNA.

5. **Wet Lab:** Agarose gel electrophoresis of the isolated DNA 6.

Dry Lab: Design Primers for PCR Experiment and analysis.

WetLab: Polymerase chain reaction (demonstration)

Dry Lab: Download 3D protein structure and visualize the (3D) structure.

Dry Lab: To perform Sequence alignment (BLAST) and interpret the output.

Dry Lab: Use a gene prediction tool to identify potential genes in a given DNA sequence.

Suggested Readings:

. Sambrook, Joseph. 2001. Molecular Cloning: A Laboratory Manual. Cold Spring Harbor, N.Y.:Cold Spring Harbor Laboratory Press

Wilson, K. and Walker, J. 2010. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press, Cambridge.

S. Janarthanan and S, Vincent. 2007. Practical Biotechnology: Methods and Protocols World Universities Press.

4.Janusz M. Bujnicki. 2007. Practical Bioinformatics. Springer Berlin, Heidelberg. 978-3-540-74268-5

5.Zvebil, Marketa and Baum O. Jeremy 2008. Understanding Bioinformatics, Garland Science, Taylor and Francis Group, USA.

Mapping of CO's to syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6
CO1	H	H				
CO2			H			
CO3						H
CO4				H	H	

ZGMP312P: MINOR PROJECT: 4 Credit

ZGEB400T: EVOLUTIONARY BIOLOGY

(3 CREDITS: 45 HOURS) (L-T-P: 3-0-0)

Objective(s)

To provide adequate knowledge about Micro-evolutionary changes, Speciation and Adaptive Radiation, and Origin and Evolution of Man.

Course Outcomes:

CO 1: Explain the basic evolutionary processes and concept of extinction. (Understanding)

CO 2: Interpret the evolutionary history of living species through the phylogenetic analysis of molecular and morphological information. (Understanding)

CO 3: Explain the basics of evolution of population in the light of population genetics. (Understanding)

CO 4: Apply evolutionary principles in their research. (Applying)

Module I: Life's Beginnings (6 Hours)

Chemogeny, RNA world, Biogeny, Origin of photosynthesis, Evolution of eukaryotes

Module II: Historical review of evolutionary concept (3 Hours)

Lamarckism, Darwinism, Neo-Darwinism

Module III: Evidences of Evolution (8 Hours)

Fossil record (types of fossils, transitional forms, geological time scale, evolution of horse, Molecular (universality of genetic code and protein synthesizing machinery, neutral theory of molecular evolution, molecular clock.

Module IV: Source of Variations (2 Hours)

Heritable variations in evolution

Module V: Population genetics (12 Hours)

Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium; Natural selection (concept of fitness, selection coefficient, derivation of one unit of selection for a dominant allele, genetic load, mechanism of working, types of selection, density-dependent selection, heterozygous superiority, adaptive resemblances, sexual selection. Genetic Drift (mechanism, founder's effect, bottleneck phenomenon; Role of Migration and Mutation in changing allele frequencies.

Module VI: Product of evolution (7 Hours)

Micro evolutionary changes (inter-population variations, clines, races, Species concept, Isolating mechanisms, modes of speciation—allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches

Module VII: Extinctions (2 Hours)

Back ground and mass extinctions (causes and effects), detailed example of K-T extinction

Module VIII: Origin and evolution of man (3 Hours)

Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from Dryopithecus leading to Homo sapiens.

Module IX: Phylogenetic trees (2 Hours)

Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees

Suggested Readings:

Ridley, M (2004). Evolution, 3rd Edition, Blackwell publishing.

Hall, B.K. and Hallgrimson, B (2008). Evolution, 4th Edition, Jones and Barlett Publishers.

Campbell, N.A. and Reece J.B (2011). Biology, 9th Edition, Pearson, Benjamin, Cummings.

Douglas, J. Futuyma (1997). Evolutionary Biology, Sinauer Associates.

Snustad, D.P. and Simmons, M.J. (2015). Principles of Genetics, 7th edition, Wiley.

Pevsner, J (2009). Bioinformatics and Functional Genomics, 2nd Edition, Wiley Blackwell.

Mapping of COs to Syllabus:

Course Out-comes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII	Module IX
CO 1	M	M		M			M	M	
CO 2			M						
CO 3					M	M			
CO 4									H

ZGEB401L: EVOLUTIONARY BIOLOGY LAB

(2 CREDITS: 60 HOURS) (L-T-P: 0-0-2)

Objective(s)

To demonstrate understanding of ecological and evolutionary processes including the role of genetic variation, heredity, and natural selection.

Course/ Learning Outcomes:

CO 1: Explain in details about fossils from models/pictures and fossil age determination techniques. (Understanding)

CO 2: Demonstrate the concept of homology and analogy and Hardy Weinberg Law. (Understanding)

CO 3: Explain various phenomenon of evolution. (Understanding)

CO 4: Construct and interpret phylogenetic trees. (Creating and understanding)

Syllabus:

Study of fossils from models/ pictures.

Study of radiometric dating techniques used in determination of fossil age.

Study of homology and analogy from suitable specimens.

Study and verification of Hardy-Weinberg Law by chi square analysis.

Demonstration of role of natural selection and genetic drift in changing allele frequencies using simulation studies.

Graphical representation and interpretation of data of height/ weight of a sample of 100 humans in relation to their age and sex.

Construction of phylogenetic trees with the help of bioinformatics tools (Clustal X, Phylip, NJ) and its interpretation.

Study of molecular analysis of human origin.

Suggested Readings:

Ridley, M (2004). Evolution, 3rd Edition, Blackwell publishing.

Hall, B.K. and Hallgrimson, B (2008). Evolution, 4th Edition, Jones and Barlett Publishers.

Campbell, N.A. and Reece J.B (2011). Biology, 9th Edition, Pearson, Benjamin, Cummings.

Douglas, J. Futuyma (1997). Evolutionary Biology, Sinauer Associates.

Snustad, D.P. and Simmons, M.J. (2015). Principles of Genetics, 7th edition, Wiley.

Pevsner, J (2009). Bioinformatics and Functional Genomics, 2nd Edition, Wiley Blackwell.

Mapping of COs to Syllabus:

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8
CO 1	H	H						
CO 2			M	M				
CO 3					M	M		
CO 4							H	M

ZGEZ402T: ECONOMIC ZOOLOGY

(3 credits – 45 Hours) (L-T-P: 3-0-0)

Objective(s):

To develop the students for understanding on various culture system for the uplift of rural economy.

To acquaint the students about the skill of various farming systems and management for future entrepreneurship.

Course/ Learning Outcomes:

CO 1: Understand the experiential and significance of learning on lac culture, aquaculture, poultry and animal husbandry for the uplift of rural economy. (Understanding)

CO 2: Develop the skill to identify the agricultural pests and insect vectors, their role and control measures to extension services to the common people. (Evaluating)

CO 3: Create the self-employment opportunities to students through poultry, animal husbandry, aquaculture and Vermiculture. (Creating)

CO 4: Develop an overall idea of fish farming, the scientific management of different species in aquaculture and fish diseases. (Applying)

CO 5: Identify the different types of parasites, their role in human health and prophylactic measures to cure them. (Applying)

Module I: Beneficial and harmful insects (12 Hours)

Agricultural pest: Types of agricultural; Common pest's of paddy, grams and stored grains (Damage and control), Common pest's of Tea, Coconut, Cashew, sugarcane, Banana (Damage and control); Biological and integrated pest control methods. **Insect vectors:** *Anopheles*, *Culex*, *Aedes* and *Xenopsylla* as vectors for yellow fever, chikungunya, malaria, filariasis, pasteurella and rickettsia; their life cycle, pathogenicity and control.

Lac Culture: Types of Lac; Life cycle of Lac insect; Harvesting and Extraction of Lac; Uses and Enemies of Lac; Economic importance.

Module II: Poultry & Animal Husbandry (8 Hours)

Poultry: Types of birds for poultry (indigenous and exotic breeds); Quail and duck farming- advantages, housing and management, economic importance– egg and meat production; Bio-security measures followed in Poultry farms, Diseases and pests.

Animal husbandry: Types of breeds rearing in animal husbandry (Cow, Sheep and Goats, Pigs); Disease and parasites of animal husbandry; Economic importance.

Module III: Aquaculture (12 Hours)

Aquaculture: Diversity of aquaculture and significance; Pisciculture- importance, construction and management of pond; Common culturable fish, seed collection, breeding and types of culture; Modern fish farming techniques- Aquaponics, RAS, Biofloc, Aquascaping; Integrated fish farming; Fish utilization- Nutritive value and fish byproduct; Ornamental fish farming and potentials, diseases.

Prawn culture: Importance, culturable species, methods of prawn farming and marketing potential.

Pearl culture & mollusk culture: Importance, culturable species, farming techniques and marketing potential.

Module IV: Vermiculture (5 Hours)

Vermiculture: Species of earthworm used in vermiculture; Raw materials for vermiculture; Compost Production. Natural enemies and their control measures; Harvesting of vermicompost and worms; Role of vermicompost in agriculture.

Module V: Parasitology (8 Hours)

Parasitism in relation to human health: Classification of Parasites & hosts and mode of infection; Morphology, life cycle, pathogenicity & control of *Entamoeba histolytica*, *Taenia solium*, *Schistosoma haematobium*, *Ancylostoma duodenale*, *Wuchereria bancrofti*, *Enterobius vermicularis*.

Suggested Reading:

Ahmed N., Dawson M., Smith C. & Wood Ed. (2007) *Biology of Disease*. Taylor and Francis Group.

Arora, D. R. & Arora, B. (2001) *Medical Parasitology. II Edition*. CBS Publications and Distributors

Arumugam N., Murugan T., Ram Prabhu R. & Johnson Rajeshwar J. (2015) *Applied Zoology*. Saras publication Independent Pub.

Khan A.A. (2007) *Encyclopedia of Economic Zoology. 2 vols*. Anmol Publications Pvt. Ltd., New Delhi.

Metcalf R.W. & Luckmann H. (2011) *Introduction to Insect Pest Management*. Wiley India Pvt Ltd.

Noble E.R. & Noble G.A. (1982) *Parasitology: The biology of animal parasites. V Edition*. Lea & Febiger.

NPCS Board of Consultants & Engineers. The Complete Technology Book on Vermiculture and Vermicompost.

Packer B. (2014) *Aquaponics System: A Practical Guide to Building and Maintaining Your Own Backyard Aquaponics*.

Parija S. C. (2013) *Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition*. All India Publishers & Distributors, Medical Books Publishers, Chennai, Delhi

Shukla G.S. & Upadhyay, V.B. (2005) *Economic Zoology*. Rastogi Publications, Meerut, India.

Srivastava K.P. & Dhaliwal G.S. (2010) *A Text Book of Applied Entomology, Vol. II & III*. Kalyani Publishers.

Tomar B.S. (2004) *Introduction to Economic Zoology*. Emkay Publications, New Delhi.

Upadhyay V.B. (2006) *Economic Zoology*. Rastogi Publications, Meerut, India.

Mapping COs to syllabus:

Course Outcomes	Module-I	Module-II	Module-III	Module-IV	Module-V
CO1	M	H	L	L	
CO2	H				
CO3			M	H	M

CO4			H	H	
CO5					H

ZGEZ403L: ECONOMIC ZOOLOGY lab

(2 credits: 60 Hours) (L-T-P: 0-0-2)

Objective(s):*To acquaint the students for identification of various insect pests.**To develop the skill of field survey on various farming systems and management for future entrepreneurship***Course/ Learning Outcome:**

CO 1: Identify the insect vectors and the agricultural pest of tea, coconut, cashew and cotton through survey and field observation. (Applying)

CO 2: Identify the structure and biological functioning of insect vectors with preparation of permanent slides. (Applying & creating)

CO 3: Develop the skill of dissection and study the anatomy of earthworm. (Applying)

CO 4: Develop the skill of field survey to different farming systems to provide a way to entrepreneurship. (Understanding)

Syllabus

Collection and identification of pest of tea, Coconut, Cashew and cotton.

Identification of insect vectors through whole mount – *Anopheles*, *Culex*, *Aedes* and *Xenopsylla* 3.

Dissection of earthworm and study of its digestive and nervous system.

Morphology and life history of lac insect.

Identification of food and ornamental fishes of Northeastern India.

Study on prepared slides/ specimens of *Anopheles*, *Culex*, *Aedes*,

Field visit to a modern fish farming/ poultry/ cattle farming centre and write a report on it.

Suggested Reading:Ahmed N., Dawson M., Smith C. & Wood Ed. (2007) *Biology of Disease*. Taylor and Francis Group.Arora, D. R. & Arora, B. (2001) *Medical Parasitology. II Edition*. CBS Publications and DistributorsArumugam N., Murugan T., Ram Prabhu R. & Johnson Rajeshwar J. (2015) *Applied Zoology*. Saras publication Independent Pub.Khan A.A. (2007) *Encyclopedia of Economic Zoology. 2 vols*. Anmol Publications Pvt. Ltd., New Delhi.Metcalf R.W. & Luckmann H. (2011) *Introduction to Insect Pest Management*. Wiley India Pvt Ltd.Noble E.R. & Noble G.A. (1982) *Parasitology: The biology of animal parasites. V Edition*. Lea & Febiger.

NPCS Board of Consultants & Engineers. The Complete Technology Book on Vermiculture and Vermicompost.

Packer B. (2014) *Aquaponics System: A Practical Guide to Building and Maintaining Your Own Backyard Aquaponics*.Parija S. C. (2013) *Textbook of medical parasitology, protozoology & helminthology (Text and colour Atlas), II Edition*. All India Publishers & Distributors, Medical Books Publishers, Chennai, DelhiShukla G.S. & Upadhyay, V.B. (2005) *Economic Zoology*. Rastogi Publications, Meerut, India.Srivastava K.P. & Dhaliwal G.S. (2010) *A Text Book of Applied Entomology, Vol. II & III*. Kalyani Publishers.Tomar B.S. (2004) *Introduction to Economic Zoology*. Emkay Publications, New Delhi.Upadhyay V.B. (2006) *Economic Zoology*. Rastogi Publications, Meerut, India.**Mapping of COs to syllabus**

Course Outcomes	Exp. 1	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6	Exp.7
CO 1	M	H	M				
CO 2	H					M	
CO 3	M	M	M	H			H
CO 4			H				
CO 5					H		

ZGCA404T: COMPARATIVE ANATOMY OF VERTEBRATES

(3 Credits: 45 Hours)(L-T-P:3-0-0)

Objective(s)

To know the differences and similarities between the different organ structure of different vertebrate to predict whether they are related to a common ancestor or not.

Course/ Learning Outcomes:

At the end of the course, students will be able to:

CO 1: Identify the distinct anatomical structures that comprise the vertebrate body. (Understanding)

CO 2: Demonstrate the structural and functional similarities and differences of these organ systems amongst different vertebrate groups. (Applying)

CO 3: Evaluate the pattern of organ development in various vertebrate groups. (Evaluating)

CO 4: Compare the functioning of these organ systems from lower to higher vertebrates. (Analyzing)

Module I: Integumentary System (8 Hours)

Structure, functions and derivatives of integument

Module II: Skeletal System (8 Hours)

Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches

Module III: Digestive System (8 Hours)

Alimentary canal and associated glands, dentition

Module IV: Respiratory System (8 Hours)

Skin, gills, lungs and air sacs; Accessory respiratory organs

Module V: Circulatory System (8 Hours)

General plan of circulation, evolution of heart and aortic arches

Module VI: Urinogenital System (6 Hours)

Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

Module VII: Nervous System (8 Hours)

Comparative account of brain Autonomic nervous system, Spinal cord, Cranial nerves in mammals

Module VIII: Sense Organs (6 Hours)

Classification of receptors Brief account of visual and auditory receptors in man

Suggested readings

Kardong, K.V. (2005) Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition. McGraw-Hill Higher Education

Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies

Hilderbrand, M and Gaslow G.E. Analysis of Vertebrate Structure, John Wiley and Sons

Walter, H.E. and Sayles, L.P; Biology of Vertebrates, Khosla Publishing House

Mapping of Cos to Syllabus:

Course Out-comes	Mod I	Mod II	Mod III	Mod IV	Mod V	Mod VI	Mod VII	Mod VIII
CO 1	H	H	H	H	H	H	H	H
CO 2	M	M	M	M	M	M	M	M
CO 3	H	H	H	H	H	H	H	H
CO 4	M	M	M	M	M	M	M	M

ZGCA405L: COMPARATIVE ANATOMY OF VERTEBRATES LAB

(2 Credits: 60 Hours)(L-T-P: 0-0-2)

Objective(s)

To demonstrate the differences and similarities between the different organ structure of different vertebrate at laboratory.

Course Outcomes:

CO 1: Compare the different types of scales. (Analyzing)

CO 2: Demonstrate the structural and functional similarities and differences of the organ systems amongst different vertebrate groups (Applying)

CO 3: Compare the functioning of these organ systems from lower to higher vertebrates

(Applying) CO 4: Explain the arterial and urogenital system. (Understanding)

Syllabus:

Study of placoid, cycloid and ctenoid scales through permanent slides/photographs

Disarticulated skeleton of Frog, Varanus, Fowl, Rabbit

Carapace and plastron of turtle /tortoise

Mammalian skulls: One herbivorous and one carnivorous animal

Dissection of rat to study arterial and urogenital system(subject to permission)

Study of structure of any two organs (heart, lung, kidney, eye and ear) from video recording (may be included if dissection not permitted)

Project on skeletal modifications in vertebrates (may be included if dissection not permitted)

Mapping of Cos to Syllabus:

Course Outcomes	Exp. 1	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6	Exp.7
CO 1	H						
CO 2			H	H			H
CO 3							
CO 4					H		

ZGMP406T: BIOCHEMISTRY OF METABOLIC PROCESSES

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To understand how macromolecules like carbohydrate, protein, lipids metabolized for providing energy and structural component of the cells.

Course/ Learning Outcomes:

CO 1: Define characteristic features of catabolic and anabolic pathways of metabolism (Remembering)

CO 2: Demonstrate the differences of carbohydrate, lipid and protein metabolism and their inter-relationships (Understanding)

CO 3: Infer the significance of the electron transport system in metabolic pathways (Analyzing)

CO 4: Interpret the biochemistry of metabolic disorders (Evaluating)

Module I: Overview of Metabolism (9 Hours)

Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as 'Energy Currency of cell'; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms

Module II: Carbohydrate Metabolism (12 Hours)

Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis

Module III: Lipid Metabolism (8 Hours)

β -oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis

Module IV: Protein Metabolism (8 Hours)

Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids

Module V: Oxidative Phosphorylation (8 Hours)

Redox systems; Review of mitochondrial respiratory chain, Inhibitors and uncouplers of Electron Transport System

Suggested Readings:

Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.

Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.

Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.

Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.

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Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	M
CO 2		H	H	H	
CO 3					H
CO 4	M	M	M	M	M

ZGMP407L: BIOCHEMISTRY OF METABOLIC PROCESSES LAB

(2 Credits: 60 Hours) (L-T-P: 0-0-2)

Objective(s)

Develop skill to measure and trace biochemical pathways as well as enzyme activities etc. and to interpret its results.

Course Outcomes:

CO 1: Estimation of protein content (Evaluating)

CO 2: Interpretation of enzyme activity (Evaluating)

CO 3: Determination of metabolic pathways (Evaluating) CO

4: Tracing metabolic pathway using bioinformatics (Applying)

Syllabus:

1. Estimation of total protein in given solutions by Lowry's method.
2. Detection of SGOT and SGPT or GST and GSH in serum/ tissue

To study the enzymatic activity of Trypsin and Lipase.

Study of biological oxidation (SDH) [goat liver]

To perform the Acid and Alkaline phosphatase assay from serum/ tissue.

Dry Lab: To trace the ^{13}C labeled C atoms of Acetyl-CoA till they evolve as CO_2 in the TCA Cycle Mapping of Cos to Syllabus

Suggested Readings:

Cox, M.M and Nelson, D.L. (2008). Lehninger Principles of Biochemistry, V Edition, W.H. Freeman and Co., New York.

Berg, J.M., Tymoczko, J.L. and Stryer, L. (2007). Biochemistry, VI Edition, W.H. Freeman and Co., New York.

Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.

Hames, B.D. and Hooper, N.M. (2000). Instant Notes in Biochemistry, II Edition, BIOS Scientific Publishers Ltd., U.K.

https://onlinecourses.swayam2.ac.in/cec20_bt19/preview

Mapping of Cos to Syllabus

Course Outcomes	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6
CO 1	H					
CO 2		H	H		H	
CO 3				H		
CO4						H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	ZGAN104T	Animal Diversity I	4 (3-0-1)
		ZGAN105L	Animal Diversity I Lab	
2	Minor Course 2	ZGAD106T	Animal Diversity II	4 (3-0-1)
		ZGAD107L	Animal Diversity II Lab	
3	Minor Course 3	ZGPH210T	Environment and Public Health	4 (3-0-1)
		ZGPH211L	Environment and Public Health Lab	
4	Minor Course 4	ZGAZ212T	Applied Zoology I	4 (3-0-1)
		ZGAZ213L	Applied Zoology I Lab	
5	Minor Course 5	ZGAY313T	Applied Zoology II	4 (3-0-1)
		ZGAY314L	Applied Zoology II Lab	
6	Minor Course 6	ZGPE315T	Principles of Ecology	4 (3-0-1)
		ZGPE316L	Principles of Ecology Lab	
7	Minor Course 7	ZGAB408T	Animal Biotechnology	3 (2-0-1)
		ZGAB409L	Animal Biotechnology Lab	
7	Minor Course 8	ZGRM410T	Research Methodology	2
8	Minor Course 9	ZGWC411T	Wildlife Conservation and Management	3 (2-0-1)
		ZGWC412L	Wildlife Conservation and Management Lab	

ZGAN104T: ANIMAL DIVERSITY-I

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To know the general characters and classification of Non-chordates and understand the increasing complexity of body forms.

Course/ Learning Outcomes:

CO 1: Interpret the evolution of body cavity in non-Chordates. (Understanding)

CO 2: Illustrate the morphological structure different larval forms of important representative organisms belonging to these phyla. (Understanding)

CO 3: Identify the distinguishing characters of the pseudocoelomates and coelomates. (Applying)

CO 4: Distinguish the unique physiology of selected representative non-chordates. (Analyzing)

Module I: Protista, Parazoa and Metazoa (4 Hours)

General characteristics and Classification up to classes Study of Euglena, Amoeba and Paramecium Life cycle and pathogenicity of Plasmodium vivax and Entamoeba Histolytica.

Module II: Porifera (3 Hours)

General characteristics and Classification up to classes; Canal system and spicules in sponges

Module III: Cnidaria (4 Hours)

General characteristics and Classification up to classes, Metagenesis in Obelia, Polymorphism in Cnidaria, Corals and coral reefs.

Module IV: Ctenophora (2 Hours)

General characteristics and Classification up to Classes.

Module V: Platyhelminthes (4 Hours)

General characteristics and Classification up to classes. Life cycle and pathogenicity of Fasciola hepatica and Taeniasolium

Module VI: Nematelminthes (4 Hours)

General characteristics and Classification up to classes. Life cycle, and pathogenicity of Ascarislumbricoides and Wuchereriabancrofti.

Module VII: Annelida (4 Hours)

General characteristics and Classification up to classes. Reproduction, Regeneration and Locomotion of Annelida.

Module VIII: Arthropoda (4 Hours)

General characteristics and Classification up to classes. Metamorphosis in Insects; Social life in bees and termites.

Module IX: Onychophora (4 Hours)

General characteristics and Classification up to classes.

Module X: Mollusca (4 Hours)

General characteristics and Classification up to classes, Pearl formation in bivalves; Trochophore larva.

Module XI: Echinodermata (4 Hours)

General characteristics and Classification up to classes, Water-vascular system in Asteroidea, Larval forms in Echinodermata

Module XII: Hemichordata (4 Hours)

General characteristics and classification of Hemichordata up to classes; Study of Balanoglossus.

Note: Classification to be followed from "Ruppert and Barnes (2006) Invertebrate Zoology, 8th edition, Holt Saunders International Edition" CBCS Undergraduate Program in Zoology 2015

Suggested Readings

Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition

Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science

Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

Mapping of COs to Syllabus

Course Out-comes	M-I	M-II	M-III	M -IV	M-V	M-VI	M-VII	M-VIII	M-IX	M-X	M-XI	M-XII
CO 1	M			M			H			M	L	L
CO 2	H	H	H	H	H	H		H	H	H	M	M
CO 3	L				L	L			L		H	M
CO 4	H				H				M		M	H

ZGAN105L: ANIMAL DIVERSITY-I LAB

(1 Credits: 30 Hours)(L-T-P: 0-0-1)

Objective(s)

To know the general characters and classification of Non-chordates and understand the increasing complexity of body forms by doing practical and at field level.

Course/ Learning Outcomes:

CO 1: Examine and investigate different species of non-chordate (Analyzing).

CO 2: Examine various systems of non-chordate species (Analyzing).

CO 3: Differentiate different parts of body thorough prepared slides (Analyzing). CO 4: Design a project for any related topic (Creating).

Syllabus:

Study of whole mount of Euglena, Amoeba and Paramecium

Study of the following Specimens- Porifera: *Sycon* (T.S. and L.S.), *Hyalonema*, *Euplectella*, *Spongilla*; Cnidaria: *Obelia*, *Physalia*, *Millepora*, *Aurelia*, *Tubipora*, *Gorgonia*, *Metridium*, *Pennatula*, *Fungia*; Ctenophora: *Pleurobrachia*, *Ctenoplana*; Platyhelminthes: *Fasciola hepatica*, *Taeniasolium*; Nematelminthes: *Ascarislumbrecoides*; Annelida- *Aphrodite*, *Nereis*, *Heteronereis*, *Pheretima*, *Hirudinaria*; Arthropoda: *Limulus*, *Palamnaeus*, *Palaemon*, *Daphnia*, *Philosamia*, *Periplaneta*, *Termites* and *honey bees*; Onychophora-*Peripatus*, Molluscs - *Chiton*, *Dentalium*, *Pila*, *Unio*, *Sepia*, *Octopus*, *Nautilus*; Echinodermates-*Asterias*, *Ophiura*, *Echinus*, *Cucumaria*; Hemichordata- *Balanoglossus*

Examination of pond water collected from different places for diversity in protists

Dissection of the mouth parts of Cockroach

Dissection of digestive system of Cockroach

Suggested Readings

Ruppert and Barnes, R.D. (2006). Invertebrate Zoology, VIII Edition. Holt Saunders International Edition

Barnes, R.S.K., Calow, P., Olive, P. J. W., Golding, D.W. and Spicer, J.I. (2002). The Invertebrates: A New Synthesis, III Edition, Blackwell Science

Barrington, E.J.W. (1979). Invertebrate Structure and Functions. II Edition, E.L.B.S. and Nelson

Mapping of Cos to Syllabus

	Experiment 1	Experiment 2	Experiment 3	Experiment 4	Experiment 5
CO 1	H				
CO 2		H		H	
CO 3			H		
CO 4					H

ZGAD106T: ANIMAL DIVERSITY II

(3 Credits: 45 Hours)(L-T-P: 3-0-0)

Objective(s)

To know the Diversity of Chordata from lower to higher Chordates and their geographical distribution

Course/ Learning Outcomes:

CO 1: Understand the origin and evolution of the phylum Chordata. (Analyzing)

CO 2: Distinguish the unique characteristics as well as life functions of different chordate subphylum. (Applying)

CO 3: Evaluate the varied morphological, anatomical and physiological complexity in selected chordate organisms. (Understanding)

CO 4: Analyze the various theories of animal distribution and their geographical realms. (Analyzing)

Module I: Introduction to Chordates (8 Hours)

General characteristics and outline classification

Module II: Protochordata (8 Hours)

General characteristics of Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

Module III: Origin of Chordata (3 Hours)

Dipleurula concept and the Echinoderm theory of origin of chordates Advanced features of vertebrates over Protochordata

Module IV: Agnatha (2 Hours)

General characteristics and classification of cyclostomes up to class

Module V: Pisces (8 Hours)

General characteristics of Chondrichthyes and Osteichthyes, classification up to order Migration, Osmoregulation and Parental care in fishes

Module VI: Amphibia (8 Hours)

Origin of Tetrapoda (Evolution of terrestrial ectotherms); General characteristics and classification up to order; Parental care in Amphibians

Module VII: Reptilia (7 Hours)

General characteristics and classification up to order; Affinities of Sphenodon; Poison apparatus and Biting mechanism in snakes

Module VIII: Aves (8 Hours)

General characteristics and classification up to order Archaeopteryx- a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds

Module IX: Mammals (8 Hours)

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Suggested readings

Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.

Pough H. Vertebrate life, VIII Edition, Pearson International.

Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.

Hall B.K. and Hallgrímsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.

T.C. Majumuria. Introduction to Chordates, Pradeep Publications.

Veerbala Rastogi. Vertebrate Zoology, Kedar Nath Ram Nath Publication

Mapping of Cos to syllabus

	Mod I	Mod II	Mod III	Mod IV	Mod V	Mod VI	Mod VII	Mod VIII	Mod IX
CO1	M	L	M	L					
CO2		H		H	H	H	H	H	H
CO3				H	H	H	H	H	H
CO4	M								

ZGAD107L: ANIMAL DIVERSITY II LAB

(1 credits: 30 Hours)(L-T-P: 0-0-1)

Objective(s)

To demonstrate the different Chordates from lower to higher Chordates with help of the laboratory specimen.

Course/ Learning Outcomes

CO 1: Identify distinguishing characteristics of representative museum specimens belonging to different phyla. (Applying)

CO 2: Determine their affinities and evolutionary relationships. (Evaluating)

CO 3: Examine specific organ structures through dissections. (Analyzing)

Syllabus

Protochordata: Herdmania, Branchiostoma, Colonial Urochordata Sections of Balanoglossus through proboscis and branchiogenital regions, Sections of Amphioxus through pharyngeal, intestinal and caudal regions. Permanent slide of Herdmania spicules

Agnatha: Petromyzon, Myxine

Pieces: Scoliodon, Sphyrna, Pristis, Torpedo, Chimaera, Mystus, Heteropneustes, Labeo, Exocoetus, Echeis, Anguilla, Hippocampus, Tetodon/ Diodon, Anabas, Flat fish

Amphibia: Ichthyophis/Uraeotyphlus, Necturus, Bufo, Hyla, Alytes, Salamandra

Reptilia: Chelone, Trionyx, Hemidactylus, Varanus, Uromastix, Chamaeleon, Ophiosaurus, Draco, Bungarus, Vipera, Naja, Hydrophis, Zamenis, Crocodylus Key for Identification of poisonous and non-poisonous snakes
 Aves: Study of six common birds from different orders. Types of beaks and claws
 Mammalia: Sorex, Bat (Insectivorous and Frugivorous), Funambulus, Loris, Herpestes, Erinaceus. Mount of weberian ossicles of Mystus, pecten from Fowl head Dissection of Fowl head (Dissections and mounts subject to permission) Powerpoint presentation on study of any two animals from two different classes by students (may be included if dissections not given permission)

Suggested readings

Young, J. Z. (2004). The Life of Vertebrates. III Edition. Oxford university press.
 Pough H. Vertebrate life, VIII Edition, Pearson International.
 Darlington P.J. The Geographical Distribution of Animals, R.E. Krieger Pub Co.
 Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
 T.C. Majumuria. Introduction to Chordates, Pradeep Publications.
 Veerbala Rastogi. Vertebrate Zoology, Kedar Nath Ram Nath Publication

Suggested Readings

Campbell & Reece (2005). Biology, Pearson Education, (Singapore) Pvt. Ltd.
 Kardong, K.V. (2002). Vertebrates Comparative Anatomy. Function and Evolution. Tata Mc Graw Hill Publishing Company.
 New Delhi.
 Raven, P.H. and Johnson, G.B. (2004). Biology, 6th edition, Tata McGraw Hill Publications. New Delhi.

Mapping of COs to syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
CO1	H	H	H	H	H	H	H
CO2	M	M	M	M	M	M	M
CO3							H

ZGPH210T: ENVIRONMENT AND PUBLIC HEALTH

(3 Credits: 45 Hours)(L-T-P:3-0-0)

Objective(s)

After completion of the course, students will be able to explain the critical importance of evidence in advancing public health knowledge, effects of environmental factors on a population's health, and global burdens of disease.

Course/ Learning Outcomes:

CO 1: Illustrate the effects of air, water and noise pollution with regards to human health. (Understanding)
 CO 2: Identify different types and sources of environmental hazards, their persistence, dose and exposure. (Applying)
 CO 3: Distinguish the different factors contributing to climate change and their effect in human health. (Analyzing)
 CO 4: Compile the various types of waste generated, their disposal and management. (Creating)

Module I: Introduction (5 Hours)

Definition of Environmental Health and Environmental Hazards; Categories of Environmental Hazard; Principles of hazard management; Inherent Capacity of Environment; Categories of Pollution.

Module II: Pollution: (20 hours)

Air Pollution: Types, Sources, Effects and Control. Greenhouse effects, Global warming, Acid rain and Ozone layer depletion.

Water Pollution: Types, Sources, Effects and Control; Minamata diseases. Noise pollution: Types, Sources, Effects and Control of Noise Pollution.

Module III: Case histories: (5 hours)

Bhopal gas tragedy, Chernobyl disaster, Seveso disaster and Three Mile Island accident and their aftermath.

Module IV: Solid Waste Management: (10 hours)

Definition of Solid Waste, Types of Solid Waste, Sources of waste, Management of Solid waste. Biomedical waste handling and disposal, Nuclear waste handling and disposal, Waste from thermal power plants.

Module V: Diseases (5 Hours)

Causes, symptoms and control of tuberculosis, Asthma, Cholera, Minamata disease, typhoid

Suggested Readings:

Cutter, S.L., Environmental Risk and Hazards, Prentice-Hall of India Pvt. Ltd., New Delhi, 1999.

Kolluru Rao, Bartell Steven, Pitblado R and Stricoff "Risk Assessment and Management Handbook", McGraw Hill Inc., New York, 1996.

Kofi Asante Duah "Risk Assessment in Environmental management", John Wiley and sons, Singapore, 1998.

Kasperson, J.X. and Kasperson, R.E. and Kasperson, R.E., Global Environmental Risks, V.N. University Press, New York, 2003.

Joseph F Louvar and B Diane Louver Health and Environmental Risk Analysis fundamentals with applications, Prentice Hall, New Jersey 1997.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1		M	H		
CO 2	H			L	
CO 3	L	H			H
CO 4				H	L

ZGPH211L: ENVIRONMENT AND PUBLIC HEALTH LAB

(1 Credits: 30 Hours) (L-T-P: 0-0-1)

Objective(s):

To demonstrate the physical and chemical properties of water and soil.

Course/ Learning Outcomes:

CO1. To learn the procedure to find out the pH, Cl, SO₄ and NO₃ of soil of different location. (Applying)

CO2. To learn the procedure of determination of pH, DO and CO₂ in pond water. (Applying)

Syllabus

To determine pH, Cl, SO₄, NO₃ in soil samples from different locations.

To determine pH, CO₂, DO, Transparency and NO₃ in water samples from different locations.

Mapping of COs to Syllabus

Course Outcomes	Exp.1	Exp.2
CO1	H	
CO2		H

ZGAZ212T: APPLIED ZOOLOGY I

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To gain knowledge and get acquainted with major aspects of Sericulture, Apiculture, Vermiculture and Aquaculture.

Course/ Learning Outcomes:

- CO 1: Gain a thorough knowledge about different kinds of silkworms, study of different host plants of the silkworms, cultivation of silkworm, seed technology, treatment of silk cocoons and silk reeling. (Applying)
- CO 2: Learn about the various skills that are necessary for self-employment in the muga and eri silk cultivation, seed production and vermiculture. (Applying)
- CO 3: Understand the basic life cycle of the honeybee. Learn about beekeeping tools and equipment; manage beehives for honey production and pollination. (Evaluating)
- CO 4: Gain an overview of fish farming, the scientific management of different species in aquaculture, aquarium keeping and fish diseases. (Applying)

Module I: Sericulture (15 hours)

Introduction to Sericulture: Types of silkworms, Biology of Silkworm: Life cycle of *Samia ricini* and *Antheraea assamensis*, Structure of silk gland and secretion of silk, Rearing of silkworms and management practices.

Disinfectants: Formalin, bleaching powder, Silkworm rearing technology: Early age and Late age rearing, Types of mountages Spinning, harvesting and storage of cocoons, treatment of cocoons, Pests and Diseases of silkworms.

Entrepreneurship in Sericulture: Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

Module II: Apiculture (8 hours)

Different species of honey bees, bee plants, pollen calendar, bee keeping and management practices, bee products, Bee enemies and diseases.

Module III: Vermiculture (7 Hours)

Species of worms, condition for efficient vermiculture (domestic and commercial level), Economics of Vermiculture

Module IV: Aquaculture (15 hours)

Aquarium fish keeping: Ornamental Fishes of India special reference to North East India, common aquarium fishes; Aquarium Maintenance, Fisheries management: Composite fish culture, induced breeding and hybridization; Prawn and Pearl Culture, Exotic and Indigenous food Fishes of NE India, Fish and shellfish diseases and their control measures. Fish genetic resource conservation; Aquaponics—prospect and future

Suggested Readings

Venkitaraman: Economic Zoology, Sudarsana Publishers

Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers

Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.

Ananthakrishnan, T. N. and K.G. Shivaramakrishnan. Ecological entomology: Insect life in odd environment. Scientific Pub.: India

David, B. V and T.N. Ananthakrishnan. General and Applied Entomology. 2nd Edition. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi

Fenemore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)

Packer, B. Aquaponics System: A Practical Guide to Building and Maintaining Your Own Backyard Aquaponics

Jayashree, K.V., C.S. Tharadevi & N. Aurumugam. Apiculture. Saras Publication

Chandra Girish. Apiculture & the Honey Bee (Know about the species of honey bees, beekeeping, pollination, beehives, entomology, beekeepers, honey making

Arumugam, N., T. murugan, R. Ram Prabhu, J. Johnson Rajeshwar. Applied Zoology. Saras publication

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M		H	

CO 3		H		
CO 4				H

ZGAZ213L: APPLIED ZOOLOGY I LAB:

(1 CREDITS: 30 HOURS) (L-T-P: 0-0-1)

Objective(s)

To be acquainted with hands on training on the biology of silkworms, worms used in Vermiculture, the different life cycles of honey bees and to be able to identify economically important fishes

Course Outcomes:

CO 1: Develop knowledge regarding cultivation of silkworm, maintenance of the farm, selection of disease free eggs, silkworm rearing and silk reeling. (Applying)

CO 2: Learn about the various skills that are necessary for self-employment in the cultivation of muga and eri silkworms and vermiculture. (Applying)

CO 3: Understand the basic life cycle of the honeybee. Learn about beekeeping tools and equipment; manage beehives for honey production and pollination. (Evaluating)

CO 4: Identification of different types of fishes and their economic importance. (Identifying)

Syllabus:

Field Visit to any Sericulture Department to study about silkworm rearing

To study the life cycle of *Antheraea assama* and *Samia ricini*

Identification of different types of worms used for Vermiculture

To study the different types of caste of honeybees

Maintenance of freshwater aquarium

Identification of economically important fishes

Suggested Readings

Venkitaraman: Economic Zoology, Sudarsana Publishers

Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers

Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.

Ananthakrishnan, T. N. and K.G. Shivaramakrishnan. Ecological entomology: Insect life in odd environment. Scientific Pub.: India

David, B. V and T.N. Ananthakrishnan. General and Applied Entomology. 2nd Edition. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi

Fenemore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)

Packer, B. Aquaponics System: A Practical Guide to Building and Maintaining Your Own Backyard Aquaponics

Mapping of COs to Syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6
CO 1	M					
CO 2		H	M			
CO 3				M		
CO 4					M	H

ZGAY313T: APPLIED ZOOLOGY II

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s):

To impart knowledge regarding management of poultry and economically important pest.

To understand the importance of biodiversity and their conservation.

Course Outcomes:

CO 1: Learn basic concepts of poultry farming, housing, biosecurity measures, prevention of outbreaks and economics of poultry sciences. (Applying)

- CO 2: Identify and understand the different types of parasites, their life cycles and the diseases caused by them. Identifying viruses carrying vectors, like Aedes, Culex and Anopheles; Learn about the economic importance and biodiversity of different insects. (Evaluating)
- CO 3: Learn about the different types of pests and their hosts; and apply the latest knowledge in management of pest population. (Applying)
- CO 4: Analyze the importance of biodiversity and threats to biodiversity and design steps to protect and conserve biodiversity. (Analyzing and Creating)

Module I: Poultry management (6 hours)

Poultry rearing / farming: housing and equipments, breeds of fowls, nutritional requirements, poultry diseases, poultry products: Broilers, meat processing and meat products, poultry by-products.

Module II: Parasitology (18 hours)

Introduction to Parasitology: Types of parasites, Types of Host, Zoonosis, Host-parasite Relationship, Sources of Infection, Mode of infection, Pathogenesis.

Vibrio cholera and *Clostridium tetani*- Life Cycle, mode of transmission, infection and treatment.

Dengue and Bird flu - Life cycle, mode of transmission, infection and treatment.

Life history and mode of transmission of *Entamoeba histolytica*, *Plasmodium vivax*, *Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* and the diseases caused by them.

Module III: Insect pest management, Public Health and Forensic Entomology (8 hours)

Concept of Pest, different kinds of pest, concept of integrated pest management (IPM)

Mosquito (*Aedes*, *Culex*, *Anopheles*): Taxonomy, Life cycle, Biology, Behavior and their control. Life cycle of Calliphora and Scrophaga, determination of death and causes of death.

Module IV: Biodiversity (7 hours)

Components of Biodiversity, Threats to biodiversity, biodiversity conservation, hot spots and heritage sites, IUCN Red List Categories, keystone species, habitat diversity of Indian wildlife, endemic and threatened species of North East India, National parks and wildlife sanctuaries present in North East India, Ethnozoology with special reference to North East India

Module V: Insects of Economic Importance (6 hours)

Biology, Control and damage caused by *Helicoverpa armigera*, *Pyrilla perpusilla* and *Papilio demoleus*, *Callosobruchus chinensis*, *Sitophilus oryzae* and *Tribolium castaneum*

Suggested Readings

Venkitaraman: Economic Zoology, Sudarsana Publishers

Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers

Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.

Ananthakrishnan, T. N. and K.G. Shivaramakrishnan. Ecological entomology: Insect life in odd environment. Scientific Pub.: India

David, B. and T.N. Ananthakrishnan. General and Applied Entomology. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi

Dent, D. R. Insect pest management. Westville Publishing House: Delhi

Eldridge B Medical entomology (Springer)

Fenimore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	H		M
CO 3			M		M
CO 4				H	

ZGAY314L: APPLIED ZOOLOGY II Lab

(1 Credit: 30 Hours) (L-T-P: 0-0-1)

Objective(s)

To impart latest knowledge in pest management techniques, management of disease carrying vectors and poultry farming

Course Outcomes:

CO 1: Learn about the different types of pests and apply the latest knowledge of pest management techniques. (Applying)

CO 2: Creating awareness regarding virus carrying vectors, like Aedes, Culex and Anopheles etc. (Understanding)

CO 3: Learn about the insects of economic importance and biodiversity. (Applying)

CO 4: Learn about basics of poultry farming and advances in housing and equipments. (Applying)

Syllabus

Visit to poultry farm or animal breeding centre. Submission of visit report

Study of Life Cycle of Aedes, Culex and Anopheles through Photographs

Study of *Plasmodium vivax*, *Entamoeba histolytica*, *Trypanosoma gambiense*, *Ancylostoma duodenale* and *Wuchereria bancrofti* and their life stages through photographs

Study of vectors associated with human diseases: Pediculus, Culex, Anopheles, Aedes and Xenopsylla.

Study of insect damage to different plant parts/stored grains through damaged products/photographs; Identifying feature and economic importance of pest of stored grains and tea pest

Suggested Readings

Venkitaraman: Economic Zoology, Sudarsana Publishers

Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers

Shukla & Upadhyaya : Economic Zoology. Rastogi Publishers.

Ananthakrishnan, T. N. and K.G. Shivaramakrishnan. Ecological entomology: Insect life in odd environment. Scientific Pub.: India

David, B. and T.N. Ananthakrishnan. General and Applied Entomology. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi

Dent, D. R. Insect pest management. Westville Publishing House: Delhi

Mapping of COs to Syllabus

Course Outcomes	1	2	3	4	5
CO 1					M
CO 2		H	H	H	
CO 3					M
CO 4	M				

ZGPE315T: PRINCIPLES OF ECOLOGY

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To understand concepts and the Principles in ecology and wildlife management

Course Outcomes:

CO 1: Distinguish the mechanism of various biological interactions (Understanding).

CO 2: Analyse different population dynamics and interactions (Analysing).

CO 3: Evaluate ecosystem energetics with reference to food chain, food web (Evaluating).

CO 4: Apply conservation and management strategies for local endangered species (Applying)

Module I: Introduction to Ecology (3 Hours)

History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors

Module II: Population (20 Hours)

Unitary and Modular populations Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion Exponential and logistic

growth, equation and patterns, r and K strategies Population regulation - density-dependent and independent factors Population interactions, Gause's Principle with laboratory and field examples

Module III: Community (10 Hours)

Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological succession with one example Theories pertaining to climax community

Module IV: Ecosystem (10 Hours)

Types of ecosystems with one example in detail, Food chain: Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies Nutrient and biogeochemical cycle with one example of Nitrogen cycle Human modified ecosystem

Module V: Applied Ecology (2 Hours)

Ecology in Wildlife Conservation and Management

SUGGESTED READINGS

Colinvaux, P. A. (1993). Ecology.II Edition.Wiley, John and Sons, Inc.
 Krebs, C. J. (2001). Ecology.VI Edition. Benjamin Cummings.
 Odum, E.P., (2008). Fundamentals of Ecology.Indian Edition. Brooks/Cole
 Robert Leo Smith Ecology and field biology Harper and Row publisher
 Ricklefs, R.E., (2000). Ecology.V Edition. Chiron Pres

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	M	E	
CO2		H	M	M	
CO3		E	H		
CO4			E		H

ZGPE316L: PRINCIPLES OF ECOLOGY LAB

(1 Credit: 30 Hours) (L-T-P: 0-0-1)

Objective(s)

To gain the knowledge and understand about the status and the diversity of the different ecosystems

Course Outcomes

- CO 1: Investigate life tables and survivorship curves of different types (Analyzing).
- CO 2: Estimate and analyse different population dynamics and interactions (Analyzing).
- CO 3: Evaluate the aquatic ecosystem (Evaluating).
- CO 4: Design a project for any related topic (Creating).

Syllabus

Study of life tables and plotting of survivorship curves of different types from the hypothetical/real data provided
 Determination of population density in a natural/hypothetical community by quadrat method and calculation of Shannon- Weiner diversity index for the same community
 Study of an aquatic ecosystem: Phytoplankton and zooplankton, Measurement of area, temperature, turbidity/penetration of light, determination of pH, and Dissolved Oxygen content (Winkler's method), Chemical Oxygen Demand and free CO₂, alkalinity and hardness of water
 Report on a visit to National Park/Biodiversity Park/Wild life sanctuary

SUGGESTED READINGS

Colinvaux, P. A. (1993). Ecology.II Edition.Wiley, John and Sons, Inc.
 Krebs, C. J. (2001). Ecology.VI Edition. Benjamin Cummings.
 Odum, E.P., (2008). Fundamentals of Ecology.Indian Edition. Brooks/Cole
 Robert Leo Smith Ecology and field biology Harper and Row publisher

Ricklefs, R.E., (2000). Ecology.V Edition. Chiron Pres

Mapping of COs to Syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4
CO1	H			
CO2		H		
CO3			H	
CO4				H

ZGMP312P: MINOR PROJECT: 4 Credit

ZGAB408T: ANIMAL BIOTECHNOLOGY

(2 Credits: 30 Hours) (L-T-P: 3-0-0)

Objective(s)

To study the techniques and application of animal biotechnology and their relevance in today's world

Course Outcomes:

CO 1: Define the concept and scope of animal biotechnology.(Understanding)

CO 2: Understand the basic molecular technique for gene manipulation.(Understanding)

CO 3: Analyze animal cell culture and gene therapy procedure in molecular diagnosis of various genetic diseases. (Analyzing) CO 4: Apply the practical concepts of basic techniques in animal biotechnology.(Applying)

Module1. Introduction (2 Hours)

Concept and scope of animal biotechnology

Module2. Molecular Techniques in Gene manipulation (12 Hours)

Outline of Recombinant DNA technology, introduction to Cloning vectors and Restriction enzymes. Techniques used in animal biotechnology: DNA isolation, PCR, Sanger Sequencing, DNA microarray.

Module 3. Genetically Modified Organisms (10 Hours)

Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection .Applications of transgenic animals

Module 4. Applications of Biotechnology (6 Hours)

Animal cell culture, application of animal biotechnology in healthcare and medicine.

Suggested Readings:

Brown, T.A. (1998). Molecular Biology Labfax II: Gene Cloning and DNA Analysis. II Edition, Academic Press, California, USA.

Glick, B.R. and Pasternak, J.J. (2009). Molecular Biotechnology - Principles and Applications of Recombinant DNA. IV Edition, ASM press, Washington, USA

Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.

Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.

Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA- Genes and Genomes- A Short Course.

III Edition, Freeman and Co., N.Y.,USA.

Beauchamp, T.I. and Childress, J.F. (2008). Principles of Biomedical Ethics. VI Edition, Oxford University Press.

Mapping of CO's to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	L	L
CO2		H		
CO3			H	M
CO4				H

ZGAB409L: ANIMAL BIOTECHNOLOGY LAB

(1 Credit: 30 Hours) (L-T-P: 0-0-1)

Objective(s)*To acquaint oneself with basic biotechnology experiments***Course Outcomes:**

CO 1: Explain and perform the process of DNA isolation (Understanding, Applying)

CO 2: Experiment with DNA with different enzymes (Applying)

CO 3: Learn PCR technique and analysis (Analysing)

CO 4: Explain and interpret different biological techniques (Understanding)

Syllabus:

1.Genomic DNA isolation from sample

2. Restriction digestion of plasmid DNA.

Polymerase chain reaction (demonstration)

To study following techniques through photographs: Southern Blotting, Northern Blotting Western Blotting , DNA fingerprinting

Suggested Readings:

Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An Introduction to Genetic Analysis. IX Edition. Freeman and Co., N.Y., USA.

Snustad, D.P. and Simmons, M.J. (2009). Principles of Genetics. V Edition, John Wiley and Sons Inc.

Sambrook, Joseph. 2001. Molecular Cloning : A Laboratory Manual. Cold Spring Harbor, N.Y. :Cold Spring Harbor Laboratory Press

S , Janarthanan and S, Vincent. 2007. Practical Biotechnology: Methods and Protocols World Universities Press.

Mapping of CO's to syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3	Experiment 4
1	H			
2		H		
3			H	
4				H

ZGRM410T: RESEARCH METHODOLOGY

(2 Credits: 30 Hours)(L-T-P: 2-0-0)

Objective(s):*To develop the students to understand about various aspect of research and its significance.**To create the analytical thinking and judicious solving on any activities in their future.***Course outcomes:**

CO 1: Define various kinds of research, objectives of doing research, research process, research designs and sampling. (Remembering)

CO 2: Demonstrate basic knowledge on research techniques. (Understanding)

CO 3: Analyze the data collected in research through the use of analytical research tools.

(Analyzing) CO 4: Design solutions to varied biological problems. (Creating)

Module I: Foundations of Research (5 Hours)

Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied

Module II: Research Design (8 Hours)

Need for research design: Features of good design, Important concepts related to good design- Observation and Facts,

Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs

Module III: Data Collection, Analysis and Report Writing (12 Hours)

Observation and Collection of Data-Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis writing, Preparation of Tables and Bibliography. Data Presentation using digital technology

Module IV: Ethical Issues (5 Hours)

Intellectual property Rights, Commercialization, Copyright, Royalty, Patent law, Plagiarism, Citation, Acknowledgement

Suggested readings

Anthony, M, Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
Walliman, N. 2011. Research Methods- The Basics. Taylor and Francis, London, New York.
Wadhwa, B.L.: Law Relating to Patents, Trade Marks, Copyright Designs and Geographical Indications, 2002, Universal Law publishing
C.R. Kothari: Research Methodology, New Age International, 2009
Coley, S.M. and Scheinberg, C.A. 1990, "Proposal writing". Stage Publications.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H	M	
CO 2	H			
CO 3	M	M	M	H
CO 4			H	

ZGWC411T: WILDLIFE CONSERVATION AND MANAGEMENT

(2 Credits: 30 Hours) (L-T-P: 2-0-0)

Objective(s)

To impart the knowledge on modern concepts of management and conservation of Wildlife and the related Government Act.

Course Outcome:

CO 1: Explain the importance of evaluation and management of wildlife and their habitat. (Understanding)
CO 2: Analyze various characteristics of population. (Analyzing)
CO 3: Explain the management strategies to protect/unprotected areas. (Understanding)
CO 4: Apply conservation and management strategies for local endangered species. (Applying)

Module I: Introduction (7 Hours)

Introduction to Wild Life, evaluation of wild life Habitat, remote sensing and GIS in evaluation of wildlife habitat; Depletion of Wildlife; Importance of conservation; Conservation ethics, World conservation strategies.

Module II: Management of habitats (6 Hours)

Setting back succession; Grazing logging; Mechanical treatment; Advancing the succession process; Cover construction;
Preservation of general genetic diversity; Restoration of degraded habitats

Module III: Population estimation (6 Hours)

Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation; Faecal analysis of ungulates and carnivores: Faecal samples, slide preparation, Hair identification, Pug marks and census method.

Module IV: Management and planning (9 Hours)

Protected areas National parks & sanctuaries, Community reserve; Important features of protected areas in India; Management planning of wild life in protected areas; Estimation of carrying capacity; Eco tourism / wild life tourism in forests; Concept of climax persistence; Ecology of perturbation.

Module V: Management of excess population (2 Hours)

Bio- telemetry; Care of injured and diseased animal; Quarantine; Common diseases of wild animal

Suggested Readings:

Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
 Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflictor Co-existence? Cambridge University.
 Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5 th edition. The Wildlife Society, Allen Press.
 Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
 Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	M		H
CO2			H	M	
CO3	L			H	
CO4	M	L		H	M

ZGWC412L: WILDLIFE CONSERVATION AND MANAGEMENT LAB

(1 Credits: 30 Hours) (L-T-P: 0-0-1)

Objective(s)

To identify the different wildlife species and demonstration of wildlife census.

Course Outcomes:

CO 1: Identify different fauna species. (Applying)
 CO 2: Apply the equipment used for wildlife studies. (Understanding, applying)
 CO 3: Analyze animal signs (Analyzing)
 CO 4: Apply different field and survey techniques (Applying)

Syllabus:

Identification of mammalian fauna, avian fauna, herpeto-fauna.
 Demonstration of basic equipment needed in wildlife studies use, care and maintenance (Compass, Binoculars, Spotting scope, Range Finders, Global Positioning System, Various types of Cameras and lenses)
 Familiarization and study of animal evidences in the field; Identification of animals through pug marks, hoof marks, scats, pellet groups, nest, antlers etc.
 Demonstration of different field techniques for flora and fauna
 PCQ, Ten tree method, Circular, Square & rectangular plots, Parker's 2 Step and other methods for ground cover assessment, Tree canopy cover assessment, Shrub cover assessment.
 Trail / transect monitoring for abundance and diversity estimation of mammals and bird (direct and indirect evidences)

Suggested Readings:

Caughley, G., and Sinclair, A.R.E. (1994). Wildlife Ecology and Management. Blackwell Science.
 Woodroffe R., Thirgood, S. and Rabinowitz, A. (2005). People and Wildlife, Conflictor Co-existence? Cambridge University.
 Bookhout, T.A. (1996). Research and Management Techniques for Wildlife and Habitats, 5 th edition. The Wildlife Society, Allen Press.
 Sutherland, W.J. (2000). The Conservation Handbook: Research, Management and Policy. Blackwell Sciences
 Hunter M.L., Gibbs, J.B. and Sterling, E.J. (2008). Problem-Solving in Conservation Biology and Wildlife Management: Exercises for Class, Field, and Laboratory. Blackwell Publishing.

Mapping of COs to Syllabus

Course Outcomes	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6
CO1	H					
CO2		H				
CO3			H			
CO4				H	H	H

SKILL ENHANCEMENT COURSES

Se- mes- ter	Category	Course Code	Course Name	Credits
1	S E Course 1	ZGAC108L	Apiculture	3 (0-0-3)
2	S E Course 2	ZGSE109L	Sericulture	3 (0-0-3)
3	S E Course 3	ZGAK214L	Aquarium Fish Keeping	3 (2-0-1)

ZGAC108L: APICULTURE

(3 credits: 45 Hours)(L-T-P: 3-0-0)

Objective(s)

The students will be able to understand the basics knowledge of beekeeping, beekeeping tools, equipment, and managing beehives.

Course Outcomes:

CO 1: The learner will be able to manage beehives for honey production and pollination. (Applying)

CO 2: The course will be useful for providing self-employment to the learner. (Understanding)

CO 3: The learner will be able to understand the marketing of various bee products. (Understanding)

CO 4: The learner will be able to apply the basics knowledge of beekeeping tools, equipment, and managing beehives.

(Applying)

Module I: (3 Hours)

Introduction to Apiculture: Importance and History

Module II: (6 Hours)

Different Species of Honey bee. Species and Sub-Species of Hive Bees, General morphology and anatomical features.

Module III: (Hours)

Colony Organization and Life cycle of honey bee. Dances of honey bees

Module IV: (7 Hours)

Bee Hive and other Equipment, Selection of Apiary site and bee Species, Examination of bee colony, Maintenance of Apiary records

Module V: (10 Hours)

Principles of Bee Management, Spring management, Swarming and control, Summer management, Monsoon and Autumn management, Winter management, Swarming and control, Migratory bee keeping

Module VI: (5 Hours)

Dividing, Uniting and Shifting of bee colonies, Robbing and Absconding, Supplementary feeding, Economics of Bee Keeping

Module VII: (3 Hours)

Queen Management, Queen rearing, Mass Queen rearing

Module VIII: (5 Hours)

Bee enemies and diseases: Predatory wasps, Wax moths, Ectoparasite mites and other bee enemies. Different diseases of honey bees.

Mapping of COs to Syllabus

Course Out-comes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	M			E	M			
CO2		E			H		E	M
CO3	M			M		E		
CO4			E				M	

ZGSC109L: SERICULTURE

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s)

To inculcate the skills in Sericulture with special emphasis on the rearing of silkworms, diseases and pest and entrepreneurship in Sericulture

Course Outcomes:

CO 1: Outline various kinds of silkworms, their life cycles, the silk they produce and the present status of silk production in India as well as abroad (Understanding)

CO 2: Examine silkworm rearing techniques, with special importance given to those extensively reared in North East India (Analyzing)

CO 3: Inspect the loss in silk production due to increased silkworm mortality as a result of pests and diseases (Analyzing)

CO 4: Design start-ups or entrepreneur proposals to enhance the economy of the Sericulture industry thereby boosting the younger generation to develop skill in uplifting this indigenous industry (Creating)

Module I: Introduction (4 Hours)

Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races Exotic and indigenous races Mulberry and non-mulberry Sericulture

Module II: Biology of Silkworm (6 Hours)

Life cycle of *Philosamiaricini*, *Antheraeaassama* and *Bombyxmori*, Structure of silk gland and secretion of silk

Module III: Rearing of Silkworms (15 Hours)

Selection of a non-mulberry variety and establishment of garden, Rearing of Eri, Muga and Bombyxmori silkworm, Rearing house and rearing appliances Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types of mountages Spinning, harvesting and storage of cocoons.

Module IV: Pests and Diseases (5 Hours)

Pests of silkworm: Uzi fly, dermestid beetles and vertebrates Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases

Module V: Entrepreneurship in Sericulture (15 Hours)

Prospectus of Sericulture in India: Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture. Visit to various sericulture centres.

Suggested Readings:

Manual on Sericulture; Food and Agriculture Organisation, Rome 1976
 Handbook of Practical Sericulture: S.R. Ullal and M.N. Narasimhana CSB, Bangalore
 Silkworm Rearing and Disease of Silkworm, 1956, Ptd. By Director of Ptg., Stn. & Pub. Govt. Press, Bangalore
 Appropriate Sericultural Techniques; Ed. M. S. Jolly, Director, CSR & TI, Mysore.
 Handbook of Silkworm Rearing: Agriculture and Technical Manual-1, Fuzi Pub. Co. Ltd., Tokyo, Japan 1972.
 Manual of Silkworm Egg Production; M. N. Narasimhana, CSB, Bangalore 1988.
 Silkworm Rearing; Wupang—Chun and Chen Da-Chung, Pub. By FAO, Rome 1988.
 A Guide for Bivoltine Sericulture; K. Sengupta, Director, CSR & TI, Mysore 1989.
 Improved Method of Rearing Young age silkworm; S. Krishnaswamy, reprinted CSB, Bangalore, 1986.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M	H	H		
CO2	M	M	M		
CO3			E	E	H
CO4		E	E		

ZGAK214L: AQUARIUM FISH KEEPING

(2 Credits: 30 Hours) (L-T-P:2-0-0)

Objective(s):

To understand the scope of aquarium fish industry.

To develop entrepreneurship skills on aquarium fish keeping as a future career.

Course/ Learning Outcomes:

CO 1: Explain the scope of aquarium fish industry and the biology of aquarium fishes, both freshwater and marine. (Understanding)

CO 2: Compare food formulation and feeding techniques of aquarium fish. (Analyzing)

CO 3: Analyze the scope of the aquarium fish Industry as a means of livelihood (Analyzing)

CO 4: Identify techniques and skills in fish transportation (Applying)

Module I: Introduction to Aquarium Fish (2 Hours)

Introduction to aquarium fish, the scope of aquarium fish industry based on endemic and exotic species.

Module II: Biology of Aquarium Fishes (10 Hours)

Common characters and sexual dimorphism of Freshwater and Marine fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.

Module III: Food and feeding of Aquarium fishes (8 Hours)

Use of live fish feed organisms. Preparation and composition of formulated fish feeds.

Module IV: Fish Transportation (4 Hours)

Live fish transport - Fish handling, packing and forwarding techniques.

Module V: Maintenance of Aquarium (6 Hours)

General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry.

Suggested Readings

Brymer, J.H.P. (1967): Guide to tropical fish keeping. Iliffe, London.

Col, G.I. (1971): Tropical marine aquaria. Harmlyn

Dutta, R. (1972): Tropical fish setting up & maintaining fresh water & marine aquarium. Octopus Books, Ltd.

Amita Saxena (2011): Aquarium Management. Daya Publishing House.
 Himlins, A.D. (Ed.) (1981): Aquarium system. Academic Press.
 Hunnam F. Ward Lock (1981): Living aquarium. Littlehampton Book Services Ltd.
 Rataj, K. & Zukal, R. (1971): Aquarium fishes & plants. Littlehampton Book Services Ltd.
 Spotte, S. (1979): Sea water aquariums: The Captive Environment. John Wiley & Sons.
 Ray L.P. (1956): Ornamental fish for Garden ponds and home aquarium.
 Vagi, D. and Thomas, H.W. (1963): Complete aquarium.

Mapping of COs to Syllabus:

Course Outcomes	CO 1	CO 2	CO 3	CO 4	CO 5
Module I	H		M		
Module II	H				
Module III		H			
Module IV				H	
Module V			H		H

INTERNSHIP/APPRENTICESHIP/MINOR PROJECT

Semester	Category	Course Code	Course Name	Credits
2	Internship	ZGIN109I	Internship	4
4	Internship	ZGIN215I	Internship	4
5	Internship	ZGIN317I	Internship	2

ZGIN109I/ ZGIN215I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 Hours)

BOIN317I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours) **Objectives:**

Understanding of the world of work: To provide undergraduate students with an opportunity to improve their understanding of the experiences, challenges, and opportunities of the real world of work as well as to set their expectations and behavior in accordance with the demands, culture and values of current and emerging jobs.

Developing research aptitude: To create and facilitate conditions that allow students in their quest for knowledge, its discovery, learn, understand and sharpen research acumen, familiarizing with analytical tools and techniques with appropriate usage, research methodologies, data analysis, integrity and ethical behaviour, manuscripts preparations, identification of appropriate journals, patent and intellectual property rights, and their application in solving research/complex/real-life problems.

To get exposure to the emerging technologies which can improve work processes/ job roles for a better employability in job sector.

Enhance entrepreneurial capabilities: Understand how organizations / enterprises are formed for sustainable progress so that start-ups and entrepreneurial capabilities are strengthened among students and encouraged them to be job creators.

Development of decision-making and teamwork skills: To facilitate the development of problem-solving and decisionmaking skills, enable teamwork and collaboration culture to promote research, academic and professional development.

Cultivate a sense of Social imagery and citizenship responsibility, and enhancing professional competency.

Duration: Internship/Apprenticeship may be of 1 month duration (full time) and 3 months duration (part time).

Attendance: Co-Supervisor of the Institutions/Laboratories/Industries/Companies where the student is undergoing Internship/ Apprenticeship will have to maintain regular attendance records of the intern.

Assessment: Assessment would be carried out by the Supervisor and Co-supervisor based on the regularity of the student; submission of progress report followed by seminar presentation of the report.

The intern will be evaluated through a seminar/viva voce on his work, by a duly constituted expert committee (One Internal and One external), on the following suggestive aspects.

Component	Weightage
i. Activity logbook and evaluation report of Internship Supervisor	20
ii. Format of presentation and the quality of the intern's report	30
iii. Acquisition of skill sets by the intern	20
iv. Originality and any innovative contribution	10
v. Significance of research outcomes	10
vi. Attendance	10
Total	100

GUIDELINES FOR INTERNSHIP

Any kind of Internship may be carried out by the students of the Department of Zoology in any reputed and recognized Institutions/Laboratories/Industries/Companies which is recognized by Assam Don Bosco University. A written permission for Internship/Apprenticeship must be obtained from the Head of the Department/ Registrar of the University. All interns must be under the supervision of the faculty members of the Department of Zoology and may be Cosupervised by other of that institution who is a regular employee at the level of Assistant Professor and above.

All interns must abide by the rules and regulations of the host Institutions. After the completion of the Internship, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in Letterhead clearing mentioning the starting and completion dates of Internship/ Apprenticeship.

A report about the Internship/ Apprenticeship undertaken by the student will have to be submitted to the concerned department at the end of the Internship/Apprenticeship.

ZGMP312P: MINOR PROJECT (4
CREDITS-120 HOURS)

GUIDELINES FOR INTERNSHIP AND MINOR PROJECT:

Any kind of Internship or Minor project may be carried out by the students of the Department of Zoology in any reputed and recognized Institutions/Laboratories/Industries/Companies which is recognized by Assam Don Bosco University. A written permission for Internship/Apprenticeship/Minor project must be obtained from the Head of the Department/ Registrar of the University. All interns must be under the supervision of the faculty members of the Department of Zoology and may be Cosupervised by other of that institution who is a regular employee at the level of Assistant Professor and above. All interns must abide by the rules and regulations of the host Institutions. After the completion of the Internship/Apprenticeship/Minor project, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in Letterhead clearing mentioning the starting and completion dates of Internship/Apprenticeship/Minor project. A report about the Internship/Apprenticeship/Minor project undertaken by the student will have to be submitted to the concerned department at the end of the Internship/Apprenticeship/Minor project.

Duration: Internship/Apprenticeship/Minor project may be of 2 months duration (full time) and 6 months duration (part time).

Attendance: Co-Supervisor of the Institutions/Laboratories/Industries/Companies where the student is undergoing Internship/Apprenticeship/Minor project will have to maintain regular attendance records of the intern.

Assessment: Assessment would be carried out by the Supervisor and Co-supervisor based on the regularity of the student; submission of progress report followed by seminar presentation of the report.

RESEARCH PROJECT /DISSERTATION

BSC ZOOLOGY (Honours)				
Semes-ter	Category	Course Code	Course Name	Cred-its
7	Research Project/Dissertation	ZGDI413P	Research Project Phase I	6
8	Research Project/Dissertation	ZGDI414P	Research Project Phase II	6
BSC ZOOLOGY (Honours) with Research				
Semes-ter	Category	Course Code	Course Name	Cred-its
7	Research Project/Dissertation	ZGDI415P	Dissertation I	18
8	Research Project/Dissertation	ZGDI416P	Dissertation II	20

BSC ZOOLOGY (Honours)**ZGDI413P: RESEARCH PROJECT PHASE I**

(6 credits – 180 hours) (L-T-P: 0-0-12)

ZGDI414P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-12)

BSC ZOOLOGY (Honours) with Research**ZGDI415P: DISSERTATION I**

(18 Credits -540 Hours) (L-T-P: 0-0-36)

ZGDI416P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

GUIDELINES FOR RESEARCH PROJECT/DISSERTATION:

Research Project/Dissertation must be carried out in the department under the supervision of faculty members. In case of inter-disciplinary Research Project/Dissertation, a co-supervisor may be opted from within the school or from any other departments within the University for better quality data generation and results. If a student wants to carry out a portion of the Research Project/Dissertation in any Institutions/Laboratories/Industries/Companies outside the University, a written permission has to be obtained by the student from the Head of the Department or Registrar of the University. The student involved in the Research Project/Dissertation, Assam Don Bosco University will be the sole proprietor of any publications/patents/commercialization generated out of the Research Project/Dissertation works but due acknowledgement must be given to other faculties involved in the project from partner Departments/Institutions/Laboratories. All Research

Project/Dissertation students must abide by the rules and regulations of the host Institutions/Laboratories/Industries/Companies. After the completion of the Research Project/Dissertation, students must obtain a certificate from the Head of the Institutions/Laboratories/Industries/Companies in letterhead clearing mentioning the starting and completion dates of Research Project/Dissertation. A detail report of the project/works carried out by the student will have to be submitted to the concerned Department and Library of Assam Don Bosco University at the end of the project period.

Duration: Research Project/Dissertation will be carried out for 2 semesters (7th and 8th semester). Written permission from the University authorities must be obtained for extension of the Research Project/Dissertation if need arises.

Attendance: Faculty Supervisor/Co-supervisor of the Institutions where the student is carrying out the Research Project /Dissertation will have to maintain regular attendance records of the student.

Assessment: The B. Sc student undergoing research project/dissertation would be assessed by the Departmental Research Committee by conducting a progress report seminar.

A final report will have to be submitted to the department/University. Final assessment would be carried out at the end of 8th semester by the supervisor/Co-supervisor based on the regularity of the student and submission of regular progress reports. The student will have to submit a final Research Project/Dissertation thesis in proper formats to the Department, followed by seminar

DETAILED SYLLABUS
BACHELOR OF ARTS - BA ECONOMICS (HONOURS)
(w.e.f. 2023 NEP Batch)
DEPARTMENT OF ECONOMICS
ASSAM DON BOSCO UNIVERSITY

VISION

To envision excellence in quality education and moulding intellectually competent persons in economics for creating novel ideas through innovative teaching and research contributing to the modern society.

MISSION

Empower the students with critical understanding of economic theory, analytical treatment and empirical interpretations of economic issues.

Make the students aware of recent and ongoing developments in the field of economics.

Enhance the skill and efficiency of the students for better employability in competitive job markets.

POs – BA Economics

Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in group settings.

Effective Citizenship: Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.

Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PSOs – BA Economics

Knowledge of Economic System: An ability to understand economic theories and functioning of basic microeconomic and macroeconomic systems.

Statistical and Mathematical Skills: Acquaint with collection, organization, tabulation and analysis of empirical data. Ability to use basic mathematical and statistical tools to solve real economic problems.

Econometric Applications: Acquaint with basic and applied econometric tools and methods used in economics. The aim of this course is to provide a foundation in applied econometric analysis and develop skills required for empirical research in economics. It also covers statistical concepts of hypothesis testing, estimation and diagnostic testing of simple and multiple regression models.

Development Perspectives: Delineate the developmental policies designed for developed and developing economics. The course also acquaint with the measurement of development with the help of theories along with the conceptual issues of poverty and inequalities.

Environmental Strategy and Management: This course emphasizes on environmental problems emerging from economic development. Economic principles are applied to valuation of environmental quality, quantification of environmental damages, tools for evaluation of environmental projects such as cost-benefit analysis and environmental impact assessments.

Perspectives on Indian Economy: Acquaint with basic issues of Indian economy and learn the basic concept of monetary analysis and financial marketing in Indian financial markets. This course reviews major trends in economic indicators and policy debates in India in the post-Independence period.

FYUG PROGRAM STRUCTURE
Program: 4-Year Bachelor of Arts (Economics)
(As per National Education Policy 2020)
Department of Economics
ASSAM DON BOSCO UNIVERSITY

Category	Name of the course	Course Code	Credit	Hours
Semester I				
Major, Introductory level	Introductory Microeconomics	ENMI100T	4	60
Minor	Indian Economy	ENIN102T	4	60
Multi-disciplinary (MDC)	Money and Banking	ENMB107T	3	45
Ability Enhancement (AECC)	Communicative English I	AECE100T	2	30
Skill Enhancement (SEC)	Fundamentals of Mathematical Economics	ENME104T	3	45
Common Value Based (CVB)	Environmental Studies	CBES101T	1	15
Common Value Based (CVB)	Health & Wellness, Yoga Education, and Sports and Fitness	CBHY102T	1	15
Community engagement (CE)	Service Learning Theory	ENCE111T	2	30
Total Credit			20	
Semester II				
Major, Introductory level	Introductory Macroeconomics	ENMA101T	4	60
Minor	Economy of North East India	ENNE103T	4	60
Multi-disciplinary (MDC)	Introduction to Stock Market	ENSM108T	3	45
Ability Enhancement (AECC)	Communicative English II	AECE201T	2	30
Skill Enhancement (SEC)	Data Analysis and Interpretation	ENDA105L	3	45
Common Value Based (CVB)	Understanding India	CBUI104T	1	15
Common Value Based (CVB)	Digital and Technological Solutions	CBDT103T	1	15
Community Engagement (CE)	Service Learning Practice	CESL102P	2	60
Total credit			20	
Semester III				
Major	Intermediate Microeconomics	ENIC200T	4	60
Major	Statistical Methods for Economics	ENSM201T	4	60
Minor	History of Economics Thoughts	ENET205T	4	60
Multi-disciplinary (MDC)	Entrepreneurship Development	ENED110T	3	45
MIL / Ability Enhancement (AECC) (Only one choice)	Communicative Hindi I/ Communicative Assamese I/ French Beginner Level I/ Introduction to German Language I	AECH200T/ AECA200T/ AEFR200T/ AEGR200T	2	30
Skill Enhancement (SEC)	Hands-on training on Data Analysis with a Statistical Package	ENSP207L	3	45
Total Credit			20	

Semester IV				
Major	Intermediate Macroeconomics	ENIA202T	5	75
Major	International Economics	ENIE203T	5	75
Major	Fundamentals of Econometrics	ENFE204T	4	60
Minor	Gender Economics	ENGE206T	4	60
MIL / Ability Enhancement (AECC) (Only one choice)	Communicative Hindi II/ Communicative Assamese II/ French Beginner Level II/ Introduction to German Language II	AECH201T/ AECA201T/ AEFR201T/ AEGR201T	2	30
Total Credit			20	
Semester V				
Major	Development Economics	ENDE300T	5	75
Major	Environmental Economics	ENEE301T	5	75
Major	Indian Financial System	ENIF302T	4	60
Minor	Public Finance	ENPU307T	4	60
Internship	Internship	ENIN309I	2	60
Total Credit			20	
Semester VI				
Major	Population Economics	ENPO303T	4	60
Major	Public Economics	ENPB304T	4	60
Major	Labour Economics	ENLE305T	4	60
Field based learning/Minor project	Project on Resource Mapping (Rural/Urban)	ENPR306P	4	60
Minor	Rural Development	ENRD308T	4	60
Total Credit			20	
UG Degree in the relevant Discipline/ Subject (CGPA < 7.5)				
Semester VII				
Major	Applied Econometrics	ENAE400T	5	75
Major	Agricultural Economics	ENAG401T	5	75
Minor	Industrial Economics	ENID404T	3	45
Research Methodology	Research Methodology in Social Sciences	ENRM405T	2	30
Research Project/Dissertation	Dissertation Phase I	ENDI409P	5	120
Total credit			20	
Semester VIII				
Major	Health Economics	ENHE402T	5	75
Major	Economics of Education	ENED403T	5	75
Minor	Contemporary Development Policies	ENCD406T	3	60

Research Project/Dissertation	Dissertation Phase II	ENDI410P	7	180
Total Credit			20	

UG Degree (Honours) with Research (CGPA >7.5)**Semester VII**

Research Methodology	Qualitative and Quantitative Methods of Research: Theory and Applications		4	30
Research Project/Dissertation	Research Project-I	ENDI407P	16	
Total Credit			20	

Semester VIII

Research Project/Dissertation	Research Project-II	ENDI408P	20	
Total Credit			20	
Grand Total (Credits)			160	

Program Structure**Certificate Course on Stock Market and Portfolio Management**

Department of Economics
ASSAM DON BOSCO UNIVERSITY

Sl. No.	Name of the course	Course Code	Credit	Hours
1.	Indian Financial System	-	5	75
2.	Operations of Stock Market	-	5	75
3.	Fundamental Analysis of Securities	-	5	75
4.	Technical Analysis of Securities	-	5	75
Total credit			20	

DETAILED SYLLABUS

Program: 4-Year Bachelor of Arts (Economics)
(As per National Education Policy 2020)
Department of Economics
ASSAM DON BOSCO UNIVERSITY

SEMESTER I

1.1 ENMI100T: INTRODUCTORY MICROECONOMICS (4-0-0)

COURSE DESCRIPTION

This course is designed to expose the students to the basic principles of microeconomic theory. The emphasis of the course will illustrate how microeconomic concepts can be applied to analyze real-life situations. Thus, it provides a sound understanding in microeconomic theory to formally analyze the behavior of individual agents. This course looks at the behavior of the consumer and the producer and also covers the behavior of a competitive firm.

COURSE OUTCOMES (CO)

- Classify microeconomics from the perspective of individual decision making as consumers and producers. (Remembering and understanding)
- Apply the microeconomic tools in factor markets and how firms work (Applying)
- Interpret the characteristics of firms and input markets in perfect competition. (Analyzing)
- Justify the use of microeconomic tools for analyzing real time situations. (Evaluating)

Module I: Consumer Behavior (18 hours)

The Economic Problem – Scarcity and Choice, Utility – Cardinal vs. Ordinal Utility; Cardinal Utility Theory – Marginal and Total Utility, Equi-marginal Utility; Consumers' Equilibrium; Marginal Valuation; Consumers' Demand Curve; Ordinal Utility Theory - Preference of Consumers; Indifference Curve; Budget Constraint; Consumer Surplus and Producer Surplus; Utility Maximization; Consumers' Equilibrium; Income Effects and Substitution Effects of a Price Change; Price Consumption Curve; Income Consumption Curve; Derivation of Demand Curve from Price Consumption Curve

Module II: Production and Costs (15 hours)

Technology and Production Function; Isoquants; Production with One and More Variable Inputs; Law of variable Proportion; Returns to Scale; Economies and Diseconomies of Scale; Short Run and Long run Costs; Cost Curves in the Short Run and Long Run; Equilibrium of the Firm

Module III: The Firm and Input Market in Perfect Competition (15 hours)

Review of Perfect Competition - Equilibrium of the Firm and Industry in the Short Run and Long Run; The Derivation of Long Run Industry Supply Curve; Constant, Increasing, and Decreasing Cost Industry; Perfect Competition and Allocative Efficiency; Labour Markets – Basic Concepts; Demand for Labour; Shifts in Labour Demand Curves; Equilibrium in Labour market; Input Demand Curves; Labour Markets and Public Policy

Module IV: Market Failures (12 hours)

Externalities and Inefficiency; A Simple Bilateral Externalities; Public Goods and Free Riders Problems; Imperfect Markets; Asymmetric Information and Markets for Lemons; Moral Hazard; Adverse Selection; Signaling, Role of the State

SUGGESTED READINGS

Karl E. Case & Ray C. Fair, Principles of Economics, Pearson Education Inc., 8th Edition, 2007.

N. Gregory Mankiw, Economics: Principles and Applications, India edition by South Western, a part of Cengage Learning, Cengage Learning India Private Limited, 4th edition, 2007.

Joseph E. Stiglitz and Carl E. Walsh, Economics, W.W. Norton & Company, Inc., New York, International Student Edition, 4th Edition, 2007.

G.S. Maddala & Ellen Miller, Microeconomics: Theory and Applications, McGraw Hill Education, Tenth Reprint, New Delhi Edition, 2013.

A. Koutsoyinnis, Modern Microeconomics, International Edition, Macmillan Press Ltd.

D. Salvator, Principles of Microeconomics, 5th Edition, OUP.

R. S. Pindyck, D. N. Rubinfeld & P. L. Meheta, Microeconomics, 7th Edition, Pearson, New Delhi, 2009.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2		M	H	H
CO3			M	M
CO4			M	M

1.2 ENIN102T: INDIAN ECONOMY (4-0-0)

COURSE DESCRIPTION

The students will gain a better understanding of the economy of India as a whole with the completion of this course. Students will get an understanding of the myriad issues and components that make up the Indian economy, and they will do research into a variety of interconnected themes that are connected to the expansion and maturation of the Indian economy.

COURSE OUTCOMES

Define the Macroeconomic Policies and their Impact on the Indian Economy. (Remembering & Understanding)

Explain the growth and trends of population and its impact on human resources. (Applying)

Identify the issues and measures related to various social-economic factors in the economy. (Creating)

Evaluate the impact of various development policies in the Agriculture Industry & Service Sector in the Indian Scenario. (Analyzing and Evaluating)

Module I: Economic Development since Independence (20 hours)

Major Features of the Indian Economy on the eve of Independence – An Overview; Economic Planning in India – History of Indian Economic Planning, Objectives, Achievements and Failure of Indian Planning, Shortcomings of Planning in India; NITI Aayog vs. Planning Commission; New Economic Policy-Critical Evaluation of Liberalization, Privatization and Globalization; Look East Policy to Act East Policy

Module II: Population and Human Development (19 hours)

Demographic Trend and Issues – Meaning and Scope of Demography; Density of Population; Measures of Population Change; Structure and Distribution; Population as a Factor of Economic Development; National Population Policy; Demographic Dividend; Human Development Index- Concepts and Measurements; India's Human Development Record in Global Perspective; Education in India – Features, Trends, Issues; Health – Trends and Issues; Malnutrition in India

Module III: Growth and Income Distribution (20 hours)

Poverty – Concept and Incidence of Poverty in India, Poverty Estimates, Growth and Poverty, Strategy of Poverty Alleviation; Trends and Policies in Poverty; Income Inequality in India – Magnitude and Nature, Growth and Inequality, Causes of Income Inequality, Government Policies and Measures; Unemployment – Nature and Types of Unemployment in India, Magnitude, Changing Dimensions of Unemployment and Employment, Causes of Unemployment, Government Policies and Measures

Module IV: Agriculture, Industry and Service Sector in India (17 hours)

Changing structure of Indian agriculture; Sustainable agriculture-concept & constraint; Green Revolution-features and impact; Agricultural marketing and regulated market; Industrial Policies in India; Disinvestment and Privatization; Development of MSME sector; Growth & Composition of service sector; Role of service sector in Indian economy

SUGGESTED READINGS

- Shankar Acharya, Macroeconomic Performance and Policies 2000-8, in Shankar Acharya and Rakesh Mohan (Editors), India's Economy: Performances and Challenges: Development and Participation, Oxford University Press, 2010.
- Rakesh Mohan, India's Financial Sector and Monetary Policy Reforms, in Shankar Acharya and Rakesh Mohan, editors, India's Economy: Performances and Challenges: Development and Participation, Oxford University Press, 2010.
- Pulapre Balakrishnan, Ramesh Golait & Pankaj Kumar, 2008, —Agricultural Growth in India Since 1991, RBI DEAP Study No. 27.
- B.N. Goldar & S.C. Aggarwal, Trade Liberalisation and Price-Cost Margin in Indian Industries, The Developing Economics, September, 2005.
- P. Goldberg, A. Khandelwal, N. Pavcnik & P. Topalova, —Trade Liberalisation and New Imported Inputs, American Economic Review, Papers and Proceedings, May, 2009.
- Kunal Sen, Trade, Foreign Direct Investment and Industrial Transformation in India, in Premachandra Athukorala, editor, The Rise of Asia, Routledge, 2010.
- Dipak Mazumdar & Sandeep Sarkar, The Employment Problem in India and the Phenomenon the Missing Middle, Indian Journal of Labour Economics, 2009.
- J. Dennis Rajakumar, Size and Growth of Private Corporate Sector in Indian Manufacturing, Economic and Political Weekly, April, 2011.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			M
CO2		M	H	
CO3	M		H	
CO4		M		H

1.3 ENMB107T: MONEY AND BANKING (3-0-0)**COURSE DESCRIPTION**

This course is designed to understand the importance of money and banking in various economics. It aims to provide an introduction to understand the concept of money, theories of money supply and money demand and working of monetary policy. It provides an insight into the banking system.

COURSE OUTCOMES

- Interpret the components of a financial system with respect to real economy linkages and financial market participants (Understanding)
- Identify the impact of central bank monetary policy on financial systems and the overall economy. (Applying)
- Analyze the development of financial markets and securities in response to market participant requirements. (Analyzing)
- Evaluate the different financial intermediation and risk management services that financial institutions provide and the need for governmental regulation. (Evaluating)

Module I: Money and Functions of Money (10 hours)

Concept of Money; Functions of Money; Theories of Demand for Money; Type of Money – M1, M2, M3, M4 ; Money multiplier theory.

Module II: Financial Institutions, Markets, Instruments and Financial Innovations (11 hours)

Meaning, types and role of Financial Markets and Institutions; Money and Capital Markets, their characteristics and functions; call money market, treasury bill market, commercial bill market including commercial paper and certificates of deposits; primary and secondary market for securities.

Module III: Interest Rates (10 hours)

Determination of Interest Rate; Sources of Interest Rate Differentials; Types of Interest Rate – Compound and Simple Interest Rate; Theories of Term Structure of Interest Rates; Interest Rates in India

Module IV: Banking System and Monetary policy (14 hours)

Indian Banking System; Banking Sector Reforms; Functions of Commercial Banks, Credit Creation System of Commercial Bank; The Evolution of Commercial Banks, Regional Rural Bank in India; NABARD; Functions and Goals of Central banks; Instruments of Monetary Control – Quantitative Control; Repo Rate; Reverse Repo Rate; CRR; SLR; Qualitative Control; Margin Requirements; Credit Rationing; Regulation of Consumer Credit; Moral Suasion; Publicity and Publication; Monetary Management in an Open Economy; Current Monetary Policy of India

SUGGESTED READINGS

- F. S. Mishkin & S. G. Eakins, Financial Markets and Institutions, Pearson Education, 6th edition, 2009.
 F. J. Fabozzi, F. Modigliani, F. J. Jones, M. G. Ferri, Foundations of Financial Markets and Institutions, Pearson Education, 3rd edition, 2009.
 L. M. Bhole & J. Mahakud, Financial Institutions and Markets, Tata McGraw Hill, 5th edition, 2011.
 M. Y. Khan, Indian Financial System, Tata McGraw Hill, 7th edition, 2011.
 Various latest issues of R.B.I. Bulletins, Annual Reports, Reports on Currency and Finance and Reports of the Working Group, IMF Staff Papers.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2	H	M		H
CO3				
CO4		M	M	H

1.4 Ability Enhancement Courses (AECC)-(This course will be provided by the University)

AECE100T/AECE200T: COMMUNICATIVE ENGLISH I

(2 credits – 30 hours) (L-T-P: 2-0-0)

OBJECTIVE

The objective of this course is to equip the learners with the basic skills of effective communication in English language in all real life contexts, with area to enable fluency and clarity.

COURSE OUTCOMES

The course is intensely practice oriented and it specifically attempts to:

CO1: *Familiarize* the students with the basic tools of oral communication.

CO2: *Teach* the students to use grammar in meaningful contexts.

CO3: *Enable* the students to communicate in English confidently.

Module I: Essential grammar of English: An Introduction (10 hours)

Parts of speech; Basic sentence structures; Articles; Prepositions; Person and number; Tenses and their uses; Subject–verb agreement; Vocabulary building; Common idioms and phrases

Module II: Basic tools of oral communication in English (4 hours)

- Syllables, stress–pattern and intonation
- Consonants, vowels and diphthongs
- Differences between spoken and written English

Module III: Functional English: Situational Conversation Practice (7 hours)

- At the post office, bank, hotel
- At the doctors', at the chemists, in the library c) at the market, Tailors', at the garage
- In the kitchen, with a close friend, At a wedding
- Greetings, small talk, congratulations, condolences, offers, invitations

Module IV: Functional English: Structural Conversation Practice (6 hours)

Telephone conversation, Interviewing a film star; At a travel agent's, An interview; Buying, Hiring a taxi, buying a motorcycle; Agreement, disagreement; Hypothetical conditions, likelihood; Public speaking: Speeches of great men; Interjection, exclamation, emotion emphasis; Expressions of hope, disappointment, surprise, concern, worry; Willingness, wish, intention; Commands, requests, advice, promise, threat.

Module V: Non-Detailed Study: Reading and comprehension (3hours) Short stories and poems

- a. The Blind Dog – R K Narayan
- b. The Gift of the Magi- O Henry
- c. The End of the Party-Graham Greene
- d. Civility is all that Counts - SJ Duncan
- e. The Herb Seller- Yengkhom Indira
- f. Nothing Gold Can Stay- Robert Frost
- g. Night of the Scorpion - Nissim Ezekiel

SUGGESTED READINGS

1. Leech, Geoffrey and Jan Svartvik, A Communicative Grammar of English, Third edition, Pearson Education, 2002.
2. Sasikumar, V and Dhamija, P.V, Spoken English, Tata McGraw Hill, New Delhi.
3. Taylor, Grant, English Conversation Practice, Tata McGraw Hill, 1975.
4. Dixon, Robert J., Everyday Dialogues in English, Prentice Hall India, 2006.
5. Apte, Madhabi, A Course in English Communication, Prentice Hall India, 2007.
6. Seely, John, The Oxford Guide to Writing and Speaking, Oxford.
7. Plathottam, George, Public Speaking: Resource Book for Effective Communication, Don Bosco Publications, Guwahati, 2007.
8. An Anthology of Short Stories prepared by Department of Humanities and Social Sciences, Assam Don Bosco University, for private circulation, 2014.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	H	H	
CO2	M	M	H	H	
CO3	L	L	H	H	H

1.5 ENME104T: FUNDAMENTALS OF MATHEMATICAL ECONOMICS (4-0-0)

COURSE DESCRIPTION

The main purpose of this rudimentary course in mathematical economics is to provide students the necessary mathematical skills to understand advanced courses in economics. The course is devised to enhance the technical skills in the areas of algebra and calculus and other rudimentary knowledge in mathematics. The course aims to provide both the analytical and computational skills that are required for the analysis of economic problems.

COURSE OUTCOMES

- Define and explain the basic concepts of mathematics including set, functions, determinants and matrices. (Remembering and Understanding)
- Apply the mathematical techniques to elucidate the problems of economic theory. (Applying)
- Analyze economic theory and draw inferences in context of mathematical techniques. (Analyzing)
- Explain the need of mathematical techniques in understanding real economic theory and develop mathematical models to solve numerical problems in real life economics. (Evaluating and Creating)

Module I: Mathematical Foundations (10 hours)

Number System; Set Theory; Solutions to Simple Equations; Determinants and Matrices; Elementary Types of Functions - Quadratic, Polynomial, Power, Exponential, Logarithmic; Algebraic Properties and Applications

Module II: Differentiable Functions (15 hours)

Limits and Continuous Functions-Operations and Applications; Differentiations- Operations and Applications; Marginal functions and economic applications; Single-variable Optimization; Economic applications- Profit maximization, Cost minimization; Second and Higher Order Derivatives – Properties and Applications; Convex Functions; Local and Global Optima; Multi-variable Optimization

Module III: Integration (10 hours)

Meaning and Significance; Basic Rules of Integration; Applications in Economics; Indefinite and Definite Integrals; Integration by Parts and Partial Fraction

Module IV: Difference Equations (10)

Basic forms; Finite Differences; Linear Difference Equations- Homogenous and Non-homogenous; Solution of First Order Difference Equation; Applications

SUGGESTED READINGS

- K. Sydsaeter & P. Hammond, Mathematics for Economic Analysis, Pearson Educational Asia: Delhi, 2002
 Chiang A.C. & K. Wainwright, Fundamental Methods of Mathematical Economics, McGraw Hill International Edition
 Baruah S.N., Basic Mathematics and its Economic Applications, MacMillan
 T. Yamane, Mathematics for Economist: An Elementary Survey, second edition, Prentice Hall of India Pvt. Ltd., New Delhi

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M	M	
CO2	M	M	H	H
CO3	M	H	H	M
CO4			H	M

1.6 Common Value Added Course- (This course will be provided by the University)**CBES101T: ENVIRONMENTAL STUDIES**

(1 credit: 15 hours)

Course Outcomes:

CO 1: Recall the multidisciplinary nature of environmental studies. (Remembering)

CO 2: Explain ecological processes of natural resources. (Understanding)

CO 3: Categorize different types of natural resources. (Analysing)

CO 4: Evaluate the global scale of environmental pollution. (Evaluating)

Module I: The Multidisciplinary Nature of Environmental Studies (1 lectures)

Definition, scope and importance, need for public awareness.

Module II: Natural Resources (2 lectures)

a. Different types of natural resources and associated problems - forest resources, water resources, mineral resources, food resources, energy resources and land resources.

b. Conservation of natural resources.

Module III: Ecosystems (2 lectures)

a. Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, food chains, food webs.

b. Structure of following ecosystems - forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems.

Module IV: Biodiversity and Its Conservation (2 lectures)

Types of biodiversity – genetic, species and ecosystem, value of biodiversity, global biodiversity, India as a mega-diversity nation, threats to biodiversity, conservation of biodiversity - in-situ and ex-situ conservation.

Module V: Environmental Pollution (3 lectures)

- Definition, causes, effects and control measures of - air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards and e-pollution.
- Solid waste management.
- Disaster management.

Module VI: Social Issues and the Environment (3 lectures)

- From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, climate change, global warming, acid rain, ozone layer depletion.
- Environment protection act.
- Introduction to environmental impact assessment.

Module VII: Human Population and the Environment (2 lectures)

Population growth and sex ratio; Population explosion - family welfare programme; Environment and human health; HIV/AIDS; Role of information technology in environment and human health.

Suggested Readings

- Textbook for Environmental Studies, E. Bharucha, UGC, New Delhi.
- Fundamentals of Environmental Studies, S. Somvanshi and R. Dhupper, S.K. Kataria and Sons Publisher.
- Environmental Chemistry, A. K. De, New age publishers.
- Environmental Studies, Third edition, J. P. Sharma, University Science Press.
- Comprehensive Environmental Studies, K. G. Bhattacharyya and A. Sarma, Narosa Publishing House Pvt, Ltd.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H				H		H
CO2		M	H				
CO3				M		H	
CO4							H

Common Value Added Course- (This course will be provided by the University)**CBHY102T: HEALTH AND WELLNESS, YOGA EDUCATION, AND SPORTS AND FITNESS**

(1 Credit: 15 hours)

Course Outcomes

CO 1: Explain the importance of healthy lifestyle (Understanding)

CO 2: Make use of Yoga, sports for health and fitness (Applying)

Module I: Health and Wellness (4 hours)

Meaning and importance of health and Wellness, components/dimensions of health and Wellness; Nutrition for health and wellness

Module II: Yoga (6 hours)

Introduction to Yoga, Asanas and Pranyamas

Module III: Sports and Fitness (5 hours)

Concept of Sports and fitness; Fitness activities for strength, Flexibility and Endurance; Indoor and Outdoor sports

Suggested Readings

- Claude Bouchard, Steven N. Blair, William L. Haskell, 'Physical Activity and Health', Human Kinetics, 2007
- Emily Oddo, 'Yoga: For Beginners', White Flower Publishing, 2018
- Marzia Fernandez, Emily Attached, Gino Mackesy, 'Mental Health Workbook', 2020.
- Dr. A. K. Uppal, Dr. P. P. Ranganathan, 'Fitness, Wellness and Nutrition', Friends Publications India. 2020
- Fred Coalter, 'Sport for Development: What game are we playing?', Routledge. 2013

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1	H		M
CO2		H	M
CO3			

Community Engagement (Service Learning) Course- (This course will be provided by the University)**ENCE111T: SERVICE LEARNING THEORY**

(Credit: 2 Hours: 30)

Objectives:

Service-learning is a method of teaching through which students apply their academic skills and knowledge to address real-life needs in their own communities.

Service-learning provides a compelling reason to learn and teaches the skills of civic participation and develops an ethic of service and civic responsibility.

Service-learning increases motivation and retention of academic skills as specific learning goals are tied to community needs.

COURSE/ LEARNING OUTCOMES

Students strengthen their ethic of social and civic responsibility.

Understand problems in a more complex way, including underlying issues.

Learn how to work more collaboratively with others on real problems.

Learn about other cultures and respect for cultural differences.

Observe how decisions are made and how they can impact people's lives.

Module I: Meaning and scope of service learning (15 hours)

Understanding Service Learning - Its philosophy, historical background, purpose, value & theoretical framework; Locating Service Learning within the University context; Principles of Service Learning; Classification of Service Learning Models; Experiential Learning; Reflective Learning; Journaling; Service Learning Pedagogy; Difference between Service Learning and

other community experiences ; Historical context of University Community Partnership; Understanding Community & Community Partnership; Ethical understanding of partnership; Understanding the agency of the Community – as co-educators; Community barriers; Understanding of society & social issues.

Module II: Labor Economics (Community research model) (15 hours)

Students work in small groups to produce a report for a career and job resource center. Serving a broad spectrum of labors in the greater Sonapur area in which they study the effectiveness of vocational training in improving the labor market opportunities for non-college bound youths. Students should also be able to interact with the organization's staff to learn more about the livelihood opportunities and challenges that workers face (especially women) in the labour market. The project includes: field survey, data entry and analysis of field information using appropriate statistical tools.

Suggested Readings

1. Ball, D., McNabb, E. and Whitt, C. (2002) 'Getting Started in Service Learning: Resources for Economists', in McGoldrick, KM. and Ziegert, A. (eds), Putting the Invisible Hand to Work: Concepts and Models of Service Learning in Economics, Ann Arbor: The University of Michigan Press, pp. 93-118.
2. McGoldrick, KM. (1995) 'Service-Learning: An Application for Economics Students', unpublished paper. Presented at the IAFEE Session of the Eastern Economic Association Meetings, New York, March.
3. McGoldrick, KM. (1998) 'Service-Learning in Economics: A Detailed Application', Journal of Economic Education, Vol. 29(4), pp. 365-376.
4. McGoldrick, KM. and Ziegert, A. (eds) (2002) Putting the Invisible Hand to Work: Concepts and Models of Service Learning in Economics, Ann Arbor: The University of Michigan Press.

SEMESTER II**2.1 ENMA101T: INTRODUCTORY MACROECONOMICS (4-0-0)****COURSE DESCRIPTION**

The course aims to introduce and explain the preliminary concepts associated with the determination and measurement of aggregate macroeconomic variables like GDP, consumption, savings, investment, and balance of payments. Further, this course introduces the students to formal modeling of a macro-economy in terms of analytical tools. It discusses various alternative theories of output and employment determination in a closed economy in the short run as well as medium run, and the role of policy in this context.

COURSE OUTCOMES

Define and understand the basic concepts of macroeconomics including national income, money, business cycle and related concepts of closed economy (Remembering and Understanding).

Apply some basic principles of macroeconomics. (Applying)

Analyze the quantity theory of money, Keynesian model of income determination, IS-LM model and its application for real life economic decision making. (Analyzing)

Interpret the various roles of monetary and fiscal policy in credit control and inflation. (Evaluating)

Module I: Introduction to Macroeconomics and National Income Accounting (15 hours)

Basic Issues Studied in Macroeconomics; Concepts of National Income- GNP, NNP, NI at Factor Cost and Market Prices; Measurements of Gross Domestic Product; Income, Expenditure and the Circular Flow; Real vs. Nominal GDP; Price Indices; National Income Accounting for an Open Economy; Limitations of the GDP concept

Module II: Money (18 hours)

Functions of Money; Quantity Theory of Money – Classical and Modern Approach; Post-Keynesian theories of Demand for Money- Patinkin, Baumol, Tobin; Determinants of Money Supply in India; High Powered Money; Credit Creation; Tools of Monetary Policy- RBI

Module III: Cyclical Fluctuation (8 hours)

Characteristics of Cyclical Fluctuation; Business Cycle in Market Economies; Short-Term vs. Long-Term Growth Trend; Theories of Business Cycles – Hawtrey, Samuelson, Hicks, Kaldor, Schumpeter; Impact of Recession on Trade Imbalances

Module IV: The Closed Economy in the Short Run (20 hours)

Classical and Keynesian Systems; Simple Keynesian Model of Income Determination; IS-LM Model; Fiscal Policy in Keynesian Model; Fiscal and Monetary Multipliers; Comparative study of Monetary and Fiscal Policies.

SUGGESTED READINGS

Dornbusch, Fischer & Startz, Macroeconomics, McGraw Hill, 11th edition, 2010.

N. Gregory Mankiw, Macroeconomics, Worth Publishers, 7th edition, 2010.

Olivier Blanchard, Macroeconomics, Pearson Education, Inc., 5th edition, 2009.

Richard T. Froyen, Macroeconomics, Pearson Education Asia, 2nd edition, 2005.

Andrew B. Abel & Ben S. Bernanke, Macroeconomics, Pearson Education, Inc., 7th edition, 2011.

Errol D'Souza, Macroeconomics, Pearson Education, 2009.

Paul R. Krugman, Maurice Obstfeld & Marc Melitz, International Economics, Pearson Education Asia, 9th edition, 2012.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		M	H	M
CO3	H	H		
CO4			M	H

2.2 ENNE103T: ECONOMY OF NORTH EAST INDIA (4-0-0)

COURSE DESCRIPTION

This course is designed to expose the students to the overview of the North East Economy. It explains the trend and performance of agriculture, industry and service sector in the context of the North East scenario. It also includes the evaluation of various developmental policies for structural transformation of the region.

COURSE OUTCOMES

Define and understand macroeconomics policies and their impact on the North East Economy.

(Remembering and Understanding)

Identify the policies and performance in Industry and analyze the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Applying)

Explain the trends and performance in service sectors and the scope of growth of enterprises in the North Eastern region and the role of various policies in it. (Analyzing)

Evaluate the various development policies and the different development initiatives in the North Eastern region along with some of the reasons for its failure. (Evaluating)

Module I: Overview and Characteristics of North East Economy (15 hours)

North Eastern Region as an economy; Characteristics of the economy; Trend and Pattern of GDP growth in NER; Demographic features of the NE economy; Poverty and Inequality in NER comparison with the Indian economy; Trends of Employment and Unemployment; Recent Developments in Human Resource; Regional disparities and Northeast India, Status of Development and Urbanization

Module II: Agriculture in North East Economy (12 hours)

Agriculture: features and challenges; Growth of Agricultural Sector in NE; Agricultural Finances-Sources and Limitations; Agricultural Policies of NE States; Agriculture-Industry linkage especially in NER, Problems of Agricultural Marketing in NE

Module III: Industry and Service Sectors in North East Economy (18 hours)

Industry: growth, composition and challenges, Growth of Micro Small and Medium Enterprises (MSME); North East Industrial and Investment Promotion Policy (NEIIPP) 2007 and 2017; Causes of Industrial Backwardness and their Remedies; Services sector- growth and challenges; Diversification of rural employment; Infrastructure and regional economic development

Module IV: Structural Transformation and Institutions in North East (15 hours)

Institutions and economic Development; Governance and development-government failure and its correction; Local self-government and development; Community participation and development, community failure; Role of DONER and NEC; New development initiatives in NER, Vision Document 2020 and Act East Policy

SUGGESTED READINGS

1. Banerjee and Kar (1999): Economic Planning and Development of North-Eastern States, Kanishka, New Delhi
2. Deb, B.J & B. Dutta Ray (2006): Changing Agricultural Scenario in North-East India, Concept Publication, New Delhi
3. Dikshit, K. R and J K Dikshit (Eds.) (2014): North East India Land People and Economy, Springer
4. Menon, S. (Ed.) (2007): India's North East Economy-Problems and Prospects, ICFAI Univ. Press, Hyderabad
5. Mishra, B. (2006): Fiscal Policy in North-East India, Akansha Publishing House, New Delhi
6. Nayak. P. (Ed.) (2010): Growth and Human Development in North- East India, Oxford University Press.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H		M	H
CO2		H		H
CO3	M	H		
CO4	M		H	M

2.3 ENSM108T: INTRODUCTION TO STOCK MARKET (3-0-0)**COURSE DESCRIPTION**

This course will enhance the students with a comprehensive understanding of the workings of the stock market, including the market's structure, trading and settlement procedures, processes, and related components, as well as the regulations that govern the stock market and the emerging challenges it faces. This course's objective is to provide students with a comprehensive understanding of the workings of the stock market.

COURSE OUTCOMES

Explain the Indian capital market and financial instruments. (Remembering & Understanding)

Identify the different terms associated with the stock market in the action of buying and selling stocks. (Applying)

Discuss stock market experience and learn to analyze risk and profitability. (Analyzing)

Elaborate the possibility to evaluate and compare various financial securities and money market investment instruments. (Evaluating and Creating)

Module I: The Stock Market and its Operation (15 Hours)

Role and Structure of Money and Capital Market; Instruments of Capital Market – Share, Debentures, Equity and Bond; The Stock Market and its Operation; Stock Market Index – The BSE Sensex and the NSE Nifty; Role and working SEBI; Impact of SEBI on Capital Market in India; IDRA and its role in Financial Markets

Module II: Terminology of Stock Market (10 Hours)

Strike Price, Call Option, Put Option; Bull and Bear market; Beta, Delta, Bid, Blue chip stock; Board Lot, Odd Lot; Out of the Money (OTM), Stock split

Module III: Trading of Stock (20 Hours)

Recent development of stock exchange; Stock trading on BSE and NSE; Stock market trading mechanism; Online stock trading; OTC exchange; Commodity exchanges: evolution and history; overviews of derivatives in financial market, basic derivatives operation and trading; managing exchange rate, carbon markets, weather derivatives, ETFs – Purpose, Importance, types; risk management, commodity exposure, hedge accounting, currency futures

SUGGESTED READINGS

- Bhole, L.M.(1999), Financial Institutions and Markets, Tata McGraw Hill Company Ltd., New Delhi
 Johnson, H.J. (1993), Financial Institutions and Markets, McGraw Hill, New York.
 KhanM.Y. (1996), Indian Financial Systems, Tata McGraw Hill, New Delhi
 Robinson, R.I. and D. Wrightman (1981), Financial Markets, McGraw Hill, London.
 Fenstermaker, J.V. (1969), Readings in Financial Markets & Institutions, Appleton, NewYork
 Smith, P.F. (1978), Money and Financial Intermediation: The Theory and Structure of Financial System, Prentice Hall, Englewood-Cilffs, New Jersey

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1		M	
CO2	H		M
CO3		M	H
CO4	M		H

2.4 ABILITY ENHANCEMENT COURSE-ENGLISH**(School level course, it will be provided by the University)****AECE101T/ AECE201T: COMMUNICATIVE ENGLISH II****(2 credits – 30 hours) (L-T-P: 2-0-0)****Course Outcomes***CO1 : Equip* students with the competence of different forms of communications*CO2 : Develop* the study skills and communication skills necessary in formal and non- formal situations.*CO3 : Prepare* them to face interviews and group discussions**Module I: Basics of Business Communication (6 hours)**

Effective communications—benefits, methods, barriers, flow Speaking, listening, non-verbal, telephonic communications Use of English language in business—grammatical terms, subject-verb agreement, punctuation, some basic grammatical rules

Module II: Business Letters (5 hours)

- Introduction—layout, structure, categories of business letter
- Rules of good writing
- Recruitment correspondence—application, CV, interview, offer, acceptance, etc.
- Technical report writing

Module III: Telecommunication (3 hours)

- Fax and e-mail
- Internet, intranet, extranet

Module IV: Internal communication (5 hours)

- Memos- structure, tone
- Reports- formal, informal
- Proposals
- Meetings, minutes, agenda

Module V: Persuasive communication (4 hours)

- Circulars, sales letters
- Publicity materials- Public relations, news release, newsletters
- Notice, advertisements, leaflets

Module VI: Visual and oral communications (4 hours)

- Forms and questionnaires
- Visual presentation—methods, charts, diagrams
- Writing summaries
- Oral presentation—reading and giving speech

Module VII: Non-Detailed Study: Reading and comprehension (3 hours) Short stories and poems

- Engine Trouble – R K Narayan
- The Mouse – H H Munro
- The Rocking - Horse Winner – DH Lawrence
- Travel the Road – Mamang Dai
- Haflong Hills – Kallol Choudhury
- Self-Portrait – A.K. Ramanujan
- The Solitary Reaper – William Wordsworth

Suggested Readings

1. Taylor Shirely, Communication for Business: A Practical Approach, Fourth edition, Pearson Education, 2005.
2. Rutherford, Andrea J., Basic Communication Skills for Technology, Pearson Education, 2001.
3. Mitra, Barun K, Effective Technical Communication, OUP, 2006.
4. Sen, Leena, Communication Skills, Prentice Hall India, 2007.
5. Brian, M.H. Robinson, et. al., Communicative Competence in Business English, Orient Longman, 1988.
6. Kaul, Asha, Effective Technical Communication, Prentice Hall, 2006.
7. The Oxford Anthology of Writings from North-East India (Fiction) edited by Tilottoma Misra, OUP, 2011

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	H	H	H	H	H	H
CO2	H	H	H	H	H		
CO3		H				H	

2.5 ENDA105L: DATA ANALYSIS AND INTERPRETATION (3-0-0)**COURSE DESCRIPTION**

The objective of this course is for the purpose of providing an introduction to the underlying concepts and vocabulary that are essential to statistical analysis. The goal of the course is to increase the student's grasp of how to effectively apply statistical techniques. In the context of multivariate analysis, students will be able to explain the concepts of correlation and regression analysis.

COURSE OUTCOMES

- Understand the key statistical terms related to data the principles of statistical measures (Remembering and Understanding)
- Apply the various statistical measures and their forecasting techniques in real life problems. (Applying)
- Analyze the various statistical results like hypothesis testing and forecasting in practice. (Analyzing)
- Evaluate the statistical results employing various hypothesis testing tools with various statistical packages (Evaluating and Creating)

Module I: Basic Statistical Tools in MS Excel (15 hours)

Measures of Central tendency - Arithmetic Mean (Simple and Weighted), Geometric Mean, Harmonic Mean, Median, Mode, Quartiles, Measures of Dispersion; Correlation – Karl Pearson's Correlation Coefficient and its Properties, Spearman Rank Correlation Coefficient; Regression – Simple Linear Regression Line, Interpretation of Regression Coefficients, Time Series Analysis, Additive and Multiplicative Models, Determination of Trend

Module II: Statistical Inferences (15 hours)

Population Parameter and Sample Statistic; Point and Interval Estimation; Hypothesis – Concept of Null And Alternative Hypothesis, Simple and Composite Hypothesis, Characteristics of Good Hypothesis; Statistical Errors – Type I and Type II Errors; Critical Region, Size and Power of a Test; Level of Significance and P-value; Hypothesis Testing – Formulation of Statistical Hypotheses, Testing Hypotheses Related to Population Parameters; Sampling Distribution of a Statistic; Important Statistical Test and Inference – Z Test, T Test, F Test and χ^2 Test

Module III: Introduction to Statistical Packages (15 hours)

Introduction to Statistical Package (Open Sourced); Working - Preparing the Data File, Creating Data File and Entering Data, Defining the Variables, Entering Data, Modifying Data File, Import File, Screening and Cleaning Data; Frequency and Cross Tabulation, Descriptive/Summary Statistics, Estimating Correlation Coefficient and Regression Coefficients, Constructing Basic Diagrams

SUGGESTED READINGS

Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House, 2018.

- Agarwala, B.L., Basic Statistics, New Age International, 2019
 Salvatore, D. & Reagle, D., Statistics and Econometrics, TMH, 2011.
 Yamane, T., Statistics: An Introductory Analysis, 2nd Edition, New York: Harper and Row, 1967.
 Hooda, P.R., Statistics for Business and Economics, Macmillan, 2004.
 Nagar, A.L., and Das, R.K. Basic Statistics, Oxford, 1997.
 Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House, 2018.
 Field, A., Discovering statistics using IBM SPSS Statistics (5th Ed.). Thousand Oaks, Sage Publication, 2017.
 Ulrich, K. & Kreuter, F., Data Analysis Using Stata, Third Edition, Stata Press, 2012.
 Michael, N.M., Data Management Using Stata: A Practical Handbook, Second Edition, Stata Press, 2020

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1	H	M	
CO2		H	M
CO3	H	M	M
CO4		H	M

2.6 COMMON VALUE ADDED COURSE- (This course will be provided by the University)

CBUI104T: UNDERSTANDING INDIA

Credit – 1 (0-0-1) – 15 Hours

Course Outcomes

CO 1: At the end of this course, students will be able to explain the social, cultural and religious diversity of India and its impact on Indian psyche.

CO 2: At the end of this course, students will be able to evaluate the political and economic system of India.

Module 1: India and its Diversity (18 hours)

Overview of India's geography, diversity, demographics and development indicators

A brief survey of India's history, highlighting key events, personalities and movements that shaped its identity and destiny

An exploration of India's rich and varied cultural heritage, including its languages, religions, arts, literature and philosophy

An overview of India's social structure, institutions, norms and values, with a focus on issues such as caste, gender, class and ethnicity

Module 2: Indian Political System (12 hours)

A study of India's political system, institutions, parties and ideologies

India's role in regional and global affairs

A review of India's economic performance; the challenges and opportunities for growth;

An overview of sectors such as agriculture, industry, services, and trade.

A discussion of India's environmental problems & the solutions for sustainable development

A discussion on India's journey towards a developed nation.

Suggested Readings

1. Thapar, R. (2015). The Penguin History of Early India: From the Origins to AD 1300. India: Penguin Books Limited.
2. Kosambi, D. D. (2022). The Culture and Civilization of Ancient India in Historical Outline. United Kingdom: Taylor & Francis.
3. Zimmer, H. R. (2020). Philosophies of India. United States: Princeton University Press.
4. Mohanty, M. (2004). Class, Caste, Gender. India: SAGE Publications.
5. Mitra, S. K. (2017). Politics in India: Structure, Process and Policy. United Kingdom: Taylor & Francis.
6. Kothari, R. (1970). Politics in India. India: Orient Longman.
7. Balasubramanyam, V. N. (2019). The Economy of India. United Kingdom: Taylor & Francis.

8. Fisher, M. H. (2018). *An Environmental History of India: From Earliest Times to the Twenty-First Century*. United Kingdom: Cambridge University Press.

2.7 COMMON VALUE ADDED COURSE- (This course will be provided by the University)

CBDT103T: DIGITAL AND TECHNOLOGICAL SOLUTIONS

(1 credit: 15 hours)

Module I: Computer Fundamentals and Office automation (8 Hours)

Evolution of Computers and its applications, latest IT gadgets, basics of hardware and software, Operating Systems: types and functions, Office tools – Word Processor, Spreadsheets, Power Presentation, Introduction to graphic editing tools.

Module II: Communication Systems and Digital Solutions (4 Hours)

Types of Communication Systems model and principles, Types of transmission media, Internet concepts, Web browsers, search engines, Email, Social networking and Netiquettes.

Introduction & Evolution of Digital Systems, Role and Significance of Digital Technology, Overview of e-governance, Ecommerce & Digital Marketing: Basic Concepts, Benefits & Challenges, Digital India & e-Governance: Initiatives, Infrastructure, Services and Empowerment, Digital Financial Tools: Unified Payment Interface (UPI), Unstructured Supplementary Service Data (USSD), Aadhaar Enabled Payment System (AEPS), Banking Cards, e-Wallets, Internet Banking, 5G Technology.

Module III: Cyber Security and Emerging Technologies (4 Hours)

Concepts of cyber security, Issues and challenges of cyber security, Classification of cyber-crimes, Introduction to IT Act 2000 and its amendments, Needs and best practices for the use of Social media. Introduction to emerging technologies, Internet of Things (IoT), Big Data Analytics, Cloud Computing, Virtual reality, Artificial Intelligence, Block Chain technology, 3D Printing, Robotic Process automation.

Suggested Readings

1. Rajaraman V., *Fundamentals of Computers*, PHI Publications
2. Anita Goel, *Computer Fundamentals*, Pearson Publication New Delhi
3. Suresh Basandra, Computers Today A. Shinde, *Introduction to Cyber Security: Guide to the World of Cyber Security*, Notion Press, 2021
4. U Sharma, P Nand, J Chatterjee , V Jain, N Z Jhanjhi, R. Sujatha, *Cyber-Physical Systems: Foundations and Techniques*, Wiley, 2022.
5. U Sharma, P Astya, A Baliyan, S Krit,V Jain, M Z Khan, *Advancing Computational Intelligence Techniques for Security Systems Design*, CRC Press, 2021
6. Rich & Knight, *Artificial Intelligence*, TMG, 3 e/d
7. Rachel Schutt, Cathy O'Neil, "Doing Data Science: Straight Talk from the Frontline" Schroff/O'Reilly
8. Khan, Jamil Y., and Mehmet R. Yuce, eds. *Internet of Things (IoT): systems and applications*. CRC Press, 2019.
9. Redwood, Ben, Filemon Schöffner, and Brian Garret. *The 3D printing handbook: technologies, design and applications*. 3D Hubs, 2017.
10. G. Nandi, R. K. Sharma, *Data Science Fundamentals and Practical Approaches*, BPB, 1st Edition, 2020

E Resources

1. Evolution of Computers and its Applications: <https://computerhistory.org/>
2. Basics of Hardware and Software: Tutorial by Khan Academy
3. Hardware and Software: <https://www.coursera.org/learn/computer-hardware>
4. Operating Systems: Types and Functions: GeeksforGeeks Tutorial Website
5. Office Tools: Spoken Tutorial on Office Tools
6. GIMP Tutorials
7. Internet Fundamentals and Digital Systems - Courses by GeeksforGeeks and Coursera
8. IT Act 2000 – Website on IndiaKanoon
9. Social Media Best Practices – Website on Hootsuite
10. Cloud Computing – Resources by AWS

2.8 COMMUNITY ENGAGEMENT COURSE- PRACTICAL (This course will be provided by the University)

SERVICE LEARNING PRACTICE

SEMESTER III

3.1 ENIC200T: INTERMEDIATE MICROECONOMICS (4-0-0)

COURSE DESCRIPTION

This course presents a logical and coherent framework in which to organize observed economic phenomena. Microeconomic theory is based on the notion that individuals (and firms) have well-defined objectives (such as maximizing utility or profits) and behave systematically according to the incentives and constraints of their economic environment. It is this framework the course has been designed to gain a fundamental understanding of the choices people make in an economic setting.

COURSE OUTCOMES

Identify the concepts and terms of microeconomics. And classify the role of economic agents and their interdependence (Remembering and Understanding)

Apply the basic principles of microeconomics. (Applying)

Illustrate the behavior of consumer and producer in different situations. (Analyzing)

Interpret the production techniques under perfect markets and discuss the use of microeconomic tools for examining real life problems (Evaluating)

Module I: Consumer Choice under Risk and Uncertainty (15 hours)

Choice Under Risk and Uncertainty – Uncertainty and Probability Distributions; Expected Value and Expected Utility; Maximizing Expected Utility; Expected Utility Hypothesis; Expected Utility Functions and Attitudes towards Risk – Risk Neutral, Risk Averse Risk Preference, Certainty Equivalent and Risk Premium; Demand for Risky Assets; Reducing Risks; Intertemporal Choice – Saving and Borrowing

Module II: Market Structure (15 hours)

Derivation of Long Run Industry Supply Curve; Constant, Increasing, and Decreasing Cost Industry; Monopoly Equilibrium; Pricing with Market Power; Degree of Monopoly Power; Price Discrimination under Monopoly; Equilibrium of Multi-plant Monopoly; Monopolistic Competition – Price and Output Determination; Excess Capacity under Monopolistic Competition; Duopoly Model- Cournot, Bertrand, Stackelberg; Oligopoly – Basic Structure; Kinked demand curve, Collusive and Non-collusive Oligopoly

Module III: Welfare Economics (15 hours)

Pareto Optimality; Social Welfare Functions – Bergson & Samuelson, Arrow; Maximization of Social Welfare; Grand Utility Frontier; Compensation Criteria- Kaldor and Hicks; Arrow's Impossibility Theorem; Edgeworth Box; The Theory of Second Best; Social vs. Private Costs and Benefits

Module IV: Game Theory (15 hours)

Game Theory – Basic Ideas; Two-person Zero-Sum Game; Dominant Strategy; Prisoners' Dilemma; Nash Equilibrium; Tit-for-tat Strategy; Non-Zero Sum Game – Basic Ideas, Examples; The Concept of Repeated Game; Competitive Strategy

SUGGESTED READINGS

1. Karl E. Case & Ray C. Fair, Principles of Economics, Pearson Education Inc., 8th Edition, 2007
2. N. Gregory Mankiw, Economics: Principles and Applications, India edition by South Western, a part of Cengage Learning, Cengage Learning India Private Limited, 4th edition, 2007
3. Joseph E. Stiglitz and Carl E. Walsh, Economics, W.W. Norton & Company, Inc., New York, International Student Edition, 4th Edition, 2007
4. G.S. Maddala & Ellen Miller, Microeconomics: Theory and Applications, McGraw Hill Education, Tenth Reprint, New Delhi Edition, 2013
5. A. Koutsoyinnis, Modern Microeconomics, International Edition, Macmillan Press Ltd
6. D. Salvatore, Principles of Microeconomics, 5th Edition, OUP
7. R. S. Pindyck, D. N. Rubinfeld & P. L. Meheta, Microeconomics, 7th Edition, Pearson, New Delhi, 2009

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M			M
CO2		M	M	
CO3	H		M	H
CO4		M		H

3.2 ENSM201T: STATISTICAL METHODS FOR ECONOMICS (4-0-0)**COURSE DESCRIPTION**

This course will provide a solid foundation in probability and statistics for students in economics and other social sciences. Students will learn topics including elements of probability theory, sampling theory, statistical estimation, and hypothesis testing. The course is designed to enhance the decision making process. Moreover, the course emphasizes topics needed for further study of econometrics and helps in developing research hypotheses for research projects.

COURSE OUTCOMES

Define and understand simple concepts of statistics. (Remembering and Understanding)

Apply the statistical techniques to calculate various measures of central tendency, dispersion and probability. (Applying)

Analyze the sampling and economic data and draw inferences from it. (Analyzing)

Evaluate the statistical inferences in understanding real economic problem (Evaluating)

Module I: Probability Theory (15 Hours)

Sample Spaces and Events; Probability Axioms and Properties; Addition and Multiplication Theorem of Probability, Counting Techniques; Conditional Probability and Bayes' Rule; Independence of Events

Module II: Random Variables and Probability Distributions (20 hours)

Defining Random Variables; Probability Distributions; Expected Values of Random Variables and of Functions of Random Variables; Properties of Commonly used Discrete and Continuous Distributions (Uniform, Binomial, Normal, Poisson and Exponential Random Variables); Joint Distribution; Covariance and Correlation Coefficients

Module III: Statistical Distributions and Hypothesis Testing (15 hours)

Normal Distribution; χ^2 , t and F Distributions; Parameters and Statistics; Estimation of Parameters; Properties of Estimators; Testing of Hypotheses - Steps and decision making process; Distributions of Test Statistics; Testing Hypotheses related to Population Parameters; Type I and Type II Errors; Power of a Test

Module IV: Sampling and Parameter Estimation (15 hours)

Principal Steps in a Sample Survey; Methods of Sampling; Role of Sampling Theory; Properties of Random Samples; Errors in Statistics - Sampling vs. Non-sampling Errors; Estimation of Population Parameters; Properties of Estimators; Confidence Intervals for Population Parameters

SUGGESTED READINGS

Jay L. Devore, Probability and Statistics for Engineers, Cengage Learning, 2010

John E. Freund, Mathematical Statistics, Prentice Hall, 1992.

Richard J. Larsen & Morris L. Marx, An Introduction to Mathematical Statistics and its Applications, Prentice Hall, 2011.

William G. Cochran, Sampling Techniques, John Wiley, 2007.

Gupta S.C, Fundamentals of Statistics, Himalaya Publishing House, 2018.

Mapping of COs

	Module I	Module II	Module III	Module IV
CO1	H	M		M
CO2	M	H	M	M
CO3		H	H	H
CO4			H	M

3.4 ENET205T: HISTORY OF ECONOMIC THOUGHTS (4-0-0)**COURSE DESCRIPTION**

This course will help to relate and understand the evolution of different economic theories led by classical, neo-classical and modern economists. Through philosophical foundations, the student will be able to relate different positions of economic thoughts. It will help to explain the policy implications of the theories and their usefulness in the context of current world scenarios in general and Indian Economy in particular.

COURSE OUTCOMES

Relate, understand and explain the contributions on themes of economic analysis

(Remembering, Understanding)

Identify their texts and link the different positions of economic thought. (Applying)

Evaluate political implications and link the different positions of economic thought to philosophical foundations. (Analyzing)

Explain and discuss the political implications and usefulness of their texts in context to the current World Scenario and Indian Economy in particular (Evaluating, Creating)

Module I: Pre-Classical and Classical Economic Thought (10 hours)

Mercantilism: Tenets, Rise & Fall; Physiocracy; Tableau Economique of Quesnay; concept of Natural Order, Produit Net, Taxation, Trade; Contributions of Adam Smith, David Ricardo, T.R. Malthus, J.B. Say, J.S. Mill's Restatement of Classicism.

Module II: Reaction against Classicism and the reconstruction of Economic Science (20 hours)

Positive and Critical ideas of the Historical School; State Socialism – Ideas of J.K. Rodbertus and F. Lassalle; Scientific Socialism- Chief, tenets of Marxian Thought, Dialectical Materialism; The Labour Theory of Value; Theory of Surplus Value; The Law of Concentration of Capital; Marx and Modern Economists; Subjectivism and Marginalism – Factors giving rise to Subjectivism and Marginalism; Economic ideas of Walras and Carl Menger; Neoclassicism – Contributions of Alfred Marshall, Knut Wicksell and Bohm Bawerk

Module III: Keynesian Economics (10 hours)

Keynes departure from Classical Economics; Salient Features of the General Theory of Employment, Interest and Money; Theory of Employment; Theory of Prices; Keynes and International Economics; Keynes Influence on Public Policy; Keynesian Economics and Underdeveloped Countries; Keynesianism Vs. Monetarism.

Module IV: Indian Economic Thought (20 hours)

Main themes of Kautilya's Arthashastra; Modern Economic Ideas: Dada Bhai Naoroji, Ranade, Gokhle; M.K. Gandhi's ideas on —Village, Swadeshi, Khadi, Cottage Industries and place of Machine; Welfare of Labour; Non-violent Economy; Decentralisation; Trusteeship; Sarvodaya

SUGGESTED READING

Guide, C. & C. Rist, A History of Economic Doctrine

Roll, Eric, A History of Economic Thought

Hajela, T.N., History of Economic Thought

Bhatia, H.L., History of Economic Thought

Vohra, Munish, History of Economic Thought

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M	M	H	M
CO2	M			H
CO3	H	H	M	M
CO4	H	M		H

3.5 ENED110T: ENTREPRENEURSHIP DEVELOPMENT (3-0-0)**COURSE DESCRIPTION****COURSE OUTCOMES**

- Students will get the knowledge of the term Entrepreneurship, and the qualities required to become an Entrepreneur. (Understanding)
- Will be introduced to various theories of entrepreneur and their applicability in real life (Apply)
- Will be introduced to various sources of financial assistance available to promote entrepreneur (Evaluating)
- The students will get some idea of various legal protections for innovation and develop the skill of decision making. (Creating)

Module 1 Introduction (Hours 10)

Meaning and Importance, Evolution of term Entrepreneurship, Factors influencing entrepreneurship; Characteristics of an entrepreneur; Types of entrepreneur; Barriers to entrepreneurship

Module 2 Entrepreneurial Motivation (Hours 12)

Motivation meaning; Maslow's theory; Herzberg's theory; McGregor's Theory; Culture & Society; Risk taking behavior of entrepreneurs.

Module 3 Entrepreneurial Creativity (Hours 8)

Creativity and entrepreneurship and Steps in Creativity; Innovation and inventions; Legal Protection of innovation Skills of an entrepreneur Decision making and Problem Solving

Module 4 Organization Assistance (Hours 15)

Industrial Park (Meaning, features, & examples); Special Economic Zone (Meaning, features & examples); Financial assistance by different agencies; MSME Act and Small Scale Industries; Environmental Clearance: National Small Industries Corporation (NSIC); Financial assistance to MSME; The Small Industries Development Bank of India (SIDBI); The State Small Industries Development Corporation (SSIDC) Export oriented units; Incentives and facilities to exports entrepreneurs; Export oriented zone; Export-Import Bank of India

SUGGESTED READINGS

1. Arya Kumar, Entrepreneurship, Pearson, Delhi.
2. Poornima MCH, Entrepreneurship Development –Small Business Enterprises, Pearson, Delhi
3. Sangeetha Sharma, Entrepreneurship Development, PHI Learning
4. Kanishka Bedi, Management and Entrepreneurship, Oxford University Press, Delhi
5. Anil Kumar, S., ET.al., Entrepreneurship Development, New Age International Publishers, New Delhi
6. Khanka, SS, Entrepreneurship Development, S. Chand, New Delhi
7. Peter F. Drucker, Innovation and Entrepreneurship
8. A. Sahay, M. S. Chhikara, New Vistas of Entrepreneurship: Challenges and Opportunities

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M	M	M	
CO2	H	M		M
CO3		M		H
CO4		H	H	M

3.6 ENSP207L: HANDS-ON TRAINING ON DATA ANALYSIS WITH A STATISTICAL PACKAGE (3-0-0)**COURSE DESCRIPTION**

The purpose of this course is to provide students the necessary hand-on skills to use at least one statistical package to analyze data. This course aims to provide both the digital and analytical skills that are required for the analysis of data mainly employed in social science research.

PREREQUISITES

Personal laptop or tablet (own device) for this course is mandatory.

Familiarity with basic concepts in statistics, such as measurement levels, mean, median, mode and standard deviation.

Firm grasp of MS Word and MS Excel is helpful.

Basic understanding of the purpose and functions of statistical softwares is helpful.

COURSE OUTCOMES

Define and understand the key terms related to data and data analysis. (Remembering and Understanding)

Apply the MS Excel for data entry and calculation of various measures of central tendency, dispersion. (Applying)

Analyze the computer generated output provided by any open-source statistical package and draw inferences from it. (Analyzing)

Evaluate the statistical inferences from the outputs provided by statistical software in understanding real economic problem (Evaluating)

Module I: Introduction to Data and Statistical Packages (25 Hours)

Data – Meaning and Nature; Types of Data – Nominal, Ordinal, Interval and Ratio; Sources of Data – Primary and Secondary Data; Analysis of Data – Quantitative and Qualitative Data; Time Aspect of Data – Cross Sectional, Time Series and Pooled Data; Accuracy of Data; Concept of Variable; Applications of MS-Excel in data analysis - File, Edit, View, Data, Data Set Creation and Management; Data entry and Data Cleaning; Introduction to statistical packages

Module II: Calculations of Descriptive Statistics (10 Hours)

Frequency; Summation; Maximum; Minimum; Mean; Median; Mode; Standard Deviation; Skewness; Covariance; Correlation – Bivariate, Partial, Rank, Correlation Matrix; Simple Linear Regression

Module III: Graphical Presentation of Data (10 Hours)

Diagrammatic Presentation; One Dimensional – Single, Subdivided, Multiple Deviation; Two Dimensional – Histogram, Pie Diagram; Three Dimensional – Rectangular, Cube; Pictograms and Cartograms; Scatter; Line and Radar Diagrams; Tabular Presentation – Single, Double, Multiple

SUGGESTED READINGS

Field, A. (2013): Discovering Statistics Using IBM SPSS Statistics, Sage Publication

Field, A. (2017). Discovering statistics using IBM SPSS Statistics (5th Ed.). Thousand Oaks, CA, USA

Gupta S.C, Fundamentals of Statistics, Himalaya Publishing House, 2018

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1	H	M	M
CO2	H	H	H
CO3	M	H	
CO4		H	M

SEMESTER IV**4.1 ENIA202T: INTERMEDIATE MACROECONOMICS (5-0-0)****COURSE DESCRIPTION**

This course introduces the students to formal modeling of a macro-economy in terms of analytical tools. It also provides the macro-foundations to the various aggregative concepts used in the previous course. It introduces various theoretical issues related to an open economy. It also introduces the concept of inflation, its relationship with unemployment and some basic concepts in an open economy.

COURSE OUTCOMES

Understand macroeconomics from the perspective of policy making. (Understanding)

Apply some basic principles of macroeconomics. (Applying)

Draw Inferences from interactions between macroeconomic thoughts and real life situations. (Analyzing)

Interpret the links between the domestic economy and the rest of the world. (Evaluating)

Module I: Aggregate Demand and Aggregate Supply Curves (15 hours)

Derivation of aggregate demand and aggregate supply curves; interaction of aggregate demand and supply; Multiplier analysis with AD curve and changes in price levels; Aggregate supply in the SR and LR

Module II: Macroeconomic Foundations (23 hours)

Consumption: Keynesian Consumption Function; Fisher's Theory of Optimal Intertemporal Choice; Life-cycle and Permanent Income Hypothesis; Rational Expectations and Random-walk hypothesis of Consumption Expenditure; Investment: Determinants of Business Fixed Investment; Residential Investment and Inventory Investment; Marginal Efficiency of Capital and Investment

Module III: Inflation, Unemployment and Expectations (22 hours)

Inflation – Types, Causes, Effects; Measures to Control Inflation; Pull and Cost Push; Inflationary Gap; Inflation and its Social Costs; Anti-inflationary Measures; Structural Theories of Inflation; Inflation in Developing Countries; Inflation-unemployment Trade-off – Phillips Curve; Hyperinflation; Deflation – Meaning, Effects; Inflation vs. Deflation; Adaptive Expectations; Rational Expectations.

Module IV: Open Economy Models (15hours)

Short-run Open Economy Models; Mundell-Fleming Model; Exchange Rate Determination; Purchasing Power Parity; Dornbusch's Overshooting Model; Monetary Approach to Balance of Payments; International Financial Markets; Inflation and Unemployment in the Open Economy

SUGGESTED READINGS

Dornbusch, Fischer & Startz, Macroeconomics, McGraw Hill, 11th edition, 2010.

N. Gregory Mankiw, Macroeconomics, Worth Publishers, 7th edition, 2010.

Olivier Blanchard, Macroeconomics, Pearson Education, Inc., 5th edition, 2009.

Charles I. Jones, Introduction to Economic Growth, W.W. Norton & Company, 2nd edition, 2002.

Andrew B. Abel & Ben S. Bernanke, Macroeconomics, Pearson Education, Inc., 7th edition, 2011.

Errol D'Souza, Macroeconomics, Pearson Education, 2009.

Robert J. Gordon, Macroeconomics, Prentice-Hall India Limited, 2011.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M	M	H
CO2		H	H	
CO3	M	H		M
CO4				H

4.2 ENIE203T: INTERNATIONAL ECONOMICS (5-0-0)**COURSE DESCRIPTION**

This course develops a systematic exposition of models that try to explain the concept, subject matter, direction, and consequences of international trade, and the determinants and effects of trade policy. Students will be exposed to various theories of international trade and their application. It concludes with an analytical account of the causes and consequences of the rapid expansion of international financial flows in recent years. Although the course is based on abstract theoretical models, students will also be able to learn the real-world examples and case studies.

COURSE OUTCOMES

- Understand the key principles and the main theories of international economics. (Remembering and Understand)
- Apply the theories and models of international trade for economic growth and global welfare. (Applying)
- Analyze the links between trade, international finance, economic growth and globalization, with a particular emphasis on the experiences of developing countries. (Analyzing)
- Evaluate international trade policies regarding increase in exports, international debt, and international institutions to solve domestic economic problems. (Evaluating)

Module I: Introduction (15 hours)

International Economics – Meaning, Importance and Subject Matter; Gains from Trade; Overview of World Trade; Globalization of the World Economy; International capital flows – significance and limitations of foreign capital; Foreign direct investment- factors affecting direct investment, effects of direct investment; Current International Economic Problems and Challenges

Module II: Theories of International Trade (20 hours)

Offer Curves; Terms of Trade; The Ricardian Theory of Trade; Specific Factor Model of Trade; Heckscher-Ohlin Models; Leontief Paradox; New Trade Theories; Rybczynski and Stolper-Samuelson Theorem; The International Location of Production; Firms in the Global Economy – Outsourcing and Multinational Enterprises

Module III: Trade Policy (20 hours)

Instruments of Trade Policy; Trade Restrictions – Tariffs and Optimum Tariff; Nontariff Trade Barriers; Partial and General Equilibrium Analysis of a Tariff; Inward looking and outward looking trade policy; Economic Integrations – Free Trade Areas, Customs Unions, Common Markets, Optimum Currency Area, Economic Union; Dumping; Political Economy of Trade Policy; Controversies in Trade Policy

Module IV: International Macroeconomic Policy (20 hours)

Balance of Payments – Current and Capital Account; Foreign Exchange Markets – Types and Functions; Exchange Rates – Fixed vs. Flexible Exchange Rates, Spot and Forward Exchange Rates; Determination of equilibrium Exchange Rate; Foreign Exchange Risks – Hedging, Speculation, Interest Arbitrage; International Monetary Systems; WTO and International Trade; International Debt Crisis; Financial Globalization and Financial Crises

SUGGESTED READINGS

- Salvatore, D., International Economics, Wiley, 11th Edition, 2013
- Krugman, Paul R., & Maurice Obstfeld. International Economics. Harlow: Pearson Education, 2011
- Chacholiades, M., International Trade: Theory and Policy, McGraw Hill, 1988
- Cherunilam, F., International Economics, McGraw Hill India, 5th Edition, 2008

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H		M	H
CO2		H		H
CO3	M	H		M
CO4	M		H	

4.3 ENFE204T: FUNDAMENTALS OF ECONOMETRICS (4-0-0)

COURSE DESCRIPTION

This course is an undergraduate level introduction to econometrics, a powerful tool applied to the analysis of economic phenomena. Students will learn the core concepts of estimation of economic parameters, prediction of economic outcomes, and statistical inference in this course. Moreover, the course covers the statistical tools needed to understand empirical economic research and to plan and execute independent research projects in future.

COURSE OUTCOMES

Define the basic concepts like definition, scope and nature of econometrics. (Remembering and Understanding)

Apply various statistical tools in hypothesis testing and econometric research. (Applying)

Analyze the results of regression models using the OLS method and make decisions with hypothesis testing. (Analyzing)

Evaluate the regression models for violations of classical assumptions and design regression models to test hypotheses of real economic problems. (Evaluating and Creating)

Module I: Introduction to Econometrics (10 Hours)

Basics of Econometrics – Meaning and Methodology; Relation with Mathematical Economics and Statistics; Applications of Econometrics; Nature of Econometrics; Scaling and Units of Measurement

Module II: Estimation of Regression Model (20 hours)

Regression-Concepts and Functional forms; Classical Linear Regression and its Assumptions; Estimation of Simple Linear Regression models; Properties of Estimators; Goodness of Fit; Tests of Hypotheses; Confidence Intervals; Forecasting; Multiple Linear Regression-Adjusted R^2 ; Partial Regression Coefficients; Testing Hypotheses – Individual and Joint

Module III: Violations of Classical Assumptions (15 hours)

Multicollinearity – Consequences, Detection, Remedies; Heteroscedasticity – Consequences, Detection, Remedies; Serial Correlation – Consequences, Detection, Remedies

Module IV: Simultaneous-Equation Models and its Identification (15 hours)

Nature and Problems of Simultaneous-equation models; Structural, Reduced-form and Recursive Models; Estimation through ILS and 2SLS methods; Identification of Simultaneous-equation models

SUGGESTED READINGS

Jay, L. Devore, Probability and Statistics for Engineers, Cengage Learning, 2010

John E. Freund, Mathematical Statistics, Prentice Hall, 1992.

Richard J. Larsen & Morris L. Marx, An Introduction to Mathematical Statistics and its Applications, Prentice Hall, 2011.

Madnani, G.M.K., Introduction to Econometrics: Principles and Applications, CBS Publishers & Distributors, 2009.

Dougherty, C., Introduction to Econometrics, 4th ed., Oxford University Press, 2011.

Gujarati, D., & Porter, D., Essentials of Econometrics, 4th ed., McGraw-Hill, 2010.

Kmenta, J., Elements of Econometrics, Khosla Publishing House, 2008.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M	M	
CO2	H	H	H	M
CO3	M	H	H	H
CO4			H	H

4.4 ENGE206T: GENDER ECONOMICS (4-0-0)**COURSE DESCRIPTION**

The current subject will help us understand the concepts of gender economics. It includes knowing the different concepts of gender indicators, demographic profile of female population and gender development measures. It will also throw light on the role of women in decision making at different levels, focusing on visible and invisible work of women. Further the subject will cover women in the labor market and various economic issues and policy implications on improving gender equality in India.

COURSE OUTCOMES

Relate the demography concepts to understand the demography of a nation with special reference to women (Remembering and Understanding)

Examine the various gender indices to understand the framework of policy relating to gender issues. (Applying)

Inspect the factors responsible for gender discrimination in India (Analyzing)

Evaluate and analyze the role of technology and institutions in addressing the problem of gender inequalities and women empowerment. (Evaluating and Creating)

Module I: Concept and Importance of Gender Economics (15 hours)

Importance of Gender Economics; Women in Patriarchal and Matriarchal Societies and Structures; Gender Bias in the Theories of Values; Demography of Female Population; Causes of Declining Sex Ratios and Fertility Rates; Women and their Access to Nutrition, Health and Education; Gender Planning Frameworks and Tools; Gender Inequality Indices – GII, MPI, WEIA, SIGI, GDI, GEM

Module II: Decision Making, Economic Activity and Women (15 hours)

Factors Affecting Decision Making by Women; Property Rights; Power of Decision Making at Household, Class, Community Level; Economic Status of Women and its Effect in WPR, Income Level, Health and Education in Developing Countries; Concept and Analysis of Women's Work – Visible and Invisible Work, Economically and Socially Productive Work

Module III: Labour Market, Technology, Environment and Women (15 hours)

Factors Affecting Female Entry in Labor Market; Studies of Female work Participation in Agricultural and Non-agricultural Rural Activities; Wage Differentials in Female Activities; Structure of Wage across Regions and Economic Sectors; Impact of Technological Development and Modernization on Women's Work Participation; Women and Environment – Female Activities and Environmental Concerns

Module IV: Social Security, Gender Planning and Development Policies (15 hours)

Effectiveness of Collective Bargaining; Schemes for Safety net for Women; Need for Female Labour Unions; Gender Mainstreaming in Development Policies; Gender Sensitive Governance – Gender Budgeting, Democratic Decentralization (Panchayats) and Women's Empowerment in India; The Kudumbashree Experience in Kerala, A comparative assessment on Gender policies between developed and developing countries (with special reference to Asian countries)

SUGGESTED READINGS

Amsden, A.H., The Economics of Women and Work, Penguin, Harmondsworth, 1980

Beneria, L. & M. Roldan, *The Crossroads of Class and Gender*, University of Chicago Press, Chicago, 1987
 Beneria, Lourdes, Gunseli Berik, and Maria Floro, *Gender, Development and Globalization: Economics as if all People Mattered*, Second Edition, Routledge, London, 2015
 Bonnie G Smith, *Women's Studies: The Basics*, Routledge, London, 2013
 Borerup, E., *Women's Role in Economic Development*, George Allen and Unwin, London, 1970
 Irene Tinker, *Persistent Inequalities: Women and world development*, New York: Oxford University Press, 1990

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M	M	M	M
CO2		M		M
CO3	M	M	M	H
CO4	H	H	H	H

SEMESTER V

5.1 ENDE300T: DEVELOPMENT ECONOMICS (4-0-0)

COURSE DESCRIPTION

This subject will help the students to define and understand the different concepts of development. The course will help in comparing the changes in the process of development and compare among developed, developing and under-developed countries. The course will include different economic theories related to growth and development. Finally, the subject will learn to criticize and appraise different economic policies towards economic development.

COURSE OUTCOMES

- Define and describe the different concepts of Economic growth and development (Remembering and Understanding)
- Demonstrate the changes in Classical, Neo-classical and modern theories of economic development (Applying)
- Compare and criticize the different strategies of economic development (Analysing)
- Evaluate and Explain the different sectoral problems and policies for development (Evaluating and Creating)

Module-I: Economic Growth and Development (15 hours)

Meaning of Economic Growth and Development; Scope; Measures of Development-GDP, PCI, HDI- Gender Index-PQLI (including adjusted indices); Characteristics of Under-developed, Developing and Developed Countries; Factors determining Economic growth; Capital formation ; Technological process and economic development; Hicks Neutral Technological Change; Harrods Neutral

Module-II: Classical, Neo-Classical and Modern Theories of Economic Growth (20 hours)

Adam Smith's Theory of Economic Development; Malthus's Theory; Marx Theory; Shumpeter theory of development; Rostow's Theory of Growth; Solow Neoclassical Growth Model; Harrod-Domar Growth Model; The Neo-colonial Dependency Model; Endogenous Growth Models-AK Model and Romer's Model; Meade's neo-classical model of economic growth-Joan Robinson's Model of Growth

Module-III: Strategies of Development (10 hours)

Lewis's theory of Economic Development; Big-Push Theory; Balanced and Unbalanced Growth Strategies; Critical Minimum Effort Theory; Social Dualism-Higgin's Technology Dualism; Mahalanobi's Growth Model; Wage Good Model; Michael Kremer's O-Ring Theory

Module-IV: Sectoral Problems and Policies (15 hours)

Agriculture, Productivity and Economic Development; Land Reforms; Industrialization- Measuring Inequality- Lorenz Curve, Gini-Coefficient and Aggregate measures of inequality; Gender Inequality; Human Capital; Education and Health; Poverty; Kuznet's Inverted U Hypothesis; Poverty- MPI- Policy Options on Income Inequality and Poverty in India- Unemployment- Problems and Policies in India

SUGGESTED READINGS

Todaro & Smith, Economic Development, Pearson Education
 A P. Thirlwall, Growth and Development, Macmillan Press Ltd.
 M. L. Taneja & R. M. Myer, Economics of Development and Planning, Vishal Publishing Company.
 Mishra & Puri, Growth and Development, Himalaya Publishing House.
 Debraj Ray, Development Economics, Princeton University Press.
 Abhijit Banerjee, Roland Benabou & Dilip Mookerjee, Understanding Poverty, Oxford University Press, 2006.
 H.L Ahuja, Development Economics: A critical Study of Economic Growth, Development and Environment, S. Chand, 2018.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M	M		M
CO2	M	H	M	M
CO3	H		M	H
CO4	M	H	H	M

5.2 ENEE301T: ENVIRONMENTAL ECONOMICS (5-0-0)**COURSE DESCRIPTION**

This course designed economics to understand the fundamental concepts, subject matter, nature and scope of environmental economics and key environmental issues and problems. The concept of market failure and externalities, Pareto efficiency, maximum social welfare and perfect competition, measures to control pollution and externalities, Pigouvian tax and subsidies, Compensation criterion, social choice and justice, property rights and Coase theorem etc. will be thoroughly discussed. Environmental concerns like climate change: global warming, ozone depletion and Biodiversity loss, policy instruments for environmental protection are the areas where serious discussion will be conducted

COURSE OUTCOMES

Define the basic concepts of environmental economics. (Remembering)
 Understand the environmental issues in relation to the theory of externalities. (Understanding)
 Analyze environmental problems using economic principles. (Applying/Analysing)
 Evaluate the diverse methods of environmental valuation for sustainable development. (Evaluating)

Module I: Introduction (15 hours)

Environmental Economics - Meaning, Nature, Scope; Interlinkage between Economy and Environment; Population and Environment; Poverty and Environment

Module II: The Theory of Externalities (15 hours)

Pareto Optimality and Market Failure in the Presence of Externalities; Property Rights and the Coase Theorem

Module III: The Design and Implementation of Environmental Policy and Environmental Problems (20 hours)

Overview; Pigouvian Taxes and Effluent Fees; Tradable Permits; Choice between Taxes and Quotas under Uncertainty; Market base and Non Market base instrument of Environmental pollution control; Implementation of Environmental Policy; Trans-Boundary Environmental Problems; Economics of Climate Change; Trade and Environment

Module IV: Environment Valuation and Sustainable Development (20 hours)

Non-Market Values: Use Value, Option Value, Bequest Value; Measurement Methods - Willingness to Pay and Willingness to Accept Compensation; Risk Assessment and Perception. Sustainable Development - Basic Concepts and Measurement; Perspectives from Indian Experience

SUGGESTED READINGS

Kolstad, Charles D., Environmental Economics, Oxford University Press, New Delhi, 1999.

- Robert N. Stavins (ed.), *Economics of the Environment: Selected Readings*, W.W. Norton, 5th edition, 2005.
- Roger Perman, Yue Ma, James McGilvray and Michael Common, *Natural Resource and Environmental Economics*, Pearson Education/Addison Wesley, 4th edition, 2011.
- Maureen L. Cropper & Wallace E. Oates, *Environmental Economics: A Survey*, Journal of Economic Literature, 1992.
- Bhattacharya, Rabindra N., *Environmental Economics: An Indian Perspective*. New Delhi: Oxford University Press, 2002.
- Hanley N., J.F. Shogren & B., White. *Environmental Economics in Theory and Practice*, Macmillan, 1997.
- Lewis, Lynne, & Thomas Harry Tietenberg, *Environmental Economics and Policy*, Routledge, 2020.
- Shankar, U., *Environmental Economics*, Oxford University Press, New Delhi, 2001.
- Tietenberg, T., *Environmental Economics and Policy*, Harper Collins, New York, 1994.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			M
CO2		H		H
CO3	M		H	
CO4		H		H

5.3 ENIF302T: INDIAN FINANCIAL SYSTEM (4-0-0)

COURSE DESCRIPTION

This course aims at providing the basic knowledge of the Indian Financial system and its components, institutions and their functions. It also helps to understand the workings of the financial institutions and their role in economic development. This also helps to understand the operation of the financial market and capital market.

COURSE OUTCOMES

- Understand the basic ideas and developments of the Indian financial system. (Understanding)
- Demonstrate the workings of the Indian financial institutions. (Applying)
- Analyze the basic operation of the financial market and capital market. (Analyzing)
- Evaluate various roles and functions played by the Indian financial system in economic development. (Evaluating)

Module I: Introduction of Financial System (10 hours)

Financial System-meaning, concept, basic functions; Financial System and Economic Development; Components of Financial system; Overview of Indian Financial System

Module II: Money Market and Capital Market (15 hours)

Financial market; Classification of Financial Markets; Money Market- its constitutions, functions of Money Market, Money Market Institution; Money Market Instruments; Capital Market-Primary Market, Secondary Market, Functions of Capital Market and its significance; Methods of issue of Stock Market in Primary Market.

Module III: Financial Institution, Instruments and Services (20 hours)

Financial Institution; Banking and Non-Banking Financial Institution, Distinction between Banking and Non-Banking Financial Institutions; Structure of Banking in India; Commercial bank, Co-operative Bank, Rural Bank- their features, types of Non-Banking Financial Institution; Financial Instruments and Services- concepts and characteristics, features of various Financial Instruments, emerging Financial Service- leasing, hire-purchase, merchant banking, depository, credit rating, mutual funds; Insurance Companies and Pension Funds

Module IV: Regulatory Institutions (15 hours)

Regulatory framework; Overview of Regulatory Framework of Financial System, functions of RBI, SEBI- objectives, scope of securities Contract (Regulation) Act 1956, relevant provision of India Companies Act 1956 in regard to securities market; Insurance Regulatory and Development Authority of India; Pension Fund Regulatory and Development Authority; Small Industries Development Bank of India (SIDBI); Ministry of Corporate Affairs

SUGGESTED READINGS

Indian Financial System, M.Y Khan, McGraw Hill Companies.

Department of Economics
Financial Institution and Markets, Structure, Growth and Innovations, L.M. Bhole, The McGraw Hill Companies.

The Indian Financial System, Markets, Institutions and Service, Bharati V. Pathak, Pearson Education
Banking Theory and Practices, K.C Shekhar, Lakshmi Shekhar, Vikas Publishing House Pvt. Ltd
Indian Financial System- P.N Varshney & D.K. Mittal- Sultan Chand & Sons, New Delhi.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		M	H	
CO3		H		
CO4	M		M	H

5.4 ENPU307T: PUBLIC FINANCE (4-0-0)

COURSE DESCRIPTION

This course is a non-technical overview of government finances with special reference to India. The course does not require any prior knowledge of economics. It will look into the efficiency and equity aspects of taxation of the centre, states and the local governments and the issues of fiscal federalism and decentralization in India. The course will be useful for students aiming towards careers in the government sector, policy analysis, business and journalism.

COURSE OUTCOMES

1. Discuss the nature and scope of public finance and its functions. (Understanding)
2. Demonstrate the different types of taxation and the effects of taxation. (Applying)
3. Analyze the effects of public expenditure and welfare aspects. (Analyzing)
4. Explain the types of public budget and deficits and its significance. (Evaluating)

Module I: Introduction (10 hours)

Public Finance and Private Finance; Public Finance –Nature and Scope: Allocation Function, Distribution Function and Stabilization Function; Public Goods and their characteristics; Types of Public goods; Free Rider Problem and Market Failure; Externalities vis-à-vis Public Good

Module II: Public Revenues and Receipts (20 hours)

Revenue and Non-Revenue Receipts; Sources of Tax Revenue and Non-tax Revenue; Direct and Indirect Tax; Goods and Service tax in India; New Direct tax code; Concepts of taxation: tax rate, buoyancy & elasticity of a tax: Proportional, Progressive and Regressive Taxation; Neutral and Non- Neutral Taxes; Taxable Capacity; Principles of Taxation; Objectives and Effects of Taxation; Impact, Shifting and Incidence of Tax

Module III: Public Expenditure (20 hours)

Canons of Public Expenditure; Plan and Non Plan Expenditure; Effects of Public Expenditure and Welfare Aspects, Theories of Public Expenditure: Maximum Social Advantage, Maximum Aggregate Benefit, Lindahl Model of Voluntary Exchange; Crowding out effect; Tiebout Model; Wagner's Law of Increasing State Activities; Wiseman-Peacock Hypothesis; Cost-Benefit Analysis

Module IV: Budget and Deficit Financing (10 hours)

Structure of the Public Budget; Kinds of Budgets; Types of Deficits and their significance: Revenue Deficit, Fiscal Deficit and Primary Deficit; Fiscal Federalism in India and the Finance Commission; Fiscal Responsibility and Budget Management(FRBM) Act 2003; Recent Amendments to FRBM Act

SUGGESTED READINGS

- Aronson, J.R., Public finance, New York: McGraw-Hill International, 1985.
Atkinson, A.B., & Stiglitz, J.E., Lectures on public economics. New Jersey: Princeton University Press, 2007.
Basu, K., & Maertens, A., The new Oxford companion to economics in India, New York: Oxford University Press, 2012.
Bhatia, H. L., Public Finance, Vikas Publishing House Private Ltd., 2006.
Brown, C.V., & Jackson, P. M., Public Sector Economics, United Kingdom: Wiley-Blackwell, 1990.

Buchanan, J. M., & Musgrave, R. A., Public Finance and Public Choice: Two contrasting visions of the state, Cambridge, Massachusetts: MIT Press, 1990.

Cullis, J., Jones, P., & Jones, P.R., Public Finance and Public Choice: Analytical perspectives, New York: Oxford University Press, 2009.

Musgrave, R.A., & Musgrave, P.B., Public Finance in Theory and Practice, New York: McGraw Hill Book Company, 1989.

Rao, M.G., & Sen, T. K., Fiscal Federalism in India: Theory and Practice, Macmillan India, 1996.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3		M	H	
CO4				H

5.6 ENIN309I: INTERNSHIP COURSE

Internship is an important part of the course. The student will be required to join for internship during the tenure. The student can find institutes providing internships on their own or through online portals such as Internshala. Internshala provides opportunities for students to have hands-on experience with organizations and also earn some remuneration along with certificates of participation. Students can also get certified courses in the beginning of the semesters for better opportunities for internships. Internshala also provides online courses with guaranteed job and guaranteed internship with longer durations of 3 to 6 months. Thus, students will be encouraged to participate in such courses.

SEMESTER VI

6.1 ENPO303T: POPULATION ECONOMICS (4-0-0)

COURSE DESCRIPTION

The course will examine the economic determinants of population change and demographic behavior including household formation, marriage, child bearing and rearing, mortality (and especially infant mortality) and key forms of human capital investment including schooling and migration. We will apply analytical tools of economics to investigate various economic and social consequences of population change.

COURSE OUTCOMES

Understand the different theories related with population growth and development (Remembering and Understanding)

Examine the changes in social and political economy due to demographic changes. (Applying)

Identify the factors responsible for internal and international Migration. (Analyzing)

Evaluate the population growth and trends of different states in India. (Evaluating)

Module I: Population theories and Development (10 hours)

Demography –Meaning and Scope; Theories of Population – Malthus, Optimum Theory of Population; Theory of Demographic Transition – Views of Meadows; Population and Development – Demographic Dividend; Concepts of Stable Population; Methods of Population Projection

Module II: Fertility, Nuptiality and Mortality (15 hours)

Fertility – Emerging Issues in Fertility Control; Fertility Analysis; Theories of Fertility; Nuptiality Concept and Analysis of Marital Status – Single Mean Age at Marriage, Synthetic Cohort Methods, Trends in Age at Marriage; Mortality – Death Rates, Crude Age-specific; Mortality at Birth and Infant Mortality Rate; Sex and Age Pattern of Mortality; Levels and Trends of Mortality rate; Life Table Construction and Uses

Module III: Distributional Pattern of Population (20 hours)

Population Trends in the Twentieth Century; Population Distribution; Population Explosion and its Dynamics; Pattern of Age and Sex Structure; Determinants of Age and Sex Structure; Demographic Effects of Sex and Age Structure; Economic and Social Implications; Age Pyramids Projections, Measures of Population Change; Evolution of Population Policy in India – The Shift in Policy from Population Control to Family Welfare

Module IV: Migration and Urbanization (15 hours)

Internal and International Migration Flows; Internal Migration its Effect on Population Growth and Pattern; Factors Affecting Migration; Theories of Migration Related to Internal Migration; International Migration Flows; Dynamics of the International Migration Process; Urbanization Growth and Distribution of Rural-urban Population in Developed and Developing Countries; Gravity Model

SUGGESTED READINGS

- Bogue, D.J., Principles of Demography, John Wiley, NY, 1971
 Chenery, H. & N. Srinivasan (eds.), Handbook of Development Economics, Vol. I & II, Elsevier, Amsterdam, 1989
 Chiang, C.L., Life Tables and Mortality Analysis, W.H.O., Geneva, 1974
 John, R. W., Population: An Introduction to Concepts and Issues, (7th ed.), New York: Wadsworth Publishing Company, 2002
 Shryock, H. S. et. al., The Methods and Materials of Demography, New York: Academic Press, 1976
 Srinivasan, K., Basic Demographic Techniques and Applications, New Delhi: Sage Publications, 1998
 Thompson, W. S. & Lewis, D. T., Population Problems, New Delhi: Tata McGraw Hills Publishing Co., 1976

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M		M
CO2		H	H	
CO3				H
CO4	M	M	H	

6.2 ENPB304T: PUBLIC ECONOMICS (4-0-0)

COURSE DESCRIPTION

The course covers theory and evidence on government taxation policy. Topics include tax incidence, optimal tax theory, the effect of taxation on labor supply and savings, taxation and corporate behavior, and tax expenditure policy. The course also discusses the evolution of public choice theories and public expenditure theories. The impact of social safety net on productivity of the human capital, cost benefit analysis of government policies will be thoroughly covered.

COURSE OUTCOMES

- Define the main concepts in public economic policies relating to public goods, public expenditures (Remembering/Understanding)
- Identify the main issues of budgeting and fiscal policies in context of income redistribution (Applying/ Analyzing)
- Evaluate the public investment projects and decision making in the public sector. (Evaluating)
- Examine the usefulness and problems related to government subsidies and income support (Creating)

Module I: Government Activity and Public Economic Policies (15 hours)

Efficiency, Markets and Governments – Markets, Prices, Efficiency Conditions; Market failure – A Preview of the Basis for Government Activity and the Functions of the Government; Equity vs. Efficiency – Positive and Normative Analysis; Externalities and Government Policy – Market Failures, Externalities and Efficiency; Public Choice Theory – Meaning, Outcomes of Collective Choice; The Choice Process – Unanimity, Majority Rule and the Voting Paradox, Arrow's Theorem

Module II: Theories of Public Goods, Public Expenditures and Taxation (15 hours)

The Theory of Public Goods; Provision of Private Goods and Public Goods – Markets and Government; The Demand for a Pure Public Good; Efficient Output of a Pure Public Good – Partial and General Equilibrium Analysis; Individual Action; Voluntary Cooperation and Efficiency; Local Public Goods; Voting Models of Public Goods; The Theory of Public Expenditure – Tiebout, Samuelson, Buchanan.

Module III: Budgeting, Fiscal Policies and Income Redistribution (15 hours)

Program Budgeting – It's Application; Zero-Based Budgeting; Budgeting Policies; Fiscal Policy with Special Reference to Under-developed Countries; Federal-Fiscal Relation in India; Income Redistribution – Taxes, Government Expenditures and the Distribution of Income, Welfare, Social Security and the Social Safety Net; Demographic Changes and the Future of Social Security; The Impact of Social Security on Savings and Work Incentives.

Module IV: Public Investment Projects and the Public Sector (15 hours)

Public Utilities and Project Evaluation – Cost-Benefit Analysis; Problem of Government Failure – Privatization, Devolution, Rules vs. Discretion; Public and Private Sectors – Lack of Residual Claimant, Citizens and Rational Ignorance, Collective vs. Individual Consumption.

SUGGESTED READINGS

Browning E K & Browning J M, Public Finance and the Price System, Pearson Education, Singapore
 Hyman D N, Public Finance: A Contemporary application of Theory to Policy, Thomson South Western
 Jha, Raghendra, Modern Theory of Public Finance, Wiley Eastern, Delhi, 1987
 Ulbrich, H., Public Finance in Theory and Practice, Thompson South Western
 Mukherjee, S., Ghose, A. & Nag, N. N., Analytical Public Finance. Public Economics – Public Choice - Public Policies, New Central Book Agency (P), Kolkata
 Musgrave, Richard A., The Theory of Public Finance, Tata McGraw Hill, N.Y., 1959
 Ghosh A & Ghosh C, Public Finance, PHI Learning Private Limited, Delhi
 Ursula, H., Public Finance, James Nisbet and Co., London, 1968

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M			
CO2		H	M	
CO3		M		H
CO4		M	H	

6.3 ENLE305T: LABOUR ECONOMICS (4-0-0)

COURSE DESCRIPTION

The main objective of the course is to introduce students to core topics in the field of labour economics. The course covers topics such as wage and employment determination, immigration, unemployment, wage differentials and discrimination among many others. This course will encourage the students to develop independent research in labour economics and related fields.

COURSE OUTCOMES

Define and relate the main concepts of labour economics. (Remembering and Understanding)
 Identify the main issues of wage determination. (Applying)
 Analyze the theoretical issues in labour economics. (Analyzing)
 Explain the practical applicability of theories related to labour productivity and labour mobility and evaluate the key issues of the Indian labour market to solve the problems in the labour market. (Evaluating & Creating)

Module I: Introduction to Labour Economics (10 Hours)

Concept, Nature and Scope of Labour Economics; Labour Market – Concept, Labour Supply, Labour Demand; Measuring the Labour Force, Workers Preferences, Time and Budget Constraints, Hours of Work Decision; Production Function; Imperfect Information in Labour Market; Labour Flexibility

Module II: Wage Determination, Wage Differentials, Labour Efficiency and Discrimination (20 Hours)

Theories of Wage – Classical, Neoclassical, Modern; Employment Decision in the Short Run and Long Run; Homogeneous and Heterogeneous Workers and Jobs; The Hedonic Wage Function; Theory of Optimal Fringe Benefits; Labour Efficiency – Education in the Labour Market, Schooling Model; Efficiency Wage Models; Segmentation and Discrimination in Labour Market-The Crowding Model, Measuring Discrimination – The Oaxaca Decomposition; Impact of Trade Union and Collective Bargaining on Employers

Module III: Labour Productivity, Unemployment and Migration (15 Hours)

Labour Productivity – Concept, Measurement; Wages, Prices and Employment; Unemployment – Frictional, Structural, Demand-deficient Unemployment; Measurement of Unemployment – The Stock-Flow Model; Reducing Unemployment – Public Policies; Labour Mobility; Migration as an Investment in Human Capital; Determinants of Migration; Consequences of Migration; The Economic Benefits of Immigration

Module IV: Issues in Indian Labour Market (15 Hours)

Features of Indian Labour Market – Size and Composition in the Organized and Unorganized Labour Market; Major issues in the Indian Labour Market; Labour Productivity in India; Women and Child Labour in India; Agricultural and Rural Labour; Labour Market Institutions of Minimum Wage; Employment and Wage Policy in India; Informal Labour and Social Security Measures; Globalization and Labour Market

SUGGESTED READINGS

- Butler, A.D., Labor Economics and Institutions, American Publishing Company, ND, 1972
 Datt, G., Bargaining Power, Wages and Employment: An Analysis of Agricultural Labour Market in India
 George J. Borjas, Labour Economics, McGrawhill, New York, 2000
 Marshall, F.R., V.M. Briggs, & A.G. King, Labour Economics, Richard D. Irwin Inc., Homewood, Illinois, 1984
 McConnell, C.R., S.L. Brue & D.A. Macpherson, Contemporary Labour Economics, McGraw Hill, NY, 2009
 Michael Hopkins, Labour market planning revisited, Palgrave Macmillan, 2002
 Rees, A., Economics of Work and Pay, Harper and Row, NY, 1973

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M	H	M
CO2	H	H	M	M
CO3	M	H	M	H
CO4		M		H

6.4 ENPR306P: PROJECT ON RESOURCE MAPPING (RURAL/URBAN)

COURSE DESCRIPTION

This project-based course will enable students to understand, analyze, and document the spatial and socio-economic resources of rural or urban areas through systematic resource mapping techniques. Students learn to identify socio-economic aspects including natural, human, financial, infrastructural, and institutional resources using both conventional field-based approaches and modern geospatial tools. Emphasis is placed on hands-on fieldwork, participatory rural appraisal (PRA), GIS-based and non GIS-based mapping, data analysis, and preparation of a comprehensive resource map and report. The course enhances critical thinking, community engagement, and research skills, preparing students for developmental planning, local governance support, and evidence-based policymaking.

COURSE OBJECTIVES (CO)

To familiarize students with the concepts, importance, and methodologies of rural/urban resource mapping.

To train students in field data collection, stakeholder interaction, and participatory mapping techniques.

To develop competencies in spatial data analysis and enable students to interpret resource distribution and identify developmental gaps.

To guide students in preparing a professional project report and presenting resource mapping findings.

PROJECT DELIVERABLES

Field Data Collection Sheets

Resource Maps (land use, water resources, infrastructure, institutions, etc.)

Analysis Notes (resource gaps, needs assessment)

Final Project Report

Presentation/Viva

6.5 ENRD308T: RURAL DEVELOPMENT (4-0-0)

COURSE DESCRIPTION

This course will help understand the rural economy and its features and its scope for development. The course will also help describe the financial system for agriculture and the credit and marketing system for the development of rural areas. Also, through this course, various development policies towards inclusive development will be illustrated.

COURSE OUTCOMES

Draw distinctive features of rural economy which can influence the economy of rural sector and understand the prevailing problems of rural economy and identify the scope for development of rural areas. (Remembering, Understanding)

Elucidate the Agricultural Finance and rural credits system and marketing system. (Analyzing)

Identify the new development strategies for development of rural economy. (Applying)

Assess the various policy and programmes of rural development and use of economic prospective for the development of rural economy. (Evaluating, Creating)

Module I: Basic Concept of Rural Economy (15 hours)

Definition and Features of Rural Economy; Characteristics of Rural Sector; Rural Economic Structure in Indian context; Indicators of Rural Development; Causes of Rural Backwardness; Rural Demography – Size, Growth, Distribution of Rural Population; Rural-Urban Migration – Types, Pull and Push Factors; Rural Poverty and Poverty Alleviation Programmes

Module II: Transformation of Rural Economy (15 hours)

Transformation of Rural Economy – Sectoral Approach, Multi-sectoral Approach, Territorial Approach, Local Approach; Rural Development Strategies; Policies for Rural Economy Development – Land Policy, Agriculture Policy, Rural Industrialization Policy, Employment Policy

Module III: Agriculture and Rural Industrialization (20 hours)

Importance and Problems of Agriculture in Rural India; Agriculture Marketing – Problems and Prospects, Marketing of Agricultural Product, Co-operative Marketing; Concept of Agricultural Credit; Need for Agriculture Credit; Sources of Agricultural Finance; Role of NABARD in Rural Development; Allied Agricultural Activities – Dairy, Fishery, Horticulture, Sericulture; Development of Agro-based Industry; Role of Village Industry; Growth of MSME in Rural Economy; Appropriate Technology for Rural Industries Development; Government Policy and Programme for Entrepreneurship Development in Rural India

Module IV: Rural Governance (10 hours)

Concept of Decentralization and its Significance in Rural Development; Role of Panchayat Raj Institutions in Rural Development; Rural Development Institutions and Administration- SIRD, DRDA; e-Governance and its Impact on Rural Development

SUGGESTED READINGS

- A N Agarwal & Kundana Lal, Rural Economy of India: Problems, Progress and Prospects, Vikas Publication, New Delhi, 1990
- Satyasundaram, Rural Development, Himalaya Publishing House, New Delhi, 1997
- S. Maheswari, Rural Development in India, - A Public Policy Approach, Sage publication, New Delhi, 1985
- Katar Sing, Rural Development, Principles, Policies, and Management, Sage publication, New Delhi, 1986
- N. Lalitha, Rural Development, Emerging issues and Trends (Vol.I and II) dominate Publications, New Delhi, 2004
- Kalipada Deb, The challenge of Rural Development, M.D. Publications Pvt. Ltd., New Delhi, 1997

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M	M	M	M
CO2	M			M
CO3	M	M	M	
CO4		H	H	H

SEMESTER VII

(UG Degree in the relevant Discipline/ Subject (CGPA < 7.5))

7.1 ENAE400T: APPLIED ECONOMETRICS (4-1-0)**COURSE DESCRIPTION**

The main objective of this course is to introduce the students to the various econometric techniques under regression analysis that would help them in the decision making process. The course teaches the theory and application of contemporary econometric tools including time series analysis and panel data models. It also caters to the interest in econometric research applying various econometric tools to data in a variety of real life economic problems.

COURSE OUTCOMES

- Define advanced topics like empirical research, regression diagnostics. (Remembering and Understanding)
- Apply estimation methods to determine parameters of dynamic and panel data models. (Applying)
- Analyze the results of dynamic and panel data models along with regression diagnostics. (Analyzing)
- Evaluate the dynamic regression models and design dynamic regression models and panel data models to test hypothesis of real economic problems (Evaluating and Creating)

Module I: Stages in Empirical Econometric Research (15 hours)

Statement of the Problem; Review of Literature; Research Design and Methodology; Data Collection; Data Analysis; Interpretation

Module II: Regression Diagnostics and Specification (20 hours)

Functional Forms; Model Selection; Tests for Multicollinearity; Tests for Heteroscedasticity; Tests for Autocorrelation; Misspecification and Specification Bias

Module III: Advanced Topics in Regression Analysis (20 hours)

Dynamic Econometric Models: Distributed Lag Models; Autoregressive Models; Instrumental Variable Estimation; Simultaneous Equation Models

Module IV: Panel Data Models (20 hours)

Methods of Estimation; Fixed Effects Model; Random Effects Model; Applications of Statistical Package in parameter estimations for panel data models

SUGGESTED READINGS

- Jeffrey M. Wooldridge, Econometrics, CENGAGE learning, India Edition, 2009
- Dimitrios Asteriou & Stephen Hall, Applied Econometrics: A Modern Approach, Palgrave Macmillan, 2007.
- Damodar Gujarati, Econometrics by Example, Palgrave Macmillan, 2011.

Madnani, G.M.K. Introduction to Econometrics: Principles and Applications, CBS Publishers & Distributors, 2009.

Dougherty, C. Introduction to Econometrics, 4th Ed., Oxford University Press, 2011.

Gujarati, D., & Porter, D. Essentials of Econometrics, 4th Ed., McGraw-Hill, 2010.

Kmenta, J. Elements of Econometrics, Khosla Publishing House, 2008

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2	H	H	M	
CO3		H	H	H
CO4		H	M	H

7.2 ENAG401T: AGRICULTURAL ECONOMICS (5-0-0)

COURSE DESCRIPTION

The objectives of this course are to familiarize students with policy issues that are pertinent to Indian agriculture economics, to provide students with the tools necessary to analyze those issues, to raise students' awareness of the challenges facing agricultural productivity, and to encourage students to consider potential solutions to those challenges.

COURSE OUTCOMES

Recall distinctive features of agriculture and the limited available resources which can influence the whole economy (Remembering & Understanding)

Identify the new investment opportunities in agriculture to challenge economic problems like unemployment, inequality etc. (Applying)

Examine the role of agricultural finance and marketing to achieve harmonious development (Analyzing)

Elaborate the concept of globalization and agricultural policy and their implication on the society as a whole.(Evaluating and Creating)

Module I: Agricultural Resources and Allocation (15 hours)

Resources in Agriculture; Land as a Resource; Land Capability; Issues in Utilization of Land; Competition for Agricultural Land; Effects of Urbanization; Land Degradation; Water as a Resource; Institutional Arrangements and Issues in Water Allocation; Managing Disasters – Drought, Flood, Famine; Production Function in Agriculture; Watershed Management and Water Budgeting

Module II: Agricultural Production and Market (20 hours)

Supply Response in Agriculture; Issues Relating to Specification of Supply Response Function – Distributed Lags; Rigidities in Farm Supply Response – Supply Response of Individual Crops and Aggregate Production; Market Supply of Subsistence and Perennials Crop; Barriers to Internal Trade; Marketing Reforms; Behaviour of Agricultural Prices – Cobweb Cycles and Demand and Supply of Agricultural Products; Marketed and Marketable Surplus; Terms of Trade between Agriculture and Non-agriculture

Module III: Agricultural Finance (13 hours)

Role of Agencies; Inter-linked Markets; Subsidy and Taxation in Agriculture; Regulated Markets; Crop and Livestock Insurance; Food Security and Public Distribution System; Infrastructural Development; Rural Credit and Rural Indebtedness; Need for State Intervention, NABARD and Cooperative Societies

Module IV: Globalization and Agricultural Policy (12 hours)

Concept of globalization and the relevance of agricultural policies in India; Role of agriculture in economic development; Development Issues – Population, Food Security, Rural Poverty, Inequality and Environmental Concerns; Agricultural Policies- National Agriculture Policy, National Water Policy, National Seed Policy, National Fertilizer Policy, Credit Policy, Price Policy, Crop Insurance Policy

SUGGESTED READINGS

Soni, R., Leading Issues in Agricultural Economics, New Delhi: Vishal Publishing, 2004

Kahlon, A.S. & Singh, K., Managing Agricultural Finance: Theory and Practice, Allied Publisher Ltd., New Delhi, 1984.

Lekhi, R. K. & Singh, J., Agricultural Economics: An Indian Perspective, Ludhiana: Kalyani Publishers, 2015.

Penson, Capps, Rosson & Woodward, Introduction to Agricultural Economics, 7th Edition

R. S. Deshpande & Arora, S., Agrarian Crisis and Farmer Suicide, (eds.), Sage India Publications, 2010.

Reddy, S.S. & Ram, P.R., Agricultural Finance and Management, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.

Reddy, S.S., Ram, P.R., Sastry, T.V.N., & Devi, I.B., Agricultural Economics, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India, 2015.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H		M	
CO2		H	M	
CO3	M			H
CO4		H	M	

7.3 ENID404T: INDUSTRIAL ECONOMICS (3-0-0)

COURSE DESCRIPTION

This course provides an introduction to current theory and empirical work in Industrial economics. It starts by examining the internal structure of firms. It then moves on to the analysis of various aspects of strategic interaction between firms and the determinants of industrial structure. Finally, it discusses the role of policy in the context of competition and industrial policies and regulation. The emphasis will be throughout on understanding how the theoretical tools can be used to analyze real world issues.

COURSE OUTCOMES

Define various concepts of Non-Price Competition and Imperfect Market Structure (Remembering/ Understanding)

Apply the different concepts of game theory to understand strategic behaviour in imperfectly competitive markets (Applying).

Examine the impact of price and non-price barriers on competition. (Analyzing)

Discuss the role of regulation on efficiency in imperfectly competitive markets. (Evaluating/Creating)

Module I: Market Structure and Strategic Interaction (10 Hours)

Introduction to Industrial Economics –Type of organizational form; Industrial location analysis, Static and Dynamic models of oligopolistic competition; Monopolistic competition and dominant firm models

Module II: Entry Costs, Barriers, Mergers and Vertical Integrations (10 Hours)

Entry costs and market structure; Free entry and social welfare; Barriers to entry - Limit price theory; Pricing Decision - overinvestment in capacity, product proliferation; Mergers and Vertical Integration

Module III: Non- Price Competition (15 Hours)

Product differentiation - Horizontal vs. vertical; Price competition with differentiated products, Market structure and advertising - Informative and pervasive advertising, Effects on competition; Determination of the monopolist optimal advertising expenditure, Market concentration

Module IV: Regulation (10 Hours)

Introduction to competition policy and regulation - effects of government actions on firms and market structure; The natural monopoly case; Competition policy; Price regulation mechanisms

SUGGESTED READINGS

Carlton, D. W. & J. M. Perloff, Modern Industrial Organization, HarperCollins, New York, 1994.
 Tirole, J., The theory of industrial organization, The MIT press, 1988.
 Cabral, L., Introduction to Industrial Organization, The MIT press, Cambridge, 2000.
 Barthwal, R., Industrial Economics, New Age International Publishers fourth edition 2022

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	M			
CO2	H			
CO3		M		H
CO4		H	H	

7.4 ENRM405T: RESEARCH METHODOLOGY IN SOCIAL SCIENCES (2-0-0)**COURSE DESCRIPTION**

The main aim of this course is to introduce the research methodology for scientific research including economics and other social sciences. Students will learn the meaning and importance of research along with the philosophical perspective of it. Topics covered in this course are formulation of research proposals, reviewing the literature and choosing appropriate methodologies for data collection and analysis. This course is intended to prepare students for research projects during their graduation program.

COURSE OUTCOMES

- Understand the basic concepts of research including meaning, types, importance, and philosophical perspectives. (Remembering and Understanding)
- Apply the various philosophical perspectives in social science research along with the ontological and epistemological issues in it. (Applying)
- Analyze the different stages of research in social science enhancing better research in social science. (Analyzing)
- Evaluate research in social science and its trend with greater reflection of plausible philosophical perspectives. (Evaluating and Creating)

Module I: Introduction (10 Hours)

Meaning and Purpose of Research; Types of Research- Pure and Applied, Historical and Futuristic, Analytical and Synthetic, Descriptive and Prescriptive, Survey and Experimental Researches; Significance of research; Scientific Method- Inductionism and Deductionism; Ethics in Research

Module II: Philosophical Perspectives of Social Science Research (10 Hours)

Philosophical Foundations- Ontological and Epistemological Issues in Social Science Research; Nature of Science and Social Science; Methodological Perspective- Positivism, Hermeneutics, Reflexivity, and Feminist methodology

Module III: Stages of Research (20 Hours)

Research Problem- Identification, Selection and formulation of research Problem; Literature Review- Importance and types of literature review; Identifying Research Gaps; Hypothesis Testing- Meaning, Sources and Formulation of Hypothesis; Research Design; Data Collection; Analysis and Interpretation; Research Reports- Types, Contents; Principles of good report writing; References and Annotation

SUGGESTED READINGS

Ahuja, R., Research Methods, Rawat Publications, Jaipur (India), 2001
 Kothari C., R. Research Methodology: Methods and Techniques, New Delhi: New Age International (P) Limited, Publishers, 2004
 Babbie, E., The Practice of Social Research, Belmont: Wadsworth, 11th Edition, 2007

Crotty, M., The Foundations of Social Research: Meaning and perspective in the research process. London: Sage, 1998

Neuman, W. L., Social Research Methods, Qualitative and Quantitative Approaches, (4th Ed.), Boston: Allyn and Bacon, 2000

Bhandarkar, P.L. and T.S. Wilkinson, Methodology and Techniques of Social Research, Himalaya Publishing, 1999

Mapping of COs

	Module I	Module II	Module III
CO1	H	M	
CO2	H	H	M
CO3	M	H	H
CO4		M	H

7.4 ENDI409P: DISSERTATION (Phase I)

Course Code: NA Total Credits 6

COURSE DESCRIPTIONS

The BA Honours students would be required to do project work and submit dissertation. Dissertation submitted by the students would be evaluated by External Examiners appointed by the University. The work for the BA Honours dissertation is spread over Semester VII and Semester VIII as Dissertation Phase-I and Dissertation Phase-II respectively. The total dissertation grades are distributed between the two semesters 4 credits in Semester VII and 6 credits in Semester VIII equaling 10 credits in total.

COURSE OBJECTIVES

The aim of the course is to equip the students with presentation skills and develop academic writing skills. Moreover, the students will also be able to apply the statistical research training acquired in the taught element of the program by designing an appropriate research strategy and research methodology to carry out the research.

THE STRUCTURE OF THE COURSE

In Dissertation Phase-I, the students have to independently think of a research idea and, by the end of the semester, have to defend a research proposal based on the idea i.e. need to present the Synopsis by the end of the third semester. The total credit in Dissertation Phase-I equals to 4 credits.

SEMESTER VIII

(UG Degree in the relevant Discipline/ Subject (CGPA < 7.5))

8.1 ENHE402T: HEALTH ECONOMICS (5-0-0)

COURSE DESCRIPTION

This course is designed to obtain adequate knowledge on health economics theory and application in order to enable students to provide health policy analysis and make better decisions in the areas of health care. This course includes different subsets of health economics such as public health, global health policy, and economic evaluation of health care and government intervention in the healthcare delivery system. This course provides foundations to analyze contemporary health problems from an economic perspective to support healthcare professionals and policymakers.

COURSE OUTCOMES

Define and explain the concepts of health economics and application of economic concepts in the health sector. (Remembering and Understanding).

Identify the demand and supply gap in the healthcare system to suggest healthcare professionals and policymakers. (Applying)

Analyze the role of government in the health care delivery system and identify the scope of health financing to suggest healthcare professionals and policymakers. (Analyzing)

Evaluate the health care programmes and policy to provide decisions concerning the allocation of resources. (Evaluating)

Module I: Microeconomic Foundations of Health Economics (20 hours)

Concepts, Definition of Health Economics; Measures of Health Status; Topics in Health Economic Theory – Production Function of Health, Grossman's Model of Demand for Health; Supply-side Health Economics; Theory of Health Behavior; Market of Health Insurance; Causes of Market Failure in the Provision of Health Services – Moral Hazard, Adverse Selection, Supplier-induced Demand, Externalities; Issues of Equity and Efficiency in Healthcare Market

Module II: Economic Evaluation in Healthcare (20 hours)

Economic Evaluation in Healthcare – Concepts, Importance; Types of Economic Evaluation in Healthcare – Cost Minimization Analysis, Cost Effectiveness Analysis, Cost Benefit Analysis, Cost Utility Analysis; Health Technology Assessment – Basic Concept, Importance of HTA in Health Economics

Module III: Public Policy on Health (15 hours)

Public Policy in Health Care Delivery – Role of State, Rationale for Government Intervention in the Health Sector – Public and Private sector; Health Financing; Concept and Calculating Methods of Burden of Disease- HALE, QALYs and DALYs

Module IV: Health Sector in India (20 hours)

Overview of Health Care in India; Health System of India – Post Reform Scenario; Socio-economic Determinants of Health; Indicators of Health Outcomes; Health and Nutrition; Different Dimension of Health - Poverty, Malnutrition, Gender Perspectives in Indian context; Public Health Expenditure in India

SUGGESTED READINGS

- Henderson, J. W., Health Economics & Policy, (3e), Thomson South-Western, Latest Edition, 2007.
 David Wonderling, Reinhold Gruen & Nick Black, Introduction to Health Economics, Open University Press, 2005.
 Sherman Folland, Allen Goodman & Miron Stano, Economics of Health and Health Care, Routledge, 8th edition, 2017
 Stephen Morris, Nancy Devlin, David Parkin & Anne Spencer, Economic Analysis in Healthcare, 2nd Edition, Wiley, 2012.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2	M		H	
CO3		M	H	
CO4			M	H

8.2 ENED403T: ECONOMICS OF EDUCATION (5-0-0)**COURSE DESCRIPTION**

This course discusses the economic aspects of current issues in education, using both economic theory and econometric and institutional readings. Topics include discussion of basic human capital theory, the growing impact of education on earnings and earnings inequality, statistical issues in determining the true rate of return to education, the labor market and manpower planning. In addition, various policies of the government and the budget to address the issues of inclusivity in education will be discussed.

COURSE OUTCOMES

- Understand the concept of welfare economics and its applicability in education sector (Remembering/Understanding)
 Evaluate the policy for improvement of the education sector from an economics perspective. (Applying)

Examine the investment pattern in education and interpret the direct and indirect benefits of education in the development of society. (Analyzing)

Evaluate the educational financing from the point of view of public and private expenditure (Evaluating)

Module I: Economics of Education (20 hours)

Human Capital – Types, Components; Human Capital Theory; Education as an Instrument for Economic Growth; Demand for Education; Supply of Education; Determinants of Demand for Education; Costs of Education – Private Costs, Social Costs; Benefits of Education – Direct, Indirect, Social; Wastage and Stagnation in Education – Causes and Measures; Manpower Planning – Meaning, Techniques of Forecasting

Module II: Education and Budget Allocation (15 hours)

The Concept of Knowledge Economy – The Spread of Education across the World; Budgetary Allocations across Space and Time; Institutional Design; Alternative Systems for Service Delivery; Role of Imperfect Information, Incentives and Contracts

Module III: Education and Planning (20 hours)

Approaches to Educational Planning – Production Function Models, Manpower Requirement Approach, Input-Output Model, Gender Based Approach; Educational Planning in Developing Countries with Special Reference to India; Vocational Education in India; New Education Policy

Module IV: Discrimination and Inequality in Education (15 hours)

Models of Preference-based and Statistical Discrimination; Effective Policies to Address Historical Inequalities; Evaluating Policy Impact – The Estimation of Treatment Effects in Randomized Experiments and in Observational Data

SUGGESTED READINGS

Banerjee, A. & Somanathan, R., The Political Economy of Public Goods, 2007.

Becker G.S., Human Capital (2nd Edition), National Bureau of Economic Research, New York, 1974.

Becker, G., Investment in Human Capital: a Theoretical Analysis, The Journal of Political Economy, 70(5), 9-49, 1962.

Benabou, R., Workings of a City, Quarterly Journal of Economics, 108(3), 619-652, 1993.

Cohn E. & T. Gaske, Economics of Education, Pergamon Press, London.

Galanter, M., Competing Equalities: Law and the Backward Classes in India, University of California Press, 1984.

McMohan, W.W., Education and Development: Measuring the Social Benefits, Oxford University Press. 1999.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H	M	M
CO3		M	H	
CO4	M	H		H

8.3 ENCD406T: CONTEMPORARY DEVELOPMENT POLICIES (3-0-0)

COURSE DESCRIPTION

The main objective of the course is to inform readers on recent developments in the Indian economy in an understandable way. The course lays a heavy emphasis on giving students simply accessible information because knowledge is necessary to arrive at the optimal solution. Students will get a fundamental grasp of the concerns, difficulties, and challenges that the economy is currently facing.

COURSE OUTCOME

Understand the socio-economic issues and India's macroeconomic problems (Understanding & Remembering)

Explain the recent economic reforms in the Indian economy since 1991. (Applying)

Examine the impact of various development policies in Agriculture, Industry and Service Sector in the Indian Scenario. (Analyzing)

Discuss their understanding of the usefulness of various development policies. (Evaluating and Creating)

Module I: Contemporary Socio-Economic Policies (13 Hours)

National Pension Scheme for Traders and The Self-employed Persons (NPS); Pradhan Mantri Jeevan Jyoti Yojana (PMJJBY); Pradhan Mantri Suraksha Bima Yojana (PMSBY); Atal Pension Yojana; Janani Shishu Suraksha Karyakaram (JSSK); Universal Immunisation Programme; Mission Indradhanush (MI); Janani Suraksha Yojana (JSY); Rashtriya Madhyamik Shiksha Abhiyan (RMSA); Sarva Shiksha Abhiyan; Mid Day Meal; Pradhan Mantri Awas Yojana (Gramin); Pradhan Mantri Gram Sadak Yojana (PMGSY); Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA)

Module II: Agricultural Sector Schemes in India (10 Hours)

Soil Health Card Scheme; Paramparagat Krishi Vikas Yojana (PKVY); Pradhan Mantri Krishi Sinchayee Yojana (PMKSY); National Agriculture Market (e-NAM); Pradhan Mantri Fasal Bima Yojana (PMFBY); Interest Subvention Scheme (ISS); National Mission For Sustainable Agriculture (NMSA); Gramin Bhandaran Yojana; Livestock insurance Scheme; Micro Irrigation Fund (MIF); PM Kisan Maan Dhan Yojana; Krishi UDAN scheme; Agriculture Infrastructure Fund

Module III: Programmes and Initiatives for Industries in India (12 Hours)

Make in India; Industrial Corridor Development Programme; Ease of Doing Business; National Single Window System; PM Gati Shakti National Master Plan; National Logistics Policy; Production Linked Incentive Scheme; Credit Guarantee Trust Fund for Micro & Small Enterprises; A Scheme for Promoting Innovation, Rural Industry & Entrepreneurship (ASPIRE); National Manufacturing Competitiveness Programme; Market Promotion & Development Scheme; Revamped Scheme of Fund for Regeneration of Traditional Industries (SFURTI); Trade and Industry Related Functional Support Services (TIRFSS); Welfare Measures (Pradhan Mantri Suraksha Bima Yojana (PMSBY)

Module IV: Contemporary Schemes for the Service Sector (10 Hours)

Future Skills PRIME; Next Generation Incubation Scheme (NGIS); Production Linked Incentive (PLI) Scheme; National Broadband Mission; Pradhan Mantri Jan Dhan Yojana; Mahatma Gandhi National Fellowship; PM Ayushman Bharat Health Infrastructure Mission; Pradhan Mantri Kaushal Vikas Yojana (PMKVY); Skill India Mission; Digital India Mission

SUGGESTED READINGS

1. Dutt Rudder & K.P.M Sunderam, Indian Economy, S Chand & Co. Ltd. New Delhi, 2017
2. Mishra S.K & V.K Puri, Indian Economy and – Its Development Experience, Himalaya Publishing House, 2017
3. Kaushik Basu, The Oxford Companion to Economics of India, Oxford University Press, 2007
4. Kapila U, Indian economy since independence, Academic foundation, New Delhi
5. Government of India, Economic Survey (Annual), Economic Division, Ministry of Finance, New Delhi
6. Ahluwalia, I.J. & I.M.D. Little (Eds.), India's Economic Reforms and Development (Essays in honour of Manmohan Singh), Oxford University Press, New Delhi, 1999

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO1		H		M
CO2		M	M	
CO3	M		H	
CO4		M		H

8.4 ENDI410P: DISSERTATION (Phase II)

COURSE DESCRIPTIONS

The students would be required to do project work and submit dissertations. Dissertation submitted by the students would be evaluated by External Examiners appointed by the University. The work for the BA Honours dissertation is spread over Semester VII and Semester VIII as Dissertation Phase-I and Dissertation Phase-II respectively. The total dissertation grades are distributed between the two semesters 5 credits in Semester VII and 7 credits in Semester VIII equaling 12 credits in total.

COURSE OBJECTIVES

The aim of the course is to fine-tune the dissertation he/she working in the Phase-I and during the work, the students will also learn how to apply the statistical and econometric tools in their own research.

THE STRUCTURE OF THE COURSE

In Dissertation Phase-II, the student has to carry out data analysis and write the dissertation and defend it by the end of the fourth semester. The dissertation will include original research question(s) if any, critical review of the relevant literature, analytical tools employed in response to the research questions, data analysis and interpretation. Finally, the students need to submit the dissertation to the university authority maintaining all instructions provided by the university in the semester.

SEMESTER VII

(UG Degree (Honours) with Research (CGPA >7.5))

ECQQ401T: QUALITATIVE AND QUANTITATIVE METHODS OF RESEARCH

ENDI407P: RESEARCH PROJECT-I

SEMESTER VIII

(UG Degree (Honours) with Research (CGPA >7.5))

ENDI408P: RESEARCH PROJECT-II

DEPARTMENT OF EDUCATION

PROGRAMME: BACHELOR OF ARTS in EDUCATION (BA)

DEGREE: BA EDUCATION (HONOURS)/ BA EDUCATION (HONOURS) WITH RESEARCH

VISION:

To build a pool of intellectually competent educational leaders and teacher educators leading on the process of education in general, and teacher education in particular, which nurtures individual autonomy and social development by ensuring quality with peace across the globe

MISSION:

To facilitate the expression of leaders hidden within the students developing some cognitive, affective and psychomotor abilities and making them a sound citizen of the country and the world as a whole

PROGRAM OUTCOMES

PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO 7: **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PROGRAM SPECIFIC OUTCOMES

PSO 1: To inculcate the sense of self and lifelong learning among the students with an appropriate critical thinking and managerial skill.

PSO 2: To inculcate an effective social interaction and ethical values among the students.

PSO 3: To enable the students to be effective in cognitive and psychomotor abilities in different situations. PSO 4: To create the skills of teaching and research among the students.

COURSE LIST

3 Year UG Degree		
Semester 1	Credit	Course Name
Major, Introductory level	4	FOUNDATIONS OF EDUCATION
Minor	4	GUIDANCE AND COUNSELLING IN EDUCATION
Multi-disciplinary	3	
Ability Enhancement	2	
Skill Enhancement	3	LIFE SKILLS EDUCATION
Common Value Added	1	ENVIRONMENTAL EDUCATION

Common Value Added	1	HEALTH AND WELLNESS,YOGA EDUCATION AND SPORTS & FITNESS
Community Engagement	2	SERVICE LEARNING (THEORY)
	20	
Semester 2		
Major, Introductory level	4	PHILOSOPHICAL FOUNDATIONS OF EDUCATION
Minor	4	TEACHER AND TEACHING SKILLS
Multi-disciplinary	3	
Ability Enhancement	2	

Skill Enhancement	3	REFLECTIVE JOURNALING- A TECHNIQUE FOR PERSONAL AND ACADEMIC GROWTH
Common Value Added	1	DIGITAL AND TECHNOLOGICAL SOLUTIONS
Common Value Added	1	UNDERSTANDING INDIA
Community Engagement	2	SERVICE LEARNING (PRACTICUM)
	20	
Semester 3		
Major	4	PSYCHOLOGICAL BASES OF EDUCATION
Major	4	EDUCATION AND SOCIETY
Minor	4	EDUCATIONAL THINKERS
Multi-disciplinary	3	
Ability Enhancement	2	
Skill Enhancement	3	PSYCHOLOGICAL TESTING
	20	
Semester 4		
Major	5	EDUCATIONAL ADMINISTRATION AND MANAGEMENT
Major	5	TEACHING LEARNING METHODS AND PEDAGOGY
Major	4	DEVELOPMENT OF EDUCATION IN INDIA
Minor	4	HUMAN RIGHTS EDUCATION
Ability Enhancement	2	
	20	
Semester 5		
Major	5	HUMAN GROWTH AND DEVELOPMENT
Major	5	EDUCATIONAL TECHNOLOGY
Major	4	ELEMENTARY STATISTICS IN EDUCATION
Minor	4	PEACE EDUCATION
Internship	2	INTERNSHIP
	20	
Semester 6		
Major	4	MEASUREMENT AND EVALUATION IN EDUCATION- PART-I
Major	4	TEACHER EDUCATION
Major	4	EARLY CHILDHOOD CARE AND EDUCATION
Field based learning/Minor project	4	INSTITUTIONAL VISIT NATIONAL/ ACADEMIC
Minor	4	WOMEN EMPOWERMENT
	20	
4 Year UG Degree (Honours)		
Semester 7		
Major	5	CURRICULUM STUDIES
Major	5	INCLUSIVE EDUCATION
Minor	3	EDUCATION FOR SUSTAINABLE DEVELOPMENT

Research Methodology	2	ELEMENTS OF RESEARCH IN EDUCATION-I
Research Project/ Dissertation	6	DISSERTATION-I
	21	
Semester 8		
Major	5	ADVANCED STATISTICS IN EDUCATION
Major	5	MEASUREMENT AND EVALUATION IN EDUCATION-PART-II
Minor	3	EDUCATIONAL SEMINAR
Research Project/ Dissertation	6	DISSERTATION-II
	19	
4 Year UG Degree (Honours with Research)		
Semester 7		
Research Methodology	2	Research Methodology
Research Project/Dissertation	18	Dissertation Phase – I
Total Credit	20	
Semester 8		
Research Project/Dissertation	20	Dissertation Phase – II

U.G-PO-PSO-COURSE MAPPING

BA 1ST SEMESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
FOUNDATIONS OF EDUCATION	EDFE100T	H	M	M	H	M	L	H	H	H	H	H
GUIDANCE AND COUNSELLING IN EDUCATION	EDGC102T	H	H	H	M	H	H	H	H	H	H	M
LIFE SKILLS EDUCATION	EDLS103L	H	H	H	M	H	L	H	H	H	H	H
BA 2ND SEMESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
PHILOSOPHICAL FOUNDATIONS OF EDUCATION	EDPF101T	H	M	M	H	H	L	H	M	H	H	H
TEACHER AND TEACHING SKILLS	EDTT103T	M	H	H	H	H	M	H	H	H	H	H
REFLECTIVE JOURNALING-A TECHNIQUE FOR PERSONAL AND ACADEMIC	EDJD104L	H	M	H	H	H	M	H	H	H	H	H

GROWTH												
BA 3RD SEMESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
PSYCHOLOGICAL BASES OF EDUCATION	EDPB200T	H	H	H	M	M	M	H	H	H	H	H
EDUCATION AND SOCIETY	EDES201T	H	H	H	H	H	M	H	H	H	H	M
EDUCATIONAL THINKERS	EDTH205T	M	H	H	M	H	H	H	H	H	H	H
PSYCHOLOGICAL TESTING	EDPT206L	M	M	M	H	M	M	M	H	H	H	M
BA 4TH SEMESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
EDUCATIONAL ADMINISTRATION AND MANAGEMENT	EDEA202T	H	H	H	H	H	M	M	H	H	M	M
TEACHING LEARNING METHODS AND PEDAGOGY	EDTL203T	H	H	H	M	H	H	H	H	H	H	H
DEVELOPMENT OF EDUCATION IN INDIA	EDDE204T	H	M	M	M	M	M	H	M	H	M	M
HUMAN RIGHTS EDUCATION	EDHE206T	H	H	H	H	H	H	H	H	H	M	M
BA 5TH SEMESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
HUMAN GROWTH AND DEVELOPMENT	EDHG300T	H	M	M	M	L	H	H	H	L	H	L
EDUCATIONAL TECHNOLOGY	EDET301T	H	M	H	M	M	L	H	M	H	H	M

ELEMENTARY	EDEL30 2T	H	L	L	L	H	H	H	H	M	H	H
STATISTICS IN EDUCATION												
PEACE EDU- CATION	EDPE30 7T	H	M	H	H	H	H	M	H	H	M	L
INTERNSHIP	EDIN30 9I	H	H	H	H	H	M	H	H	H	H	H
BA 6TH SEMESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
MEASURE- MENT AND EVALUA- TION IN EDUCA- TIONPART-I	EDME30 3T	H	H	M	M	H	M	M	M	H	H	H
TEACHER ED- UCATION	EDTE30 4T	M	H	H	H	H	M	H	H	H	H	H
EARLY CHILD- HOOD CARE AND EDUCATION	EDEC30 5T	M	H	H	H	H	M	H	H	H	H	H
INSTITU- TIONAL VISIT NA- TIONAL/ ACA- DEMIC	EDIV306 P	H	H	H	H	H	H	H	H	H	H	M
WOMEN EMPOWER- MENT	EDWE3 08T	M	M	H	H	M	M	M	M	H	M	M
BA 7TH SEMESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
CURRICULUM STUDIES	EDCS40 0T	H	M	M	H	H	M	H	H	H	M	H
INCLUSIVE EDUCATION	EDIE401 T	H	M	M	H	H	M	M	M	H	H	M
EDUCATION FOR SUSTAINABLE DEVELOP- MENT	EDSD40 4T	H	H	H	H	H	H	M	M	H	H	H
ELEMENTS OF RESEARCH IN EDUCATION-I	EDER40 5T	H	H	M	H	H	M	M	M	H	H	H
DISSERTA- TION-I	EDDI40 7P	H	H	M	H	H	M	M	M	H	H	H
BA 8TH SEMESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
ADVANCED STATISTICS IN EDUCATION	EDAS40 2T	H	H	M	M	H	M	M	M	H	H	H

MEASURE- MENT AND EVALUA- TION IN EDUCA- TIONPART-II	EDEE40 3T	H	H	M	M	H	M	M	M	H	H	H
EDUCA- TIONAL SEMI- NAR	EDES40 6T	H	H	M	M	H	M	H	H	H	M	H
DISSERTA- TION-II	EDDI40 8P	H	H	M	H	H	M	M	M	H	H	H
BA 7TH SE- MESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
RESEARCH METHODOL- OGY	EDDI40 9P	H	H	M	H	H	M	M	M	H	H	H
DISSERTA- TION PHASE – I	EDDI41 0P	H	H	M	H	H	M	M	M	H	H	H
BA 8TH SEMESTER												
Course	Code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
DISSERTA- TION PHASE – II		H	H	M	H	H	M	M	M	H	H	H

DETAILED SYLLABUS MAJOR COURSES

Semes- ter	Category	Course Code	Course Name	Cred- its
1	Major Course 1	EDFE100T	Foundations of Education	4
2	Major Course 2	EDPF101T	Philosophical Foundations of Education	4
3	Major Course 3	EDPB200T	Psychological Bases of Education	4
3	Major Course 4	EDES201T	Education and Society	4
4	Major Course 5	EDEA202T	Educational Administration and Management	5
4	Major Course 6	EDTL203T	Teaching Learning Methods and Pedagogy	5
4	Major Course 7	EDDE204T	Development of Education in India	4
5	Major Course 8	EDHG300T	Human Growth and Development	5
5	Major Course 9	EDET301T	Educational Technology	5
5	Major Course 10	EDEL302T	Elementary Statistics in Education	4
6	Major Course 11	EDME303T	Measurement and Evaluation in Education-Part-I	4
6	Major Course 12	EDTE304T	Teacher Education	4
6	Major Course 13	EDEC305T	Early Childhood Care and Education	4
6	Major Course 14	EDIV306P	Institutional Visit National/ Academic	4
7	Major Course 15	EDCS400T	Curriculum Studies	5
7	Major Course 16	EDIE401T	Inclusive Education	5
8	Major Course 17	EDAS402T	Advanced Statistics in Education	5
8	Major Course 18	EDEE403T	Measurement and Evaluation in Education-Part-II	5

COMMUNITY ENGAGEMENT

Semester	Category	Course Code	Course Name	Credits	Page No
1	Community Engagement	EGCE106T	Service Learning (Theory)	2	635
2	Community Engagement	CESL102P	Service Learning (Practicum)	2	636

EDFE100T: FOUNDATIONS OF EDUCATION

(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Objective*To help students develop a fundamental knowledge of the educational process.***Course Outcomes**

At the end of the course, students will be able to:

CO 1: Describe the concept, objective, and functions of education (Remembering)

CO 2: Identify the forms and bases of education (Understanding)

CO 3: Analyze the curriculum and dimensions of education (Analyzing)

CO 4: Apply different methods for teaching and creating learning among the students (Applying)

Module I: Meaning, Aims and Objective of Education (15 Hours)

Education: meaning, concept, nature and Functions - Narrow and broader concepts of education. Education as a process, a product and a discipline. Aims of education – individual, social and national aims. Objectives of Education – Four pillars of education (Delor 's Report: Learning to Know, Learning to Be, Learning to Do, and Learning to Live Together)

Module II: Forms and Bases of Education (15 Hours)

Forms of Education: Formal education, Informal education and non-formal Education – Meaning, concepts, nature and importance

Bases of Education: philosophical, psychological, sociological and biological

Module III: Dimensions of Education (15 Hours)

The learner, the teacher-qualities and responsibilities; curriculum and co-curricular activities- meaning and modern concept, need and importance; Educational Institutions – school, family and social institutions, religious institutions, state, etc. – their roles in education.

Module IV: Child-Centrism in Education and Educational Methods (15 Hours)

Practices and significance of child centered education; Play and play-way in education - Kindergarten, Montessori, basic education and project method.

Suggested Readings

Aggarwal, J. C. Theory and Principles of Education. New Delhi: Vikas Publishing (2017)

Chakraborty. J.C. Modern Education: Its aims and principles. Calcutta: S. Chakraborty (1982)

Chandra, S.S. and Sharma, R.K. Principles of Education. New Delhi: Atlantic Publisher.(2004)

Chaube. S.P and Chaube, A. Foundations of Education. Noida: Vikas Publication. (2007)

Daly. A. J. Social Network Theory and Educational Change. California: Harvard Education Press. (2010)

Gutek, G. L.The Montessori method. London: Rowman and Littlefield. (2004)

Hayden, M. and Thompson, J. (eds.). International Education: Principles and Practice. London: Routledge Falmer Taylor & Francis Group. (1998)

Isaacs, B. Understanding the Montessori approach: Early years' education in practice. New York: Routledge (2012)

Kundu, D. and Tarun, R.M. Modern theory and principle of education. New Delhi: The world press Pvt. Ltd (1990)
Saxena, N.R. S. Philosophical and sociological foundations of education. Meerut: Vinay Rakheja (2014)

Mapping of COs to Modules

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDPF101T: PHILOSOPHICAL FOUNDATIONS OF EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objective

To help students learn the contribution of philosophy and philosophers in shaping the different aspects of education.

Course Outcomes

At the end of the course students will be able to:

- CO 1: Define, explain, relate, and analyze the relationship between philosophy and education. (Remembering, Understanding, Application, Analysis)
- CO 2: Reflect upon the biography, philosophical and educational ideologies of Western and Indian thinkers. (Remembering, Understanding, Application, Analysis)
- CO 3: Gain insight into the educational implications of the different Indian and Western schools of philosophy. (Remembering, Understanding, Application, Analysis, Evaluation)
- CO 4: Comprehend the basics of Philosophy of Knowledge and Value as a part of Education. (Remembering, Understanding, Application, Analysis, Evaluation)

Module I: Philosophy and Education (10 Hours)

Meaning and nature of Education and philosophy; Concept of educational philosophy, Objectives of studying educational philosophy, relationship and influence of philosophy on education

Module II: Western and Indian Philosophical ideologies (20 Hours)

- a. Indian: Aurobindo Ghosh, Sarvepalli Radhakrishnan, Amartya Sen and his capability approach to education
- b. Western: Socrates, Plato, Ivan Illich

Module III: Schools of Philosophy (20 Hours)

Indian schools of Philosophy: Vedic philosophies and Buddhism - in terms of knowledge, reality and value.
Western Schools of Philosophy: Idealism, Naturalism, Pragmatism, Realism, Humanism: special reference to principles, aims of education, curriculum, teaching methods, teacher, discipline, role and place of student.

Module IV: Epistemology and Axiology in Education (10 Hours)

Knowledge - Nature, role of knowledge, Sources of knowledge
Values – concept, need, types and importance, Core values enshrined in the constitution of India. Fostering values among students

Suggested Readings

- Ayer, A.J. The Problem of Knowledge. Penguin.
- Dewey, J. Democracy and Education. Macmillan, New York.
- Dewey, J. Experience and Education. Macmillan, New York.
- 4. Durkheim, E. Education and Sociology. Free Press, Chicago.
- Froebel, F. The Education of Man. Fairfield, Kelley, New Jersey.
- Gajardo, M. (1993). Ivan Illich. <http://schoolofeducators.com/wp-content/uploads/2008/09/illiche.pdf>
- Hirst, P.H. Knowledge and the Curriculum. Routledge and Kegan Paul.
- Hirst, P.H. and Peters. The Logic of Education. Routledge and Kegan Paul.
- Illich, I. (1970). Deschooling Society. https://monoskop.org/images/1/17/Illich_Ivan_Deschooling_Society.pdf

Kant, I. Critique of Pure Reason. Dent.
 Moore, T.W. Educational Theory: An Introduction. Routledge and Kegan Paul.
 Peters, R.S., Ethics and Education. Allen and Unwin.
 Suryanarayana, S. (n.d.). Ivan Illich.
http://epgp.inflibnet.ac.in/epgpdata/uploads/epgp_content/S000033SO/P000300/M013095/ET/145258826709ET.pdf

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDPB200T: PSYCHOLOGICAL BASES OF EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objective

To help students learn to apply the knowledge of psychological principles and theories to improve students' learning.

Course Outcomes

At the end of the course, students will be able to:

- CO 1: Understand the implications of psychological concepts and principles in the field of culturally diversified classrooms. (Remembering, Understanding, Application, Analysis, Evaluation)
- CO 2: Develop critical insight into the process of human learning and the factors responsible. (Remembering, Understanding, Application, Analysis, Evaluation, Creating)
- CO 3: Create awareness about intelligence and its assessment. (Remembering, Understanding, Application, Analysis, Evaluation)
- CO 4: Create awareness about adjustment and its methods. (Remembering, Understanding, Application, Analysis, Evaluation, Creating)

Module I: Educational Psychology and Cultural Diversity in Classrooms (20 Hours)

Educational Psychology-its meaning, nature, scope and aims, Relationship between Education and Psychology, Importance of knowledge of educational psychology for the teacher, creating positive learning environments
 Cultural Diversity: Concept and types; Low Socio-Economic students and their achievement, teaching students living in poverty; Gender and its stereotyping- inherent threats, avoiding gender biases in teaching; multicultural education and culturally relevant pedagogy/teaching

Module II: Learning and transfer of learning (15 Hours)

Meaning, Nature of, learning and maturation, types of learning, Laws of learning, theories of learning: Trial and Error learning,
 Classical Conditioning, Operant Conditioning; Factors affecting Learning
 Transfer of learning: Concept, types, and Educational implications

Module III: Intelligence and its assessment (15 Hours)

Intelligence: Definition, Nature and Theories: Two Factor Theory of Intelligence, Guilford's structure of Intellect; Intelligent Quotient (IQ), Emotional Intelligence, Assessment of Intelligence

Module IV: Psychology of Adjustment (10 Hours)

Concept, Adjustment as achievement or process, Characteristics of a well-adjusted person, Methods of adjustment- direct and indirect

Suggested Readings

- Chauhan, S. S. (2004). Advanced Educational Psychology, Vikas Publishing House Pvt. Ltd, New Delhi.
- Chatterjee, S. K. (2017). Advanced Educational Psychology, Books and allied Pvt. Ltd. Calcutta

Dandapani, S. (2013): A textbook of Advanced Educational Psychology, Anmol Publications Pvt. Ltd.

4. Kuppaswami, B. (Ed.) (1963): Advanced Educational Psychology, Jalandhar: University Publications

5. Mangal, S. K., Advanced Educational Psychology, Prentice hall of India, Pvt. Ltd. New Delhi

Morgan, C.T (1961): Introduction to Psychology, New York: McGraw-Hill.

Skinner, C. E. (2007). Educational Psychology. Prentice hall of India, Pvt. Ltd. New Delhi

Woolfolk, A. (2015). Educational Psychology. Pearson India Education Pvt. Ltd. India.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDES201T: EDUCATION AND SOCIETY

(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Objective

To assist students in comprehending the role of sociological elements in creating education and society.

Course Outcomes

At the end of the course, students will be able to:

CO 1: Discuss the concept of sociology of education and agencies of education. (Remembering)

CO 2: Describe the role of education in the transmission and preservation of culture, cultural change and social change. (Understanding)

CO 3: Analyze the types of social groups and the importance of national integration, international understanding and democracy in a diverse social context. (Analyzing)

CO 4: Evaluate the role of education in solving social problems. (Evaluating)

Module I: Sociology and Education and Agencies of Education (20Hours)

Meaning of educational sociology and sociology of education; relationship between sociology and education; sociological determinants of education; agencies of education-family, school, community, religious institutions, state

Module II: Education, culture and social change (20Hours)

Meaning, concept, nature and components of culture, their role in transmission and preservation of culture; cultural lag and cultural change; social change–social mobility, stratification and the roles of education in bringing about change in social change

Module III: Education and Society (20Hours)

Education and social groups–types of groups, social interaction and its educational implications, socialization concept, factors and implications; education for national integration, international understanding and democracy

Module IV: Current Social Problems in India (15 Hours)

Equalization of educational opportunities; role of education in solving social problems such as Illiteracy, nutrition, sanitation and unemployment; lifelong education

Suggested Readings

Dash, B. N. Teacher and Education in Emerging Society. New Delhi: NeelKamal Publication (2004).

Gul, S.B. and Khan, Z. N. Philosophical and sociological foundations of education. Create Space (2010).

Khanna, S.D. Education in the Emerging Indian Society. Delhi: Doaba House (2000).

Kumar, T. P. and Talawar, M. S. Philosophical and sociological foundations of education. Mumbai: Himalaya publishing house (2010).

Sachdeva, M. S. and Sharma, K.K.. Contemporary India and Education. United States: Twenty first century publications (2015).

Saxena, N.R.S.. Philosophical and sociological foundations of education. Meerut: Vinay Rakheja (2014).

Sharma, M. Philosophical And Sociological Foundation Of Education. Guwahati: Eastern Book House (2011).

Sharma, R.S. Perspective in Modern Education. Delhi: Neel Kamal Publication (1998).

Singh, Y. K. Sociological foundations of education. New Delhi: APH Publishing Corporation (2008)

Singh, Y.K. Education in Modern India. New Delhi: Deep and Deep Publications (2000)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDEA202T: EDUCATIONAL ADMINISTRATION AND MANAGEMENT

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objective

To help students learn the importance of a good administrator and enhance the various skills required to become an effective educational administrator.

Course Outcomes

At the end of the course students will be able to:

CO 1: Define and explain the concept of educational administration, its types, elements, characteristics, functions and factors influencing educational administration. (Remembering, Understanding, Analysis)

CO 2: Explain the concept of school and school management and analyze the qualities and role of school personnel and their professional ethics. (Remembering, Understanding, Application, Analysis)

CO 3: State and explain the concept of institutional planning and identify the different steps and approaches of institutional planning. (Remembering, Understanding, Application, Analysis)

CO 4: Define and explain educational supervision, and its types and apply the principles of supervision in educational management and administration. (Remembering, Understanding, Application, Analysis)

Module I: Introduction to Educational Administration (15 Hours)

Meaning, Definition, Nature of EA, Scope of EA; Objectives of EA; Types of EA, Elements of EA, Characteristics of Administration; Functions of EA, Factors influencing EA. Autocratic and Democratic administration

Module II: School Management (20 Hours)

Concept of School, Need of School, Meaning and Definitions of School management; Process of School Management, Qualities of a Headmaster/Principal; Role of teachers in school management; Essential Qualities of Teachers, Professional ethics

Module III: Institutional planning (20 Hours)

Meaning of Planning; Concept of Institutional Planning; Importance of Institutional Planning; Aims of Institutional Planning; Steps and Preparation of Institutional planning; Approaches of Educational Planning – Man Power and Rate of return approach.

Module IV: Educational Supervision (20 Hours)

Meaning and Nature of Educational Supervision; Concept of Inspection; Difference between Inspection and Supervision; Aims, Types, Scope of Educational Supervision; Educational Supervision Procedures; Principles of Educational Supervision; Problems in Educational Supervision; Effective supervision; Functional basis of supervision.

Suggested Readings

1. Sindhu (2012). Educational Administration and Management, Noida: Dorling Kindersley.
2. Jain and Jain,. School Management, Ludhiana: Tandon Publications

3. Adams, H. P. & Duckey, F. G. Basic Principles of supervision.
4. Donahoo, S. & Hunter, R. Teaching Leaders to Lead Teachers: Educational Administration in the Era of Constant Crisis.
5. Advances in Educational Administration, Volume 10, 1–4. Elsevier Ltd.
6. English, F. (ed.). Encyclopedia Educational leadership and Administration (Vol. 1). Sage Publication: Thousand Oaks.
7. Stanley, A. G. & Samier, E. A. Political Approaches to Educational Administration and Leadership. Routledge: New York.
8. Starratt, R. Centering Educational Administration: Cultivating Meaning, Community, and Responsibility. Lawrence Erlbaum Associates, Publishers: New Jersey.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDTL203T: TEACHING LEARNING METHODS AND PEDAGOGY

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objective

To help students develop insight into the different elements of the teaching learning process to be able to create and organize their own approaches to teaching.

Course Outcomes

At the end of the course students will be able to:

- CO 1: Analytical insight into the various concepts of teaching phenomenon. (Remembering, Understanding, Application, Analysis, Evaluation)
- CO 2: Analyze the classroom implications of theories, principles and maxims of teaching. (Remembering, Understanding, Application, Analysis, Evaluation)
- CO 3: Become aware of organizing purposeful and child centered teaching. (Remembering, Understanding, Application, Analysis, Evaluation)
- CO 4: Examine the importance of teaching models for directing classroom instruction. (Remembering, Understanding, Application, Analysis, Evaluation)
- CO 5: Develop the skills of lesson planning. (Application)

Module I: Concepts of teaching (20 Hours)

Meaning of teaching- Authoritative, democratic, laissez-faire
 Teaching from a descriptive point of view; Teaching from a success point of view.
 Variables and functions of teaching,
 Levels and phases of teaching
 Modalities of teaching and their differences: Conditioning, training, instruction and indoctrination

Module II: Theories and Principles of Teaching (15 Hours)

Nature of theory of teaching
 Significance of theory of teaching;
 Types- Formal, descriptive and normative □ Principles and maxims of teaching.

Module III: Instructional Objectives and Methods of Teaching (20 Hours)

Concept of instructional objectives and learning outcomes
 Taxonomy of instructional objectives with special reference to cognitive objectives
 Methods of teaching: lecture method, discussion method, demonstration method, playway method, activity method, problem-solving method, Heuristic method, project method

Module IV: Models of teaching and Lesson Plan (20 Hours)

Meaning of models of teaching

Discussion of one model from each of the four categories of models of teaching

Techno-pedagogy

Meaning and significance of lesson plan

Types of lesson plan- knowledge, skill and appreciation

Approaches of lesson plan

Elements of a good lesson plan

Preparation of lesson plan □

Disadvantages of a lesson plan

Suggested Readings:

Chauhan, S. S. (2008). *Innovations in Teaching Learning process*. New Delhi: Vikas Publishing House Pvt. Ltd.

Mangal & Mangal. (2016). *Essentials of Educational Technology*. New Delhi: Prentice Hall of India Pvt. Ltd.

Paintal, I. (1980). *Microteaching-A handbook for Teachers*. Delhi: Oxford University Press

Passi, B. K. (1976). *Becoming Better Teacher*. Baroda: CASE

Singh, L. C. & Joshi, A. N. (1990). *Microteaching in India-A Case Study*. New Delhi: NCERT

Joyce, Bruce, Marsha Weil and Emily Calhoun (2008). *Models of Teaching*. New Delhi: Prentice Hall of India Pvt. Ltd.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H
CO 5				H

EDDE204T: DEVELOPMENT OF EDUCATION IN INDIA

(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Objectives

To familiarize students with the past and present developmental initiatives taken in the field of education, and to understand the present issues and concerns of education.

Course Outcomes

At the end of the course students will be able to:

CO 1: Review the Ancient and Medieval system of Education in India (Remembering)

CO 2: Identify the different educational policies adopted during the British Rule (Understanding)

CO 3: Analysis the development of Education in Independent India and Assam (Analysis)

CO 4: Evaluate the contemporary concerns and issues of Indian Education through various initiatives of the Government of India (Evaluation)

Module I: Education in Ancient India (15 Hours)

Vedic system of Education--Aims, Methods of Teaching, Curriculum, Teacher-pupil relationship, Discipline, Education of Women; Buddhist Period--Aims, Methods of Teaching, Curriculum, Teacher-Pupil Relationship, Discipline, Education of Women;

Medieval Period---Aims, Methods of Teaching, Curriculum, Teacher- Pupil Relationship, Discipline, Education of Women

Module II: Education during the British Period in India (15 Hours)

A brief introduction to the Educational Activities of East India Company and Christian Missionary in India; Educational Reforms and Recommendations of: Charter Act of 1813, Macaulay's Minute 1835, Wood's Despatch; Hunter Commission, 1882, Lord

Curzon's Educational Policy, 1904, Sadler's Commission, 1917, Wardha Scheme of Education, 1937, Sargent Report, 1944

Module III: Education in Post-Independence India (15 Hours)

Educational Reforms and Recommendations of: University Education Commission (1948-1949), Secondary Education

Commission (1952-53), Kothari Commission (1964-1966), National Policy on Education (1968, 1986 and 1992), Development of Education in Assam-Primary, Secondary, University and Women Education

Module IV: Issues and Challenges in Indian Education at School Stage (15 Hours)

Concept of UEE and its problems; Operation Blackboard (OBB), District Primary Education Programme (DPEP), Sarva Shiksha Abhiyan (SSA) and RTE-Act 2009; Rashtriya Madhyamik Shiksha Abhiyan (RMSA), Concept, Scope and need of Vocational

Education; Objectives of Vocational education; NPE-1986, POA-1992, and NEP 2020 with reference to Vocational Education; Use of ICT

Suggested Readings

Goswami, S. & Das Sarma, P (2012). Development of Education in India, Shanti Prakashan.

GOI (1964-1966): 'Education and National Development'. Ministry of Education, Government of India 1966.

Govt. of India, Ministry of Human Resource Development, Policy of Action, 1992, New Delhi 4. Mohanty, J., (1986). School Education in Emerging Society, Sterling Publishers

Mukerjee, S.N., (1966). History of Education in India, Acharya Book Depot.

NCERT (1986). School Education in India – Present Status and Future Needs, New Delhi.

Nurullah, S. & Naik, J.P. (1974) History of Education in India, Mc. Millan Company. India.

Rawat, P.L (2006). History of Indian Education, Ram Prasad & Sons, Bhopal.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDHG300T: HUMAN GROWTH AND DEVELOPMENT

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objective

To help students realize the importance of the knowledge of human growth and development in various stages of human life and ensuring effective learning.

Course Outcomes

At the end of the course students will be able to:

CO 1: Explain the concept of Growth and Development and its associated variables (Understanding)

CO 2: Explain the concepts of maturation and individual differences, their effect on human growth and development (Application)

CO 3: Describe childhood and adolescence as stages of development along with their developmental characteristics and role of the teacher in addressing their needs (Evaluate)

CO 4: Critically analyze the theories of development and use the knowledge of the various theories of growth and development and its associated variables in addressing the diversity of the classroom (Analyze)

Module I: Introduction to Growth and Development (20 Hours)

Concept and characteristics of Growth and Development, Difference between growth and development, Principles of growth and development and its implications for education; Dimensions of Development; Factors that influence growth and development: Heredity and Environment; Stages of Human growth and development (characteristic features): Prenatal Development, Post-natal Development

Module II: Maturation and Individual Differences (20 Hours)

Maturation: Concept, Effect of Maturation on Human growth and development, Educational implications of maturation; Individual Differences: Concept, Dimensions/ Types of individual differences, Causes of individual differences, Educational implications of Individual differences, Strategies to accommodate individual differences in the classroom

Module III: Childhood and Adolescence (15 Hours)

Childhood: Concept, Developmental Characteristics and role of teacher in addressing their needs; Adolescence: Concept, Developmental characteristics, problems encountered by adolescents, role of the teacher in addressing adolescent problems

Module IV: Theories of Development and their Educational Implications (20 Hours)

Piaget's Cognitive Theory: Freud's Psycho-sexual Theory: Erickson's Psycho-social Theory: Bronfenbrenner's Bio-ecological Theory: Kohlberg's theory of Moral Development; Chomsky's theory of Language Development; Havighurst's Developmental Tasks throughout one's life span

Suggested Readings

- Acero, V. O, Javier, E. S. and Castro, H. O. (2004). Human Growth Development and Learning. Rex Book Store: Manila Philippines
- Hurlock, E. B. (2018). Developmental Psychology: A Life Span Approach. Mc. Graw Hill Education Pvt. Ltd., Chennai.
- Hurlock, E. B. (2016). Child Development. Mc. Graw Hill Education Pvt. Ltd., New Delhi.
- Mangal, S. K. (2017). Advanced Educational Psychology. PHI Learning Pvt. Ltd., New Delhi.
- Mangal&Mangal. (2019). Psychology of Learning and Development. PHI Learning Pvt. Ltd., New Delhi.
- Erickson, E. (1950). Childhood and Society. Norton: New York.
- Kuppuswami, B. (Ed) (1971). Educational Psychology: A Cognitive Developmental Approach. New Delhi.
- Crow, L. D. & Crow, A. (1969). Child Psychology. Barney and Noble, New York.
- Singh, A. (Ed.) (2015). Human Development: A life span Approach. Orient Black Swan: Delhi.
- Cole, M & Coley, S. (1989). The Development of Children. Scientific American Books, New York.
- Chauhan, S. S. (2004). Advanced Educational Psychology. Vikash Publishing House Pvt. Ltd. New Delhi.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2		H		
CO 3		H	H	
CO 4		H		

EDET301T: EDUCATIONAL TECHNOLOGY

(5 Credits – 75 Hours) (L-T-P: 4-0-1)

Objectives

To inculcate in students the skill of utilising technology in the teaching learning process.

Course Outcomes

At the end of the course students will be able to:

- CO 1: Become aware of the contribution of educational technology to the teaching-learning process. (Remembering, Understanding, Application, Analyze, Evaluate)
- CO 2: Explain the process of communication and various instructional technology (Remembering, Understanding, Application, Analyze, Evaluate)
- CO 3: Understand the implications of behavioural technology for improved teacher behaviour. (Remembering, Understanding, Application, Analyze, Evaluate)
- CO 4: Identify the various emerging trends in technology and the multimedia approach in the classroom for the purpose of teaching (Remembering, Understanding, Application, Analyze, Evaluate)

Module I: Introduction to Educational Technology (20 Hours)

Emergence of educational technology, different views on educational technology, definition, meaning, nature and scope of educational technology, educational technology in formal and non-formal education, educational technology and quality education, problems of educational technology in the Indian context

Module II: Communication and Instruction (20 Hours)

Concept and need of communication; Forms of communication; Barriers of communication Model of communication process; Classroom communication: Verbal and Nonverbal; Instructional Technology: Programmed Instruction (PI), Personalized system of Instruction (PSI), Computer Assisted Instruction (CAI)

Module III: Behavioural Technology (20 Hours)

Need and Nature of behavioral technology; Features of teaching behavior; Concept of teaching skills and their identification;

Need, nature and steps of Micro-teaching; Interaction Analysis with special reference to Flanders; Simulated Social Skill Training (SSST)

Module IV: Practicum in Emerging Trends of Educational Technology (30 Hours)

Preparing videos using various applications

Creation of e-content in alignment with MOOCs

Learning Management System

Suggested Readings

Aggarwal, J.C. (2014) : Essentials of Educational Technology, Vikash Publishing House Pvt Ltd, New Delhi

Bruner, J. S (1966) : Toward a Theory of instruction, New York

Flanders, Ned A (1972) : Analyzing Teacher Behaviour, California, Addison Wesley

Mangal, S. K & Mangal, U (2014) : Essentials of Educational Technology PHI Learning Pvt. Ltd, Delhi

Mitra, S.K (1968) : Proceedings of symposium on educational Technology, IPAL, NCERT, New Delhi

Sharma, R. A (1988) : Technology of Teaching, Loyal Book Depot, Meerut

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDEL302T: ELEMENTARY STATISTICS IN EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objectives

To create the ability among the students to handle quantitative data and interpret computed results.

Course Outcomes

At the end of the course students will be able to:

CO 1: To acquaint the students with the concept, nature, and relevance of statistics to educational studies. (Remembering, Understanding, Application, Analysis, Synthesis)

CO 2: To make the students well aware of the organization, presentation of data and finding out central values. (Remembering, Understanding, Application, Analysis, Synthesis, Evaluation)

CO 3: To create understanding among the students about the variations of the scores in any distribution. (Remembering, Understanding, Application, Analysis, Synthesis, Evaluation)

CO 4: To create understanding among the students about the conceptual framework of normal probability curve and the relationship of variables. (Remembering, Understanding, Application, Analysis, Synthesis, Evaluation)

Module I: Nature of Statistics (15Hours)

Meaning and nature of Statistics; Utility of statistics in education; Organisation of data in frequency table; Graphical representation of data- frequency, polygon, histogram, cumulative frequency curve and ogive; Functions and limitations of statistics.

Module II: Measures of Central Tendency (15Hours)

Meaning and importance of Measures of Central Tendency; Three common measures of central tendency: Mean, Median and Mode; Definition of mean, computation of mean from ungroup data and grouped data. In case of grouped data-long and short method; Merits and demerits of mean; Definition of median, computation of median from ungrouped and grouped data; Merits and demerits of median; Definition of mode, computation of mode from ungrouped data and grouped data, merits and demerits of mode; When to use mean, median and mode

Module III: Measures of Variability (15Hours)

Meaning and importance of Measures of Variability; Types of measures of variability: Range, average deviation, standard deviation, and quartile deviation; Computation of Range and its merits and demerits; Computation of Average Deviation(AD) from ungrouped and grouped data, merits and demerits of AD; Computation of SD from ungrouped and grouped data, merits and demerits of SD; Computation of Quartile Deviation from ungrouped and grouped data, merits and demerits of QD; Percentile and Percentile Ranks; When to use range, AD, SD, and QD

Module IV: Relationship between Variables (15Hours)

Definition of Correlation, Correlation and causation; Types of correlation; Meaning of linear correlation and degree of relationship; Methods of determining correlation- Graphic methods and Mathematical method; Product Moment Method and rank Difference Method; Factors affecting correlation; Nature and features of Normal Probability Curve

Suggested Readings

1. Garrett, H.E Statistics in Psychology and Education, Vakuls, Feffera and Sumon, Bombay (1971)

2. Guilford, J.P. Fundamentals Statistics in Psychology and Education, McGraw-Mill, New York (1967):

Gupta, B.N Statistics, Theory and Practice, Sahitya Bhawan, Agra (1993).

Koul, L. Methodology of Educational Research, Vikas Publishing House, Pvt. Ltd, New Delhi (2009)

Mangal, S.K.: Statistics in Psychology and Education, PHI Pvt. Ltd, Delhi (2018)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDME303T: MEASUREMENT AND EVALUATION IN EDUCATION: I

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objectives

To help students develop insight and skills of measuring and evaluating students learning.

Course Outcomes

At the end of the course students will be able to:

- CO 1: To create understanding among the students about concept and nature of educational measurement and evaluation. (Remembering, Understanding, Analysis)
- CO 2: To make the students well aware of the nature of objective cum outcome based education with special reference to taxonomy of educational objectives. (Remembering, Understanding, Application, Analysis, Synthesis)
- CO 3: To make the students well aware of the types of evaluation. (Remembering, Understanding, Application, Analysis)
- CO 4: To create understanding about the measurement of different dimensions and their interpretations. (Remembering, Understanding, Application, Analysis)

Module I: Introduction to Measurement and Evaluation in Education (15Hours)

Concept and historical background of measurement
Types of measurement and scales of measurement
Functions of measurement in education
Concepts of assessment and evaluation
Relationship between assessment and evaluation
Principles and steps of evaluation
Scope of measurement and evaluation in education

Module II: Nature of Educational Objectives and Outcome-Based Education (15Hours)

Meaning and need of educational objectives
Educational aims, educational objectives and instructional objectives
Purpose of Taxonomy of educational objectives
Cognitive, affective, and psychomotor objectives and their taxonomy
Writing instructional objectives in behavioural form
Concepts of objective cum outcome-based education for ensuring quality education

Module III: Measurement and Evaluation of an Individual (15Hours)

Types of evaluation
Measurement of intelligence, interest, and aptitude of students
Measurement of achievement of students
Tools/ tests of intelligence, interest, aptitude, and achievement
Teacher made achievement test and standardized achievement test
Characteristics of a good test
Educational diagnosis

Module IV: Planning and Execution of Evaluation Programme (15Hours)

Features of an effective evaluation programme
Functions of evaluation programme
Steps for planning a good evaluation programme
Execution of the evaluation programme
Recording and reporting date
Use of data for guidance and counseling

Suggested Readings

- Adams, G. S. (1964). Measurement and Evaluation in Education, Psychology, and Guidance. Holt, Rinehart Winston. New York.
- Annastasi, A. (1976): Psychological Testing, McMillan Publication Co. New York
- Ebel, R. L & Fresbie, D. A. (1991). Essentials of Educational Measurement. Prentice Hall of India Pvt. Ltd. New Delhi.
- Edwards, A. L. (1966) : Techniques of Attitude Scale Construction, New York
- Frank, S. Freeman (1990) : Theory and Practice of Psychological Testing, IH Publishing Co. Bombay
- Granlund, N.E (1976): Measurement and Evaluation in Teaching, McMillan Publishing Co. New York
- Linn, R. L. & Miller, M. D. (2008) : Measurement and Assessment in Teaching, Darling Kindersley, Pvt.Ltd
- Sharma, R. A. (1998) : Essentials of Measurement in education and Psychology, R. Lall Book Depot, Meerut

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

EDTE304T: TEACHER EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objective*To inculcate in students the qualities of being an effective teacher and the various scopes associated with it.***Course Outcomes**

At the end of the course students will be able to:

CO 1: Explain the meaning, nature, features and scope of teacher education (Remembering)

CO 2: Describe the concept of Pre-service and In-service Teacher education and its various dimensions. (Understand)

CO 3: Identify the various approaches to Teacher Education programme (Analyse)

CO 4: Evaluate the current trends in the field of Teacher Education (Application)

Module I: Introduction to Teacher Education (15 Hours)

Meaning, nature and scope of Teacher Education; Historical background of Teacher Education in India; Objectives of Teacher Education; Paradigm shifts in education and preparation of teachers

Module II: Pre-Service and In-Service Teacher Education (10 Hours)

Concept of Pre-service & In-service Teacher Education; Features of Pre-service & In-service Teacher Education; Terms and conditions for Pre-service & In-service Teacher Education Programs as per NCTE

Module III: Approaches to Teacher Education (15 Hours)

Behaviouristic and constructivist approaches; Disciplinary and Inter-disciplinary approach; Modification of teaching behaviour: Simulated teaching, Flanders' Interaction Analysis Category System; Integrated Teacher Education Programme; Information Literacy and using ICT in classroom.

Module IV: Emerging Trends and Research in Teacher Education (20 Hours)

Modes of Transaction; Micro Teaching and SSST Team Teaching; Practice Teaching and Internship; Research in Teacher Education; Process of Action Research Technology in Teacher Education; Emerging trends in Teacher Education; Issues and challenges in teacher education

Suggested Readings

Aggarwal, J. C. Teacher Education, Theory and Practices, New Delhi, Daoba Home(2010)

Harvilas, S. and Naik, J.P. A History of Education in India, Bombay, McMillan & Co. (2016)

Jangaiah, C. Teacher Education, APH Publishing Corporation (2016)

Jangira, N.K. Teacher Training and Teacher Effectiveness –An experience in Teaching, New Delhi, National Publishing House (2002)

Kumar, T.P. Teacher Education, APH Publishing Corporation (2010)

NCERT: The Third Indian Year Book on Education, New Delhi, NCERT (1968)

NCTE : Teacher Education Curriculum-A Framework, New Delhi, NCERT (1978)

Mohanty, R. K . Teacher Education, R. Lal Book Depot, Raj Printers (2012)

Shirmali, K.L: Better Teacher Education, New Delhi, Ministry of Education, Govt. of India

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

EDEC305T: EARLY CHILDHOOD CARE AND EDUCATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Objectives

To help students understand the importance of stimulating environment, nutritious food and care during the early stages of human growth and development.

Course Outcomes

At the end of the course students will be able to:

CO 1: State and explain the concept, need, significance and principles guiding the framework of ECCE. (Remembering, Understanding)

CO 2: Explain and analyze the underlying philosophies of ECCE. (Understanding, Analysis)

CO 3: State the various policies, programmes and initiatives on ECCE and evaluate the accuracy and relevance of these policies, programmes and initiatives (Remembering Understanding, Evaluation)

CO 4: State the meaning and approaches of the curriculum and apply the play-way approach in teaching the learners of ECCE stage. (Remembering, Understanding, Application)

Module I: Nature of ECCE and Principles of Development in Early Years (14 Hours)

Meaning, Definitions and Significance of ECCE in the context of Universalization of Elementary Education; Objectives and principles guiding the framework of ECCE; Developmental milestone goals of ECCE centres; Meaning of Growth and Development; Principles guiding growth and development; Characteristics of children at ECE stage.

Module II: Philosophies on ECCE (12 Hours)

Philosophy of John Dewey; Friedrich Froebel; Maria Montessori; Gijubhai Badeka; Tarabai Modak

Module III: Policies, Programmes and Initiatives on ECCE in India (17 Hours)

Development of ECCE in India; National Children's Policy 2013; NPE-1986 and its Programme of Action (POA)1992; NEP-2020 and ECCE; Convention on Rights of the child, 1989; Providers of ECCE- government, private and NGOs; ICDS and SSA.

Module IV: Curriculum of ECCE (17 Hours)

Meaning of Curriculum; Approaches of the curriculum; Play Way Approach- Meaning of play; benefits of play; Types of Play; Importance of integrating play into the curriculum; Enhancing Communication Skills through play way approach; Teacher's Role and activities to promote communication; Literacy and Numeracy Meaning of Literacy; Meaning of numeracy; Components of literacy and numeracy for an early years curriculum; Play-centred activities for literacy and numeracy; Play way method in supporting reading skills Pre-reading Activities and games.

Suggested Readings

Braun, S.J & Edwards, E.P (1972): History and Theory of Early childhood Education, Ohio, Charles, A.Ones Publishing Co.

Desai, K.G.(1976): Effectiveness of kindergarten Education : Allahabad, United Publishers.

Koul, V.(et.al)(1993): Early Childhood Care and Education: An Assessment, New Delhi, NCERT.

MHRD (1986): A Guide Book for Anganwadi Workers Dept. Of Women & Child Development, MHRD, Govt. of India

Montessori Maria (1969): The Montessori Method, New York, Shockan Book

Montessori Maria (1986): The child in the Family, New York, Avon Books

Thakur, A. (1972): Perspectives in Pre-School Education, Bombay, Poplr Pradhan Pvt Ltd.

Upadhay, G. C. (1999): A study of Pre-school component and its perception and extent of Utilization by Community, New Delhi, NCERT

Viruru, R. (2001): Early Childhood Education, New Delhi, Sage Publications

Sue Bredekamp (2014): Effective Practices in Early Childhood Education: Building a Foundation (3rd Edition), Pearson Publications

Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through age eight, 3rd Edition, Editors - Carol Copple and Sue Bredekamp

Kaul. V., (2009). Early Childhood Education Programme. National Council of Educational Research and Training, New Delhi.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDCS400T: - CURRICULUM STUDIES

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Objective

To inculcate in the learners the skill of developing an effective curriculum.

Course Outcomes

At the end of the course students will be able to:

CO 1: Identify the components, principles, goals and objective of curriculum development (Remembering)

CO 2: Demonstrate the different bases of the curriculum construction (Understanding)

CO 3: Analyze the different dimensions, approaches of curriculum designing and the role of teachers in bringing about changes and modification in the curriculum (Analyzing)

CO 4: Apply the methods and process of curriculum development and examine the relevance of the existing curriculum

(Application)

Module I: Nature of Curriculum (15 Hours)

Defining curriculum, Components of curriculum, Principles of curriculum, Goals and objectives for curriculum development, Characteristics of a good curriculum

Module II: Bases of Curriculum Construction (15 Hours)

Philosophical bases: Naturalism, Idealism, Pragmatism, Sociological bases: Society, education and schooling, social change and curriculum, Psychological bases: Learning theories and curriculum, humanistic psychology

Module III: Approaches to Curriculum Development (15 Hours)

Major approaches: subject-centred, broad fields/ life-centred, learner-centred approaches, Models of curriculum development: Technical/Scientific model- Tyler Model and Taba Model, Non- technical/ non- scientific model – Open class model, Weinstein and Fantini's Model

Module IV: Process of Curriculum Development and the role of teachers in Curriculum Development (15 Hours)

Process of curriculum development: Assessment of educational needs, Formulation of objectives Selection and organisation of content, Selection and organisation of learning experiences, Evaluation Role of teachers in curriculum development and some issues in curriculum development, Irrelevant curriculum, Emerging curriculum.

Suggested Readings

Beane, A. J., Topfer, Jr. and Alessi, S.J. . Curriculum Planning and Development. London: Allyn and Bacon. (1986)

Dewey, J. (1966). The Child and the Curriculum- The School and Society. USA: Phoenix

Olivia, P. F. (1988). Developing the Curriculum. London: Scott Foreman and Company

Seethaeramu, A.S. (1989). Philosophies of Education. New Delhi: Ashish Publishing House

Sharpes, D.K. (1988). Curriculum Tradition and Practices. London: Routledge.

Shivarndrappa. G. (1985). Philosophical Approaches to Education. New Delhi: Himalaya Publishing House.

Taneja, V.R. and Taneja. S. (1980). Educational Thinkers. New Delhi: Atlantic Publishers

Tyler. R. (1949). Basic Principles of Curriculum and Instruction. Chicago: University of Chicago Press.

Weinstein, G and Fantini, M. (1970). Towards Humanistic Education: A Curriculum of Affect. New York: Praeger.

Wheeler, D.K. (1976). Curriculum Process. London: University of London

Wiles, J and Bondi, J (1989). Curriculum Development. Ohio: Merrill Publishing Company.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDIE401T: INCLUSIVE EDUCATION

(5 Credits – 75 Hours) (L-T-P: 4-0-1)

Objective

To create empathy and a scientific attitude among the students towards the education of special needs children.

Course Outcomes

At the end of the course students will be able to:

CO 1: To create awareness among the students regarding the concept of Inclusive Education and its evolution. (Remembering, Understanding, Application, Analysis)

CO 2: To make the students aware about the prevailing legal provisions and policies available for inclusion. (Remembering, Understanding, Application, Analysis)

CO 3: To create awareness about the required infrastructural facilities, pedagogical strategies, Teacher's role and competencies, and assistive and adaptive technologies available for inclusive classroom. (Remembering, Understanding, Application, Analysis, Evaluation)

CO 4: To familiarize the students with the barriers to inclusive Education and its interventions. (Remembering, Understanding, Application, Analysis, Evaluation)

Module I: Introduction to the concept of Inclusive Education and its evolution (15 Hours)

Concept and Definitions

Principles of Inclusive Education

Scope and Target Group: Diverse learners, Marginalized groups and learners with disabilities.

Evolution of the philosophy of Inclusive Education: Special, Integrated and Inclusive Education. □

Types / Models of Inclusive Education:

Full Inclusion

Partial Inclusion

Benefits of inclusion:

For children with Disabilities

For children without Disabilities

Need and importance of Inclusive Education.

Factors affecting Inclusion

Module II: Legal Provisions: Policies and Legislations for Inclusive Education (18 Hours)

National Policy of Education 1986

Programme of Action 1992

Persons with Disabilities Act 1995

National Policies of Disabilities 2006

Concession and facilities to Diverse learners: Academic and Financial (Rehabilitation Council of India Act 1992)

Features of United Nations Convention on the Rights of Persons with Disabilities

New Education Policy 2020

Module III: Planning and management of Inclusive Classrooms (15 Hours) □

Infrastructure □

Inclusive pedagogy:

Social learning

Activity based learning

Multisensory teaching
 Reflective teaching
 Collaborative and cooperative teaching
 Team teaching
 Peer tutoring
 Remedial instruction
 Individualized Educational Programme

Teacher in an Inclusive Classroom: Role and competencies

Assistive and adaptive technology for diverse learners

Module IV: Barriers to Inclusive Education and Interventions (12 Hours)

Attitude

Labelling

Peer Rejection

Accountability

Traditional Oriented Teaching etc.

Interventions:

Environmental Intervention

Social Intervention

Academic Intervention

Module V: Practicum: (Assignment- any one) (30 Hours)

Survey the nearby schools and present a report on its inclusive settings.

Survey the nearby schools and present a report on the attitude of teachers and students (both differently-abled and normal) towards Inclusive Education.

Survey the nearby schools and identify the inclusive pedagogy as adopted by them and present a report.

Organize awareness camps on the benefits of inclusive education.

Suggested Readings:

Basha, Sayed Hayath. (2017). *Inclusive Education: Policies and practices*. New Delhi Publishers: New Delhi.

Rehabilitation Council of India. (2018). *Integrated and Inclusive Education: DSE VI Manual*. Kanishka Publishers: New Delhi.

Mangal, S. K. (2017). *Educating Exceptional Children: An introduction to Special Education*. PHI Learning Pvt. Ltd. New Delhi.

Fuchs, Douglas and L. S. Fuchs. (1994). *Inclusive School Movement and the Radicalization of Special Education Reform: Exceptional Children*. 60, 294- 309.

Manivannan, M. (2001). *Inclusive Education for Disabled Children*. <http://www.dinf.ne.jp/doc/English/asia/resource>.

Stainback, S. and Stainback, W. (Edns.) (1996). *Inclusion a Guide for Educators*. (2nd ed.), Baltimore: Brookes.

Mangal, S. K. and Mangal, S. (2019). *Creating an Inclusive School*. PHI Learning Pvt. Ltd. New Delhi.

Dash, N. (2006). *Inclusive Education for Children with special Needs*. Atlantic publishers and Distributors Pvt. Ltd.: New Delhi.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDAS402T: ADVANCED STATISTICS IN EDUCATION (5-0-0)

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objective

To make the students capable of dealing with quantitative data by using varieties of advanced statistical techniques.

Course Outcomes

At the end of the course students will be able to:

- CO 1: To create understanding among the students about the applications of inferential statistics at higher levels in research (Remembering, Understanding, Application, Analysis, Evaluation)
- CO 2: To enable the students to make use of correlation for testing hypothesis in case of grouped data, regression analysis, and factor analysis (Remembering, Understanding, Application)
- CO 3: To acquaint the students with the concepts of non-parametric tests and their application in the field of educational research. (Remembering, Understanding, Application, Analysis)
- CO 4: To create interest, motivation and critical thinking in the process of quantitative type of research studies in education (Remembering, Understanding, Application, Analysis, Evaluation)

Module I: Introduction to Normal Probability Curve and Correlation (20 Hours)

Nature, principles, and theories of probability, and Binomial Distribution

Normal probability curve and its properties

Areas under normal probability curve

Skewness and kurtosis

Applications of normal probability curve

Measures of relationship with grouped data: product moment through scatter gram

Biserial, point biserial, tetrachoric correlation, Phi coefficient

Partial and multiple correlation

Regression and prediction

Module II: Introduction to Inferential Statistics (20 Hours)

Meaning of inferential statistics

Concepts of statistics and parameter and standard error

Levels of significance and confidence limits, degree of freedom

Concepts of one tailed and two tailed tests

Concepts of type I and type II errors

Application of z test and t test for testing hypotheses

Module III: Analysis of Variance (20 Hours)

Concept and need of ANOVA

Use of one way, two way, and three way Analysis of variance

Assumptions of ANOVA

Analysis of co-variance (ANCOVA) and its assumptions

Experimental designs and relevance of ANOVA and ANCOVA

Factor analysis with important methods

Linear regression analysis

Module IV: Non-Parametric Tests in Educational Research (15 Hours)

Meaning and need of non-parametric tests

Assumptions of non-parametric tests

Difference between parametric and non-parametric tests

Chi-square test

Sign test, median test

Suggested readings

Edwards, A. L. (1968). *Experimental Designs in Psychological Research*. New York: Holt, Rinehart and Winston, Inc.

Ferguson, G. A. (1981). *Statistical Analysis in Psychology and Education*. Tokyo: Mc. Graw Hill.

Garrett, H. E. (1986). *Statistics in Psychology and Education*. New York: David McKay Co. Inc.

Guilford, J. P. (1965). *Fundamental Statistics in Psychology and Education*. New York: Mc Graw Hill Book Company.

Kerlinger, F. N. (2004). *Foundations of Behavioural Research*. New York: Rinehart and Winston Inc.

Mangal, S. K. (2018). *Statistics in psychology and Education*. Delhi: PHI Learning Pvt. Ltd.

Mohanty, B. &. (2016). *Statistics for Behavioural and Social Sciences*. New Delhi, India: Sage Publications Pvt. Ltd. .

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDEE403T: MEASUREMENT AND EVALUATION IN EDUCATION-II

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Objectives

To make the students well aware of the total conceptual framework of educational measurement and evaluation

Course Outcomes

At the end of the course students will be able to:

CO 1: To inculcate the skill of construction and standardization of test and attitude scale among the students.

(Remembering, Understanding, Application, Evaluation)

CO 2: To make the students well aware of the concept of norms and transformation of scores. (Remembering, Understanding, Application, Evaluation)

CO 3: To inculcate the skill of item writing for an achievement test. (Understanding, Analysis, Synthesis, Evaluation)

CO 4: To make the students well aware of describing and summarizing measurement results. (Application, Analysis, Synthesis, Evaluation)

Module I: Tools of Measurement (20 Hours)

Need of tools in the process of measurement

Characteristics of a good and scientific tool

Construction and standardization of an achievement test, questionnaire, and attitude scale

Manual of the test

Concepts of reliability and validity

Module II: Transformation of Scores (20 Hours)

Concept of standard score

Need and importance of standard scores

Conversion of raw scores in z-score, T-score, C-score, and Stanine scores

Norms, age, grade, and percentiles

Module III: Items writing for the test (20 Hours)

Need and types of items of the test

Comparison of objective and essay type test items

Number of items

Level and distribution of difficulty

Guidelines for writing effective multiple choice type, true-false type and other objective type items

Guidelines for writing effective essay type items

Measuring complex achievement: interpretive exercises, merits and demerits □

Guide line for constructing interpretive exercises

Module IV: Describing and Summarizing Measurement Results (15 Hours)

Scores of individuals on test

Organizing scores into a frequency table

Graphical representation

Describing scores distribution in terms of central tendency, variability, normality, percentiles, correlation (product-moment and rank difference)

Grading systems, methods of assigning grades

Suggested Readings

Adams, G. S. (1964). Measurement and Evaluation in Education, Psychology, and Guidance. Holt, Rinehart Winston. New York.

Annastasi, A. (1976): Psychological Testing, McMillan Publication Co. New York

Ebel, R. L & Fresbie, D. A. (1991). Essentials of Educational Measurement. Prentice Hall of India Pvt. Ltd. New Delhi.

Edwards, A. L. (1966) : Techniques of Attitude Scale Construction, New York

Frank, S. Freeman (1990) : Theory and Practice of Psychological Testing, IH Publishing Co. Bombay

Granlund, N.E (1976): Measurement and Evaluation in Teaching, McMillan Publishing Co. New York

Linn, R. L. & Miller, M. D. (2008) : Measurement and Assessment in Teaching, Darling Kindersley, Pvt. Ltd

Sharma, R. A. (1998) : Essentials of Measurement in education and Psychology, R. Lall Book Depot, Meerut

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

MINOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Minor Course 1	EDGC102T	Guidance and Counselling in Education	4
2	Minor Course 2	EDTT103T	Teacher and Teaching Skills	4
3	Minor Course 3	EDTH205T	Educational Thinkers	4
4	Minor Course 4	EDHE206T	Human Rights Education	4
5	Minor Course 5	EDPE307T	Peace Education	4
6	Minor Course 6	EDWE308T	Women Empowerment	4
7	Minor Course 7	EDSD404T	Education for Sustainable Development	3
7	Minor Course 8	EDER405T	Elements of Research in Education-I	2
8	Minor Course 9	EDES406T	Educational Seminar	3

EDGC102T: GUIDANCE AND COUNSELLING IN EDUCATION

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective

To familiarize the students with various concepts, tools and techniques of guidance and counselling and to acquire the necessary skills needed for guidance and counselling

Course Outcomes

CO 1: Define and Explain the concept of guidance, its nature, needs and principles and the role of a teacher as a guide. (Remembering, Understanding, Applying)

CO 2: State and explain the types of guidance and analyze the components of educational vocational and personal guidance, and perform the guidance activities. (Remembering, Understanding, Analysis, Applying)

CO 3: Define and explain the concept of counselling, differentiate the different types of counselling and find out the qualities of an effective counsellor. (Remembering, Understanding, Applying)

CO 4: Describe the tools and techniques of guidance and counselling and organize the guidance and counselling services. (Remembering, Understanding, Applying)

Module I: Introduction to Guidance (10 Hours)

Meaning and Definition; Nature of Guidance; Functions of Guidance; Historical background of the guidance in India; Need and Principles of Guidance; Teacher as a Guide.

Module II: Types of Guidance (17 Hours)

Educational Guidance, Vocational Guidance, Personal Guidance; Organisation of guidance and Counselling services

Module III: Concept of Counselling (14 Hours)

Meaning and Definition; Nature of Counselling; Need for Counselling in educational Institutions; Types of Counselling: Directive, Non-directive Counselling and Eclectic Counselling; Qualities of an effective counsellor

Module IV: Tools and Techniques of Guidance and Counselling (17 Hours)

Testing techniques- Intelligence, Creativity, Interest, Aptitude and Personality traits; Non-testing Techniques: Observation, Interview, Case study, Cumulative records.

Suggested Readings

- Aggarwal, J. C. Educational, Vocational Guidance and Counselling. New Delhi: Doabai House (1991).
 Bengalee, M. D. Guidance & Counselling. Bombay: Sheth publishers (1985).
 Bhatagar, R.P. Guidance & Counseling in Education and Psychology Meerut: R-Lall Book Depot Educational Bookseller and Publishers (2018).
 Bhatnagar, R. P., & Seema, R. Guidance and Counselling in Education and Psychology. Meerut: R.Lal Book Depot (2003).
 Chauhan, S. Principles & Techniques of Guidance. N.Delhi: Vikas Publishing House Pvt Limited (2009).
 Gibson Robert & Mitchell Marianne : Introduction to Guidance & Counseling, 6th edition, N. Delhi: Prentice Hall of India(2005)
 Indu, D. The Basic Essentials of Counseling. New Delhi: Sterling Publishers Private Ltd (1983).
 Kochhar SK Guidance & Counseling in Colleges & Universities. N. Delhi: Sterling publishers (1986).
 Kochhar, S. K. Guidance in Indian education. N. Delhi: Sterling publishers (1981).
 Kochhar, S. K. Guidance and Counseling in Colleges and Universities. New Delhi: Sterling Publishing Pvt. Ltd (1984).
 Kochhar, S. K. Educational & Vocational Guidance in Secondary Schools. N. Delhi: Sterling Publishers (1987).
 Madhukar, Indira,. Guidance & Counseling. N. Delhi: Authors Press (2005).
 Madhusudan, M. Educational and Vocational Guidance. Sambalpur: Saha Publishers & Distributors (1983).
 Narayan S. Rao .Counseling and Guidance. New Delhi: Tata McGraw Hill (1991).
 Raj, Singh. . Educational & Vocational Guidance, N. Delhi: Commonwealth Publications (1994).
 Sharma, N. R. Educational and Vocational Guidance. Agra: Vinod Pustak Mandir (1989).
 Sharma, R.N. Vocational Guidance and Counseling. Delhi: Surjeet Publications (2008).
 Singh, L.K. & Sudarshan, K. N.: Vocational Education. N. Delhi: Discovery Publishing house (1996).

Mapping of Cos to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2		H		
CO 3			H	
CO 4				M

EDTT103T: TEACHER AND TEACHING SKILLS

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective

To make the students well aware of skills of teaching

Course Outcomes

CO 1: To create awareness among the students about the conceptual framework of teaching-learning process.
 (Remembering, Understanding, Applying)

CO 2: To make the students well aware of the concept of teaching skills and approach of inculcating teaching skills. (Remembering, Understanding, Applying)

CO 3: To create understanding among the students about educational objectives required by any effective teacher. (Remembering, Understanding, Applying)

CO 4: To acquaint the students about the concept and goals of teaching practice and approaches to lesson planning. (Remembering, Understanding, Applying)

Module I: Introduction to Teaching and Structure of Teaching-Learning Process (12 Hours)

Concept, meaning and definition of teaching, Structure of teaching; Teaching as profession; Principles and maxims of teaching.

Module II: Teacher and Teaching Skills (16 Hours)

Qualities of an effective teacher; Concept of teaching skills and sources of teaching skills; Micro teaching as an approach to ensure mastery over teaching skills; Micro lesson planning and its implementation.

Module III: Educational Objectives (16 Hours)

Aims of education, general objectives and specific objectives; Utility of taxonomy of objectives; Taxonomy of cognitive, affective and psychomotor objectives

Module IV: Teaching Practice and Macro Lesson Plan (20 Hours)

Concept, need and objectives of teaching practice; Concept and need of macro teaching; Difference between macro teaching and micro teaching; Meaning and importance of macro lesson plan; Development of lesson plan for macro teaching.

Scheme of Evaluation

Internal Evaluation: 40 Marks

Class Test:	20 Marks
Assignment:	10 Marks
Attendance:	5 Marks
Non-formal Behaviour:	5 Marks

External Evaluation: 60 Marks

Teaching Practice: 5 days and Delivering 5 Lesson Plan:	30 Marks
One final lesson plan presentation:	20 marks
Viva Voce:	10 Marks

Suggested Readings

NCERT(2004): Curriculum framework for teacher Education, NCERT, New Delhi.

NCTE (2004): Some specific Issues and concerns of Teacher Education, NCTE, New Delhi.

Dunkin, M.J. (Ed)(1989): International Encyclopedia of Teaching and Teacher Education, Pergamon Press, Oxford.

Kapoor, KC, (Ed) (2008): Teacher Education in 21st Century, the Associate Publishers, Ambala Cantt.

CASE (2000-2003): Policies and Issues in Teacher Education, CASE, M.S. University of Baroda.

Reddy, R.S. (1998): Principles and Practices of Teacher Education, Rajat Publication.

Mapping of Cos to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDTH205T: EDUCATIONAL THINKERS

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective

To make the students well aware of Indian and Western educational thinkers.

Course Outcomes

- CO 1: To create awareness among the students about the philosophical thoughts and education. (Remembering, Understanding, Applying)
- CO 2: To make the students well aware of the contributions of Indian educational thinkers. (Remembering, Understanding, Applying, Analyzing, Evaluating)
- CO 3: To make the students well aware of the contribution of Western educational thinkers. (Remembering, Understanding, Applying, Analyzing, Evaluating)
- CO 4: To create understanding among the students about some similarities and differences among educational thinkers. (Understanding, Applying, Analyzing, Evaluating)

Module I: Introduction to Philosophical Thoughts of Education (10 Hours)

Philosophies and their impact on education
 Indian philosophical traditions and their educational implications
 Indian society and education with special reference to British period

Module II: Indian Educational Thinkers (20 Hours)

Swami Dayanand: Life sketch and his contribution in educational process
 Swami Vivekanand: Life sketch; Basics of his philosophy and its relevance to education.
 Rabindranath Tagore and Sri Aurobindo Ghosh: their contribution in the field of education
 M. K. Gandhi: Life sketch and his contributions in the field of education
 Indian educational thinkers with special reference to NPE 1986 and NEP 2020

Module III: Western Educational Thinkers (20 Hours)

J. H. Pestalozzi: Life sketch, philosophy of life, educational philosophy in relation to curriculum, methods of teaching and role of teacher.
 J. J. Rousseau: life sketch, philosophy of education with special reference to negative education.
 John Dewey: life Sketch and philosophy of education.
 Froebel and Maria Montessori: Their life sketch and contribution in education □ Indian education policies and Western thinkers

Module IV: Analytical Views on Indian and Western Educational Thinkers (10 Hours)

Similarities in educational thoughts of Indian and Western thinkers
 Differences in educational thought of Indian and Western thinkers
 Indian National Curriculum Framework- 2005 and Indian and Western educational thinkers

Suggested Readings

- Aggarwal, J. C. (2002). Psychological, Philosophical and Sociological Foundations of Education, *Shipra Publications*, Delhi
- Goswami, M. K. (2006). Educational Thoughts and Essays, *Asian Books Pvt Ltd*, New Delhi
- Kumar, T. P. (2011). Great Philosophers of Education, *APH Publishing Corporation*, Darya Ganj, New Delhi
- Nayak, B. K. (2001). Text book on Foundations of Education. Kitab mahal, College Square, Cuttak.
- Rai, B. C. (2000). Principles of Education, *Prakashan Kendra*, Lucknow
- Safaya, S. (2010). Modern Theory and Principles of Education, *Dahnpat Rai Publishing Company Pvt Ltd*, New Delhi
- Singh, Y. K. (2013). Philosophical Foundations of Education, *APH Publishing Corporation*, New Delhi
- Sur Roy, T. (2013) Educational Thinker: Oriental and Occidental, *Ashok Publications*, Guwahati
- Taneja, V. R. (2009). Educational Thought and Practice, *Sterling Publishers Pvt Ltd*, New Delhi

Mapping of Cos to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

EDHE206T: HUMAN RIGHTS EDUCATION

(4 Credits- 60 hours) (L-T-P: 3-1-0)

Objective

To familiarize the students with Human Rights and Human Rights education, rights of children and to inculcate value education among them

Course Outcomes

CO 1: Recognize the origin, meaning, concept, objectives provisions of human rights and human rights education (Understanding)

CO 2: Identify various international covenants and conventions fostering human rights and gender equity (Understanding)

CO 3: Analyze the functions of various national and international human rights bodies and approaches to teach human rights at different ladders of school education (Analyzing)

CO 4: Apply the concept and objectives of value education in realizing Human Rights (Applying)

Module I: Introduction to Human Rights Education (20 Hours)

Origin and historical account of Human Rights; Description of UN Charter and UDHR; Meaning of Human Rights and Human Right Education; Constitutional Provisions for Human Rights

Module II: International Covenants, Convention and Gender Equity (15 Hours)

International Covenants on Economics, Social and Cultural Rights; Convention of Rights of Child and role of ILO; Right to Education Act -2009

Module III: Human Rights and Duties (15 Hours)

Human Right Protection Act and role of NHRC, SHRCs, UN, UNESCO; Curriculum framework of Human Rights Education; Approaches of Teaching for Human Rights Education

Module IV: Value Education (10 Hours)

Concept of Value; Sources of Value: Biological, Psychological, Sociological and Spiritual; Meaning, nature and objectives of Value Education; Value clarification approach

Suggested Readings

Bhardwaj, T.R. Education of Human Value. New Delhi: Mittal Pub.(2007).

Dhand, M. Teaching Human Rights- A Handbook for Teacher Educators. Bhopal: Asian Institute of Human Rights Education (2002).

Donnelly, J. Universal Human Rights in Theory and Practice. New Delhi: Sterling (2003).

NCERT. Human Rights: A Source Book. New Delhi: NCERT(1996).

Mohanty, J. Human Rights Education. New Delhi: Deep and Deep Publications (2009)

Rama, J. M. Human Rights an Indian Values. New Delhi: NCTE (1997)

Mapping of Cos to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4	M			H

EDPE307T: PEACE EDUCATION

(4 Credits- 60 hours) (L-T-P: 4-0-0)

Objective

The objective of the course is to learn about the importance of peace and the role of social organizations , thinkers and various movements that promotes peace amongst mankind.

Course Outcomes

CO 1: Describe the importance of peace and the role of social organizations towards peace. (Remembering, Understanding)

CO 2: Explain the various roles of agencies in promoting peace (Remembering, Understanding)

CO 3: Analyze the concept of peace as held by different thinkers. (Analyzing)

CO 4: Discuss the various global issues and peace movements. (Evaluating)

Module I: Understanding peace as a dynamic social reality (10 Hours)

Basic concepts of Peace and Peace Education; nature, meaning, objectives; Theories of peace – democratic peace and active peace

Module II: Role of agencies in promoting peace(13 Hours)

Role of social organizations: Family, Religion, Mass Media, Community, School

Module III: Thinkers on Peace (17 Hours)

Some thinkers on harmony: Dalai Lama, Gandhi, Mother Teresa; Gautam Buddha; Montessori; Friere; Concept of peace education; peace teacher, peace method and other enabling practices in an educational setting

Module IV: Global issues and peace movements (12 Hours)

Underlying causes of violence and war; Global peace movement; Promoting positive peace; Human rights, population control, non-alignment movement, campaign for nuclear disarmament and role of world organizations in promoting peace

Activities to be conducted: (8 hours) (any 01)

Field visit to place/organization-government/non-government working towards building peace

Exhibition on Peace related themes

Strategies to create peace building: Meditation, Yoga, Dramatization, Debate

Suggested Readings

Dalai Lama. The joy of living and dying in peace. (ed.) Donald S. Lopez. Jr. Dharamsala: Tibetan and Archives (1998).

Diwaha, R. R. and Agarwal, M. (Ed). . Peace education. New Delhi: Gandhi Marg (1984).

Doyle, M. W. Liberal peace: Selected essays. London and New York: Routledge (2012).

Duckworth, C. Teaching peace: a dialogue on the Montessori Method. Journal of Peace Education (2006), 3(1), 39-53.

Fountain, S. Peace education in UNICEF. New York: UNICEF (1999).

Gat, A. The Democratic peace theory reframed: The impact of modernity. World Politics (2005), 58, pp. 73-100.

Girard, K. Preparing teachers for conflict resolution in the schools. Washington, DC: ERIC Clearinghouse on Teaching and Teacher Education (1995)

Hopper, B. Peace education and years 1 to 10 studies of society and environment key learning Area. Queensland: Queensland School Curriculum Council.(2002)

Johan, G. Peace by peaceful means. New Delhi: Sage Publication.(1996)

Krishnamurti, J. (n.d). Education and Significance of life. Retrieved from <http://www.jkrishnamurti.org /krishnamurtiteachings/view-text.php?tid=51&chid=66876>.

Layne, C. Kant or Cant: The Myth of the Democratic Peace. International Security, Vol. 19. Issue 2, pp. 5-49.(1994)

Montessori, M. Peace and Education. India: The Theosophical Publishing House.(1943)

Morrison, M. L. Peace Education. Australia: McFarland(2003)

Nair, G. Peace education and conflict Resolution in school. Health Administrator Vol. XVII, Number 1:38-42 (1997)

Pant, D. and Gulati, S. Ways to peace: a resource book for teachers. New Delhi: National Council of Educational Research and Training (2014)

Salomon, G., &Nevo, B. Peace Education: The Concept, Principles, and Practices around the World. London: Lawrence Erlbaum Associates (2002).

Sheean, V. Mahatma Gandhi, a great life in brief. New Delhi: Random House.(1955).

UNESCO. Peace Education: Framework for Teacher Education. New Delhi: UNESCO (2005)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDWE308T: WOMEN EMPOWERMENT (3-0-1)

(4 Credits- 60 hours) (L-T-P: 3-0-1)

Objective(s)

The objective of the course is to learn about the importance of women empowerment, their raising self-esteem and selfconfidence thereby eliminating the discrimination and all forms of violence against women and girl child through education and different government policies.

Course Outcomes

CO 1: To familiarize students with the concept of women empowerment. (Remembering)

CO 2: To make students aware about the importance and factors affecting Women empowerment. (Remembering, Analyzing)

CO 3: To be aware about the government plans and policies on Women Empowerment. (Remembering, Applying)

CO 4: To analyze the various schemes related to Women empowerment. (Analyzing)

Module I: Concept of Women's Empowerment (15 Hours)

Women Empowerment: Meaning, definition, characteristics; Importance of Women Empowerment; Dimensions of Women Empowerment; Principles of Women Empowerment; Models of Women Empowerment

Module II: Women Empowerment in India (15Hours)

Factors affecting Women Empowerment in India; Concept of Gender discrimination; Women's Rights; Health conditions and work related issues of women; Women empowerment through education

Module III: Constitutional Articles, Government Plans and Programmes for Women Empowerment (15 Hours)

Constitutional Articles: Economic Empowerment; Political Empowerment; Social Empowerment; Government Plans and Programmes; Economic Empowerment; Schemes for Women Empowerment: Beti Bachao Beti Padhao (BBBP) Scheme; One Stop Centres (OSCs); The Scheme of Universalization of Women Helpline; UJJAWALA; Swadhar.

Module IV: Practicum: (any one) (30 hours)

I. Visiting women self - help groups.

Organizing flash mob, skits in neighbouring areas.

Reporting on one stop Centre scheme by Government of India.

Releasing a magazine on status of women then and now.

Suggested Readings

Agrawal, S.P (1992): *Women Education in India*, Guwahati, Concept Publishing Company.

Das Phunu (2016): *Contemporary issues of Indian Education*, Shanti Prakashan, Guwahati

Government Report (2009). India 2009: A Reference Annual (53rd edition). Publications Division, Ministry of Information and Broadcasting, Government of India.

Importance of education in empowerment of women in India. Retrieved November 18, 2022, from <https://www.motherhooduniversity.edu.in/pdf/Publications/2016/Khushboo%20Singh.pdf>

IMF-World Bank Report (2008). Global Monitoring Report. Available for download at <http://www.worldbank.org/gmr2008>

Role of education in the empowerment of women in India - eric. (n.d.). Retrieved November 18, 2022, from <https://files.eric.ed.gov/fulltext/EJ1081705.pdf>

Seth, Mira (2001) *Women and Development*. New Delhi: Sage Publication

UNESCO Report (2007). Global Education Digest. UNESCO Institute for Statistics, Montreal. http://www.uis.unesco.org/template/pdf/ged/2007/EN_web2.pdf

UNESCO Report (2010). EFA Global Monitoring Report 2010, Reaching the Marginalized. Oxford University Press. Available at <http://unesdoc.unesco.org/images/0018/001866/186606E.pdf>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

EDSD404T: EDUCATION FOR SUSTAINABLE DEVELOPMENT

(3 Credits- 45 hours) (L-T-P: 2-0-1)

Objective (s)

The course will familiarize the students with the concept of sustainable development and education for sustainable development along with its pedagogy.

Course Outcomes

CO 1: To create awareness about the concept of Sustainable Development. (Remembering, Understanding, Applying)

CO 2: To create awareness among students about the concept of Education for Sustainable Development and the role of Education in Sustainable Development. (Remembering, Understanding, Applying, Analyzing, Evaluating, Creating)

CO 3: To develop the skill of evaluating the utility and prevalence of sustainable development within self and in the community.(Applying)

Module I: Introduction to Sustainable Development (10 hours)

Concept of Development

Concept of Sustainability

Sustainable Development: Its 5 Ps (People, planet, prosperity, peace, and partnership)

Sustainable Development Goals- 17

Module II: Curricular Framework for Education for Sustainable Development (20 hours)

Definition and meaning of Education for Sustainable Development

Principles

Key Sustainable Competencies to be developed through ESD: Systems thinking Competencies, Anticipatory Competency, normative competency, Strategic competency, Collaboration Competency, Critical thinking competency, Self-awareness Competency and integrated problem-solving Competency

Pedagogical approaches in ESD: Whole- institution approach, Learner centered approach, Action oriented learning, Transformative approach

Teaching techniques for ESD: Simulations, Class discussions, Issue Analysis Techniques, Storytelling.

Module III: Practical Implications of ESD (30 hours) (Any two)

Sharing their own stories of struggle/ success with the class as well as submit report of self-reflection.

Visiting neighboring areas to collect community related stories/ activities towards the realization of Sustainable Development Goals.

Surveying industries and submitting report on its sustainability norms. □ Surveying schools and submitting report on its sustainability norms.

Suggested Readings

UNESCO. (2012). *Education for Sustainable Development: Source Book*. Retrieved from <https://sustainabledevelopment.un.org/content/documents/926unesco9.pdf>

Bubaker F. Shareia. (2015). Theories of Development. *International Journal of Language and Linguistics*.2(1), Pp. 78-90. Retrieved from http://ijllnet.com/journals/Vol_2_No_1_March_2015/9.pdf

UNESCO. (2016). *Incheon Declaration and Framework for Action*. Retrieved from http://uis.unesco.org/sites/default/files/documents/education-2030-incheon-framework-for-action-implementation-ofsdg4-2016-en_2.pdf

UNESCO. (2017). *Education for Sustainable Development Goals: Learning Objectives*. Retrieved from

https://unesdoc.unesco.org/ark:/48223/pf0000247444?utm_sq=gj34xbfn94#:~:text=Target%204.7%20of%20the%20SDGs,peace%20and%20non%2D%20violence%2C%20global
 UNESCO. (2018). *Issues and trends in Education for Sustainable Development*. Retrieved from <https://www.ensi.org/global/downloads/Publications/433/Issues%20and%20trends%20in%20Education%20for%20Sustainable%20Development.pdf>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3			H

EDER405T: ELEMENTS OF RESEARCH IN EDUCATION

(2 Credits- 30 hours) (L-T-P: 2-0-0)

Objective (s)

To acquaint the students with the concept and design of educational research

Course Outcomes

CO 1: To make the students well aware of the nature and types of research. (Remembering, Understanding, Applying)

CO 2: To make the students to learn about the steps of research process. (Remembering, Applying, Evaluating)

CO 3: To make the students to learn about research designs and methods. (Remembering, Understanding, Applying)

CO 4: To learn about sampling and sampling and samples. (Remembering, Understanding, Applying)

Module I: Introduction to Research Methodology (20 Hours)

Meaning and significance of research

Methods of acquiring knowledge

Scientific method of research

Process of research

Philosophical bases of research

Types of research and areas of research in education

Steps of research in education

Review of related literature and making synopses

Code of ethics in research

Module II: Designs and Methods in Educational Research (20 Hours)

Meaning and significance of research design

Steps for preparation of research design

Types of research designs: quantitative, qualitative, and mixed research designs

Research designs and corresponding methods of educational research: survey method, historical method, experimental method, case study method.

Sample and sampling procedures

Suggested Reading

Best, John W & James V. Kahn. (2002): Research in Education. Prentice Hall, Pvt. Ltd. New Delhi.

Check, J. & Russell K. Schutt. (2012): Research Methods in Education.

Garret, H. E. (1971): Statistics in Psychology and Education. Vakils, Feffer & Simon, Bombay.

Guilford, J. P. (1973): Fundamental Statistics in psychology and Education. McGraw Hill, New York.

Koul, L. (2009): Methodology of Educational Research. Vikas Publishing House Pvt. Ltd. New Delhi.

Mangal, S. K. & Mangal, S. (2013): Research Methodology in Behavioural Sciences. PHI Learning Pvt. Ltd., Delhi.

Mangal, S. K. (2018): Statistics in Psychology and Education. PHI Learning Pvt. Ltd. New Delhi.

Mapping of Cos to Modules

	Module I	Module II

CO1	H	
CO2		H

EDES406T: EDUCATIONAL SEMINAR (1-0-2)

(3 Credits- 45 hours) (L-T-P: 1-0-2)

Objectives

To develop the skills and competencies required to prepare academic articles, present seminar and enhance critical thinking

Course Outcomes

CO 1: Recognize the meaning, concept and objectives of educational seminar (Remembering)

CO 2: Enhance higher cognitive abilities to respond to new knowledge, critical thinking, and keen observation of researches conducted (Understanding)

CO 3: Apply the abilities to seek clarification, defend the ideas of others, and present effectively (Applying)

CO 4: Perceive the feeling of tolerance, co-operation, and respect of the ideas and feelings of others (Understanding)

Module I: Introduction to Educational Seminar (10 Hours)

Meaning, Concept, scope and objectives of educational seminar; Types of seminar; Importance of educational seminar

Module II: Practicum (60 Hours)

Article Writing: Selection of themes and making out sub-themes of the seminar; Concept paper writing, Writing of papers on sub-themes ensuring the coverage of local, national and international scenarios; Review of related literature pertaining to the selected theme and sub-themes

Preparation of the Proposal for Seminar and presentation

Organization of the Seminar: Description of the steps of organizing the seminar; Designing/developing the materials (brochures, leaflets, etc.); Writing report and publication of seminar proceeding; applying for ISBN; Collaboration with national/international agencies

Mapping of Cos to Modules

Course Outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3		M
CO 4		H

SKILL ENHANCEMENT COURSES

Se- mester	Category	Course Code	Course Name	Cred- its
1	S E Course 1	EDLS103 L	Life Skills Education	3
2	S E Course 2	EDJD104 L	Reflective Journaling- A Technique for Personal and Academic Growth	3
3	S E Course 3	EDPT206 L	Psychological Testing	3

EDLS103L: LIFE SKILLS EDUCATION

(3 credits-45 hours) (L-T-P:1-0-2)

Course objective:

The objective of the course is to essentially inculcate those abilities and skills that help promote mental well-being and competence in young people as they face the realities of life.

Course outcomes

CO 1: Explain the concept of life skills, Social Skills and their importance

CO 2: Creating awareness about cognitive skills and coping skills

CO 3: Employ various skills in life such as social skills, cognitive skills, communication skills, coping skills, creative thinking skills, decision making skills etc.

CO 4: Construct the meaning of self

Module I: Understanding of Life Skills and Social Skills (15 Hours)

Skills and life skills; Origin and development of Life skills; Significance of life skills; Introduction to 10 core skills (WHO, 1996)-

Self Awareness, Empathy, Critical thinking, Creative thinking, Decision Making, Problem Solving, Effective Communication, Interpersonal relationship, Coping with stress, Coping with emotions

Module II: Practicum (60 hours)**Topics prescribed for activities****Understanding Self**

Discovering Self / My strength and weakness/ Self -esteem and its importance/ Overcoming low self- esteem/ Setting goals for self

Social Skills

Empathy- Stepping into other's shoes/Treat others respectfully/Let us be caring and compassionate

Effective Communication- Whispering games/ Brainstorming/ Discussion/ Enhancing verbal –non -verbal communication

Interpersonal relationship- Ball game/ Discussion/ My relationship web/ I can appreciate

Thinking Skills

Critical thinking- Let us be analytical/ journal writing/ Fact or fiction

Creative thinking- Thinking out of the box/ Let us be imaginative

Decision Making- Making informed choices/ team activity

Problem Solving- Case analysis and presentation

Emotional Skills

Coping with stress- Am I stressed?/ Stress Management

Coping with emotions- Am I emotional?/ Emotional Collage

Suggested Readings

Alex, K. (2016). Soft skills: Know yourself and know the World. New Delhi. Vikas Publishing House Pvt. Ltd.

Thomas, G. (2010). Life skill education and curriculum. New Delhi. Shipra Publications.

Tripathy, A. (2016). A beautiful life: Life skills education. New Delhi. Global Publication.

- Ouane, A. (2002). Key competencies in lifelong learning. Institutionalising lifelong learning: creating conducive environment for adult learning in the Asian context. UNESCO Institute for Education, Hamburg.
- Delors, J. (1996). Learning: The treasure within: Report to UNESCO of the International Commission on Education for the Twenty First Century. Paris. UNESCO Publishing Press.
- Dohmen, G. (1996). Lifelong learning: Guidelines for a modern education policy. Bundesministerium fur Bildung, Wissenschaft, Forschung und Technologie.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3			H
CO 4	H	H	H

ERJD104L: REFLECTIVE JOURNALING - A TECHNIQUE FOR PERSONAL AND ACADEMIC GROWTH (3 credits-45 hours) (L-T-P: 1-0-2)

Course objective

The objective of Reflective journaling is to inculcate the practice of reflective writing, documenting as well as interpreting of those experiences that were profound or had an impact on our lives

Course Outcomes:

- CO 1: Recall one's life experiences (*Remembering*)
- CO 2: Explain with clearly and specifically one's life experiences & Develop the skill of writing (*Application*)
- CO 3: Analyze life experiences at a conscious level and enhance reflective thinking (*Analysis*)
- CO 4: Synthesize one's thought in an organized manner and create a new piece of writing (*Creativity*)

Journaling is a strategy for making sense of experiences. The objective of journaling is to develop in students a reflection that can be described as an inner dialogue with oneself whereby a person calls forth his or her own experiences, beliefs, and perceptions about an idea; informing and transforming functions of knowledge; and a conscious and systematic mode of thought. This is to nurture in future educational leaders a sense of reflective practice.

Module I: Introduction to Journaling (10 Hours)

Introduction to beginners mind, Recalling and Remembering, Mindfulness and meditation, The art of Journal writing, Ways of writing a journal, Benefits of Journal writing, Steps of Journaling, Journaling as an approach to Reflective practice.

Module II: Journaling as a reflective practice (05 Hours)

Reflective Journals, Types of Reflections, Method of creating Reflective Journals, Reflect and Integrate Formatting a journal article, Personal action plan

Module III: PRACTICUM (60 Hours)

Each student is required to maintain a reflective journal, using the Visible Thinking Routine (Harvard), as a critical structure for guiding their journal writing. The students are to submit the journal every Friday. Journaling has to be done six days of the week. At the end of the semester, the student will be awarded a grade/marks after assessing the learning.

Suggested Readings

- Davies, M. (2011). Concept mapping, mind mapping and argument mapping: what are the differences and do they matter?. Higher education, 62(3), 279-301. Retrieved from <http://download.springer.com> on 19th July 2016
- Dhankar, Rohit (2013). Can reflective practice be taught? Teacher Plus 2013. (<http://www.teacherplus.org/coverstory/can-reflective-practice-be-taught>)
- Hubbs, D. L., and Brand, C. F. . The paper mirror: Understanding reflective journaling (2005). Journal of Experiential Education, 28(1), 60-71.

Liulienė, A., and Metiūnienė, R. Students' Learning Through Reflective Journaling Coactivity / Santalka, (2009). 17(4), 32-37. doi:10.3846/1822-430X.2009.17.4.32-37

Lowe, G. M., Prout, P., and Murcia, K. I See, I Think I Wonder: An Evaluation of Journaling as a Critical Reflective Practice Tool for Aiding Teachers in Challenging or Confronting Contexts. Australian Journal Of Teacher Edu (2013)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3			H
CO 4	H	H	H

EDPT206L: PSYCHOLOGICAL TESTING

(3 credits-45 hours)(L-T-P: 0-0-3)

Course objective

To help students to gain better understanding of an individual and their behavior.

Course Outcomes

CO 1: Apply the steps and procedures for administering psychological tests correlate it to real life situations.(Application)

CO 2: Evaluate the psychological experiments with the help of apparatuses. (Evaluation)

a. **Psychological Experiment (with apparatus)** Any two from the following:

- Maze Learning
- Bilateral Transfer -Mirror learning
- Alexander Pass-Along Test
- Reaction Time

b. **Psychological Laboratory Practical (without apparatus)**

- Any two from the following
- Adjustment Inventory by Dr. D.N. Srivastava and Govind Tiwari
- Rorschach Ink blot test
- Thematic Apperception Test (TAT)
- Differential Aptitude Test (DBDA)

Scheme of Evaluation: (100 Marks)

Psychological Experiment with apparatus: 15 Marks

Psychological Experiment without apparatus: 15 Marks

Practical book: 10 Marks

Written Examination & Viva Voce: 60 Marks

Total 100 Marks

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	H

INTERNSHIP/APPRENTICESHIP

EDIN105I / EDIN207I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 Hours)

The 4-week internship, equivalent to a full month, can be completed either in-house within the department or, if possible, in other departments.

Objectives of internship:

- To have a shift from theory to practical.
- To acquaint pupil teachers/ students with the total environment of the school/ any other educational institution.
- To observe the administrative and managerial activities.
- To have a direct experience of the functioning of the school/ educational institution.
- To have the direct experience of organizing morning assembly and its items/ events.
- To observe some classes and have the idea of different teaching aids, and approaches of teaching adopted by regular teachers in classroom situations by different subject teachers.
- To take some classes, and have experience of taking some classes regularly like a regular and permanent teacher of the institution.
- To have experience in preparing a good timetable and developing its execution and having some discussions with teachers and principals about the existing timetable.
- To participate in curricular, cocurricular and extracurricular activities to gain some experience.
- To understand the human and non-human resources of the institution and their utilization.
- To have interaction with the teachers, headmaster, principal etc. for understanding the functioning of the school.
- To have some interaction with the local community members and understand the problems noted by community members.
- To prepare a daily report by taking the direct experience of the situation.
- To develop a positive attitude towards the functioning of the school/ institution.

FORMAT FOR DAILY REPORT WRITING DURING THE SCHOOL INTERNSHIP Report No. ()**Date:**

Name of Student Teacher : Name of the Programme : Name of School for internship :	
Time of Arrival : Time of Departure :	

Morning Assembly - Duration: ____ am to ____ am

Events:

- (a) Prayer/ National Anthem : (b) Any announcement :
 (c) Thought Delivered by : (d) Any other event :

Classes taken by Student Teacher During the Day of attending school (Planned Period):

No.	Class	Period	Subject	Topic
1				
2				

Unplanned Classes taken by the student teacher:

No.	Class	Period	Subject	Topic
1.				
2.				

Periods observed on the Day:

No.	Class	Period	Subject	Topic	Suggestions

1.					

Observations recorded:i. **Positive points:**ii. **Negative points:**iii. **Discussion with the concerned teacher:****Participation in Co-curricular and Extra Co-curricular activities:** a)

b)

Organization of co-curricular/extra co-curricular activities: a)

b)

Any other experience of the Day:

i.

ii.

(Signature of Student Teacher)**(Signature of Principal)**EDIN309I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours)

The school internship is to acquaint the students with the total environment and functioning of the school. Students will get the opportunity to observe the administrative and managerial activities. They will develop the skills of organized participating in morning assembly, co-curricular activities, extracurricular activities and plan for teaching work in the classroom. It will help them understand the behaviour of teachers, students, principal, head-master and other supporting staff. The school internship will prepare them for the real professional field as well as gain insight into their aptitude for teaching. Towards the end of the course, students will have to compile their entire activities in the form of a report and appear for viva voce. The rubric and distribution of marks for evaluation will be decided and prepared at the level of the department.

Activities to be performed:

Organization/ observation of morning assembly.

Classes to be taught during the day by preparing lesson plans.

Unplanned classes to be taken during the day if some teachers are on leave.

Observing the class of an effective/ good teacher.

Participating/ organizing co-curricular activities.

Participating/ organizing extracurricular activities.

Any other specific events of the day.

COMMUNITY ENGAGEMENT

Semester	Category	Course Code	Course Name	Credits
1	Community Engagement	EGCE106T	Service Learning (Theory)	2
2	Community Engagement	CESL102P	Service Learning (Practicum)	2

EGCE106T: Community-Engagement : SERVICE LEARNING (2-0-0)**Course Outcomes**

CO1: Understand the importance of service learning and community engagement for developing the skills of addressing real life issues in one's own community.

CO2: Appreciate the role and effectiveness of service learning in promoting inclusive education.

Syllabus

Module I: Service Learning and Community- University Engagement (15 Hours)

- Concept of service learning and community- university engagement
- History of service learning in the context of Indian Universities
- Principles for an effective service learning
- Principles of a good service learning pedagogy
- Models of Service learning:
 - Project Model, Charity Model, Social Justice Model
 1. Programs of Service learning:
 - Community Engagement, Field Education, Volunteerism, Internship
 2. Benefits of Service learning:
 - For Students
- Academic enhancement, Personal/ Professional Growth, Understanding Diversity, Civic learning, Critical reflection
 - For the University
 - For the community

Module II: Service learning: A means to Inclusive Education (15 Hours)

Concept of inclusive education, importance of inclusive education

Service Learning as means to inclusive education: Experiential Learning, Exposure to diverse populations, Challenge to comfort zones, Reflection on Experiences, Personal growth, Professional growth

References:

Brown, Erin Marie Burke. (2015). Service-Learning Challenges and Strategies. Service Learning Institute: Virginia Commonwealth University. Downloaded from http://scholarscompass.vcu.edu/service_institute/servicelearning_2015/background_information/1

Centre for Community Engagement. (n.d.). Faculty Toolkit for Service Learning. Middlesex Community College. Downloaded from https://www.uml.edu/docs/Faculty_Toolkit_MCC_tcm18-52567.pdf

Cress, Christine M., Collier, Peter J., Reitenauer, Viki L. (2005). Learning Through Serving: A Student Guidebook for Service Across Disciplines. Sterling Virginia.

Lavery, S., Chambers, D. and Cain, G. (2018). Service Learning: Enhancing Inclusive Education. Emerald Publishing. United Kingdom.

Mittal, Pankaj. Fostering Social Responsibility by Higher Education: COVID-19 and Beyond. <https://youtu.be/4Yz1h0DtoBo>

Narasimharao, B. P. (2010). Tertiary Education Institutions for Corporate Education, Need and Relevance of Corporate Education centres. Downloaded from <https://www.researchgate.net/publication/216686564>

PRIA. (2014). Occasional Paper: Participatory Research in Asia Fostering Social Responsibility in Higher Education in India. New Delhi.

CESL102P: COMMUNITY ENGAGEMENT- SERVICE LEARNING (0-0-2)**Course Outcomes**

CO1: To develop the skill of interacting with community members.

CO2: To develop the skill of organizing community awareness programmes on issues such as Early childhood care and nutrition, AIDS, Mental Health, Population explosion, Physical Health etc.

CO3: To organize training programme for teachers to train them on Pedagogy, Preparation of Teaching Aids, Use of ICT in classroom teaching, life skills development etc.

MODULES	CONTENTS	TIME
Module I	Practices for Service Learning and Community- University Engagement By collaborating with the Community Members, Village Panchayats, Parents, Educational Institutions (Heads, Teachers and Students), An-	60 Hours

	ganwadis, Balwadis etc. and following the mentioned Models and Programs of Service Learning students can be engaged with the community welfare in the following ways: (Any....) 1. Creating awareness among community members regarding Early childhood care and nutrition. 2. Creating awareness among community members about parenting. 3. Self-participatory internship in a school of one's own choice. 4. Creating awareness among school children and community members and providing training in developing one's life skills. 5. Providing teachers training in pedagogy. 6. Providing training to school teachers in the use of ICT for enhancing students learning. 7. Providing training to teachers in the preparation of teaching aids by using available community resources. 8. Creating awareness on Mental Health and strategies for its sustenance. 9. Creating awareness on the importance of Physical health and ways of maintaining ones health. 10. Creating awareness on the importance of education and ways of creating a conducive environment for proper learning. 11. Creating awareness on AIDS. 12. Creating awareness on Population explosion- its effects and ways of population control. 13. Creating awareness on life skills and ways to develop one's life skills.	

Suggested Readings

Brown, Erin Marie Burke. (2015). *Service-Learning Challenges and Strategies*. Service Learning Institute: Virginia Commonwealth University. Downloaded from http://scholarscompass.vcu.edu/service_institute/servicelearning_2015/background_information/1

Centre for Community Engagement. (n.d.). *Faculty Toolkit for Service Learning*. Middlesex Community College. Downloaded from https://www.uml.edu/docs/Faculty_Toolkit_MCC_tcm18-52567.pdf

Cress, Christine M., Collier, Peter J., Reitenauer, Viki L. (2005). *Learning Through Serving: A Student Guidebook for Service Across Disciplines*. Sterling Virginia.

Lavery, S., Chambers, D. and Cain, G. (2018). *Service Learning: Enhancing Inclusive Education*. Emerald Publishing. United Kingdom.

Mittal, Pankaj. *Fostering Social Responsibility by Higher Education: COVID-19 and Beyond*. <https://youtu.be/4Yz1h0DtoBo>

Narasimharao, B PanduRanga. (2010). *Tertiary Education Institutions for Corporate Education, Need and Relevance of Corporate Education centres*. Downloaded from <https://www.researchgate.net/publication/216686564>

PRIA. (2014). *Occasional Paper: Participatory Research in Asia Fostering Social Responsibility in Higher Education in India*. New Delhi.

Mapping of COs

	M I
CO 1	H
CO 2	H
CO 3	H

RESEARCH PROJECT /DISSERTATION

BA EDUCATION (Honours)				
Semes-ter	Category	Course Code	Course Name	Cred-its
7	Research Project/Dissertation	EDDI407P	Research Project Phase I	6
8	Research Project/Dissertation	EDDI408P	Research Project Phase II	6
BA EDUCATION (Honours) with Research				
Semes-ter	Category	Course Code	Course Name	Cred-its
7	Research Project/Dissertation	EDDI409P	Dissertation I	18
8	Research Project/Dissertation	EDDI410P	Dissertation II	20

BA EDUCATION (Honours)**EDDI407P: RESEARCH PROJECT PHASE I**

(6 credits – 180 hours) (L-T-P: 0-0-12)

EDDI408P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-12)

BA EDUCATION (Honours) with Research**EDDI409P: DISSERTATION I**

(18 Credits -540 Hours) (L-T-P: 0-0-36)

EDDI410P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

The activities under the Research Project/Dissertation will enable the students to develop the skill to write a review of the literature and prepare the research proposal. It will also help the students in applying the skill in the collection of data in the field and develop the ability to analyze the data and ability to write the report in standard academic formats.

Every student shall undertake a research project under the supervision and guidance of a faculty member. The students are expected to complete the literature review and present a research proposal and theoretical framework of the research work selected during the first phase. The dates, mode and components of the evaluation and the weightages attached to them shall be published by the department at the beginning of the semester. The students of the final semester will have to compile their research study in the form of a dissertation. Each dissertation has to be systematically structured following the proper methodology of educational research. To set the dissertations in a standardized pattern the supervisor should ensure that it follows the proper sequence containing the following main aspects:

- Preliminary section

- Main body

Reference section

The supervisor will help students to understand the detailed steps of writing a dissertation. He/ she will ensure that the dissertation is prepared keeping in view of Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Phase I of the course is carried out in the 7th semester where the students will work on research proposal, literature review, theoretical framework and the first part of the data collection. In the 8th semester they will complete data collection, analysis, and preparation of a research report (Phase II). Students are required to make a presentation of the dissertation submitted to the department on the date set in the academic calendar for the same.

**DEPARTMENT OF EDUCATION
ASSAM DON BOSCO UNIVERSITY
AUTUMN 2025
Certificate Course- Education for Health and Wellness**

Credits: 2 (1-0-1)

Total Marks:50 - Internal:40 % (20 Marks) Total Hours:45
External:60% (30 Marks)

Course objectives: After completing the course, students will be able;

CO1-To acquire the knowledge, about health and physical education (Remembering)

CO2-To acquire the knowledge about health and safety education (Remembering)

CO3-To understand the nature of injuries and providing first aid (Understanding)

CO4-To develop the skills for organising games and sports in educational institution (Application)

CO5- To perform simple forms of yoga (Application)

Module-I: Concept of Health Education

-Meaning, Definition, objectives of health education

- Nutrition, Malnutrition, Personal Hygiene, Health education in schools, Health Services.

-Food and Nutrition: Meaning, classification, constituents of food, vitamins and their deficiency, Balanced Diets, Diets for obesity and under-weight

Module-II Introduction to Physical & Yoga Education & Wellness Studies

- Meaning, Definition, Objectives and scope of Physical education

- Physical fitness: Meaning, definition, components, and benefits

- Games and sports

- First Aid: Road Accident, water accident, fire accident

- Yoga Education: Meaning, Definition and uses of yoga for focussed mind

- Selected Asanas and Pranayama: Physical exercises

- Dimensions of Wellness & Mindfulness

Practicum:

- Preparation of first aid kit
- Health awareness programme
- Demonstration of Asanas and Pranayama (IKS)
- Organizing games
- Writing about the eminent performers in games and sports
- Preparation of diet charts for respective communities (IKS)

Suggested Readings:

- Nash, T.N. (2006). Health and Physical education. Hyderabad: Nilkamal publishers
- Prasad, Y.V. (2006). Methods of teaching physical education. New Delhi: Discovering publishing house

- Chandra, S.S & Krishanan, P. (2005). Health education and physical education. Delhi: Surjeet Publications
- Mangal, S.K. (2005). Health and physical education. Ludhiana: Tandon Publication

Mapping of COs

	Module I	Module II	Practicum
CO1	H		
CO2			H
CO3		H	H
CO4		H	H
CO5		H	H

Evaluation Structure

1. Internal- Attendance, Projects, Assignments (20%)
2. Summative Evaluation- (30%)
3. Marks to be converted to grades, as follows-
 - 41-50= E (Excellent)
 - 31-40= A (Very Good)
 - 21-30= B (Good)
 - 11-20= C (Average)
 - 0-10= D (Below Average)

DEPARTMENT OF ENGLISH**PROGRAMME: BACHELOR OF ARTS (BA) in ENGLISH (Honours/Honours with Research)****MAJOR COURSES**

Semes-ter	Category	Course Code	Course Name	Cred-its	Page No
1	Major Course 1	EGIG100T	Introduction to Literary Genres 3-1-0	4	642
2	Major Course 2	EGIL101T	Introduction to English Literature 3-1-0	4	643
3	Major Course 3	EGBR200T	British Literature : 14 th -17 C	4	644
3	Major Course 4	EGBL201T	British Literature : 17 th -18 C	4	645
4	Major Course 5	EGBT202T	British Literature : 18 th -19 th C	5	646
4	Major Course 6	EGBE203T	British Literature : 19 th -21 st C	5	646
4	Major Course 7	EGIW204T	Indian Writing in English	4	647
5	Major Course 8	EGEC300T	European Classical Literature	5	648
5	Major Course 9	EGAL301T	American Literature	5	649
5	Major Course 10	EGDL302T	Diaspora Literature	4	650
6	Major Course 11	EGPC303T	Postcolonial Literature	4	651
6	Major Course 12	EGLC304T	Literary Criticism	4	652
6	Major Course 13	EGWW305T	Women's Writing	4	653
6	Major Course 14	EGMP306P	EGMP306P: Indian and Indigenous Knowledge System -Community Based Minor Project	4	654
7	Major Course 15	EGLT400T	Literary Theory	5	656
7	Major Course 16	EGLL401T	Language and Linguistics	5	657
8	Major Course 17	EGIC402T	EGIC402T: Indian and Indigenous Knowledge System - Indian Classical Literature	5	657
8	Major Course 18	EGPL403T	Popular Literature	5	658

MINOR COURSES

Semes-ter	Category	Course Code	Course Name	Cred-its	Page No
1	Minor Course 1	EGBL102T	Basic Language Skills	4	659
2	Minor Course 2	EGBI103T	Basic Linguistics	4	660
3	Minor Course 3	EGAW205T	Academic Writing and Composition	4	661
4	Minor Course 4	EGEL206T	English Language Teaching	4	662
5	Minor Course 5	EGTS307T	Translation Studies	4	663
6	Minor Course 6	EGGS308T	Introduction to Gender Studies	4	664
7	Minor Course 7	EGCS404T	Introduction to Culture Studies	3	665

7	Minor Course 8	EGRM405T	Research Methodology : Research Paper and Dissertation	2	666
8	Minor Course 9	EGLA406T	Language, Literature and Culture	3	666

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Cred-its	Page No
1	S E Course 1	EGCW104L	Creative Writing	3	668
2	S E Course 2	EGSS105L	Soft Skills	3	669
3	S E Course 3	EGEP207L	Editing and Proofreading	3	670

INTERNSHIPS

Semester	Category	Course Code	Course Name	Cred-its	Page No
2	Internship	EGN106I	Internship	4	
4	Internship	EGIN208I	Internship	4	
5	Internship	EGIN309I	Internship	2	

RESEARCH PROJECTS /DISSERTATIONS

BA ENGLISH (Honours)					
Semester	Category	Course Code	Course Name	Cred-its	Page No
7	Research Project/Dissertation	EGDI407P	Research Project Phase I	6	676
8	Research Project/Dissertation	EGDI408P	Research Project Phase II	6	676
BA ENGLISH (Honours) with Research					
Semester	Category	Course Code	Course Name	Cred-its	Page No
7	Research Project/Dissertation	EGDI409P	Dissertation I	18	676
8	Research Project/Dissertation	EGDI410P	Dissertation II	20	677

EGIG100T: INTRODUCTION TO LITERARY GENRES**(4 Credit-60 hours (L-T-P: 3-1-0))****Objective(s)**

The course intends to acquaint the students with an overview of different literary genres from the classical to the modern and postmodern era. This course will also help the students to identify and categorise different genres of English literature.

Course/Learning Outcomes

At the end of the course students will be able to:

CO 1: Define various genres of literature. (Remembering)

CO 2: Explain the significance and importance of different genres of literature. (Understanding)

CO 3: Apply the significance of the different genres in understanding literary texts. (Application)

Module I: Introduction to Literary Genres (20 Hours)

Definition and Meaning of Genre and Literary Genres. Origin & History of Literary Genres. Classification of Literary Genres: literary technique, tone, content, length. Stylistic Features and Criteria's of Different Literary Genres. Flexibility in Literary Genres

Module II: Genres and Subgenres in Literature (40

Hours) Poetry: Narrative, Dramatic, Lyric, Verse & Epic.

Novel and Drama: Tragedy, Comedy, Romance, Satire, Tragi-comedy, Rom-comedy, Pastoral, Historical, Mystery & Crime, Horror, Science Fiction.

Non Fiction: Biography, Autobiography, Essay, Travel Writing, Memoir

Suggested Readings:

1. Abell, Catharine. "Genre, Interpretation and Evaluation." *Proceedings of the Aristotelian Society*, vol. 115, 2015, pp. 25–40.
JSTOR, <http://www.jstor.org/stable/44122584>. Accessed 3 Feb. 2023.
2. Armit, Lucie. *Fantasy Fiction: An Introduction*. United Kingdom, Continuum, 2005.
3. Fowler, Alastair. *Kinds of Literature: An Introduction to the Theory of Genres and Modes*, Harvard University Press. 1982 4. *Globalizing Literary Genres: Literature, History, Modernity*. Eds. Fabienne Imlinger, Jernej Habjan, United Kingdom, Taylor & Francis, 2015.
5. Harpham, Geoffrey Galt, and Abrams, Meyer Howard. *A Glossary of Literary Terms*. India, Cengage Learning, 2015.
6. Todorov, Tzvetan, and Richard M. Berrong. "The Origin of Genres." *New Literary History*, vol. 8, no. 1, 1976, pp. 159–70.
JSTOR, <https://doi.org/10.2307/468619>. Accessed 3 Feb. 2023.
7. Frye, Northrop. *Anatomy of Criticism*. Princeton University Press, 2020.

Mapping of COs to Modules:

COs	Module I	Module II
CO 1	H	L
CO 2	M	H
CO 3	H	M

EGIL101T: INTRODUCTION TO ENGLISH LITERATURE

(4 Credits- 60 hours) (L-T-P: 3-1-0)

Objective(s)

The course intends to acquaint the students with the historical overview of English literature from the beginning to contemporary periods. The texts under study will lend a better understanding of the socio-cultural changes in respective periods through the lens of the writers.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Define the various genres and understand the historical development of English literature from the beginning to contemporary period. (Remembering)
- CO 2: Estimate the characteristic features of English literature pertaining to its form and content across various periods (Evaluate)
- CO 3: Discuss the representative style and themes of various writers as evident in their works to develop a better understanding of socio-political history of England (Creating)

Module I: Medieval, Renaissance and Elizabethan Period (20 Hours)

Poetry :Oral origins and conversion, Aldhelm, Bede, Cædmon, Heroic poetry, Christian literature, *Beowulf*, Medieval

Romances, Fabliau, Lyric, Dream-Allegory, Ballad, Chaucer, Gower and Langland, *Tottel's Miscellany*, The poetry of Wyatt and Surrey, Metaphysical Poetry

Prose: The 'New Learning' of the Renaissance, Francis Bacon

Drama: Mystery, Morality and Miracle Plays, Marlowe, Shakespeare, and the Jacobean playwrights

Module II: The Restoration Age and Augustan Age (10 Hours)

Poetry: John Milton- *Paradise Lost*, James Thompson: *The Seasons*

Prose: the periodical essay: Addison and Steele, Defoe and the rise of the Novel – Richardson, Fielding, Smollet and Sterne **Drama:** Restoration Drama: tragedy and comedy

Module III: The Romantic and Victorian Age (20 Hours)

Poetry: The shift from sensibility to romanticism in Gray (1716-71), Cowper (1731-1800), Blake (1757- 1827) and Burns (1759-96), William Wordsworth, Samuel Taylor Coleridge, Percy Bysshe Shelley, John Keats, Tennyson, the Brownings, Arnold, D.G. Rossetti and Christina Rossetti, G. M. Hopkins

Prose: The Novel of Manners; Gothic fiction; the Historical Novel, Victorian fiction with reference to the works of Charles Dickens, the Bronte Sisters, George Eliot and Thomas Hardy, Matthew Arnold and John Ruskin

Module IV: The Age of Modernism and Postmodernism (10 Hours)

Poetry: The Poetry of WB Yeats, T.S. Eliot and the Auden Circle, Poetry from the Sixties: Ted Hughes and Seamus Heaney

Prose: Fiction: Virginia Woolf, E. M. Forster, D.H. Lawrence and James Joyce, The 'Rise of English': Scrutiny and its influence **Drama:** The New Theatre: John Osborne, Christopher Fry, Samuel Beckett, John Arden, Arnold Wesker

Suggested Readings:

1. Alexander, Michael. A History of English Literature, Basingstoke Hampshire: Palgrave Macmillan, 2000
2. Birch, Dinah ed. The Oxford Companion to English Literature, Oxford: OUP, 2009
3. Sanders, Andrew. The Short Oxford History of English Literature, Oxford: OUP, 2004
4. Widdowson, Peter. The Palgrave Guide to English Literature and its Contexts 1500-2000, Basingstoke Hampshire: Palgrave Macmillan, 2004

Mapping of COs to Modules:

COs	Module 1	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	M	H	H	H
CO 3	H	H	H	H

EGBR200T: BRITISH LITERATURE: 14th -17th C

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The course intends to acquaint the students with the beginning periods of English Literature and recognise the shifts in the later periods. While looking at various historical and socio-cultural events of the times through the lens of the representative writers, the students will be able to comprehend the shifts in the contexts and prospects of the narratives.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: *Define* and identify the role of various genres, themes and styles pertaining to the prescribed periods of English literature. (Remembering)

CO 2: *Apply* the understanding of historical events, socio-political and literary shifts of the age in the reading of the texts. (Applying)

CO 3: *Design* an innovative and critical understanding of the texts based on its social and cultural set up. (Creating)

Module 1: Selected Poetry (30 Hours)

- a. Geoffrey Chaucer: "The Wife of Bath," "Prologue" from *Canterbury Tales*

- b. Edmund Spenser: Selections from *Amoretti*: Sonnet 57 'Sweet warrior...' Sonnet 75 'One day I wrote her name...'
- c. John Donne: "The Sunne Rising", "Batter My Heart", "A Valediction: Forbidding Mourning"

Module 2: Selected Drama (30 Hours)

- a. Christopher Marlowe: *Doctor Faustus*
- b. William Shakespeare: *Twelfth Night*

Suggested Readings

1. Calvin, John. "Predestination and Free Will" *The Portable Renaissance Reader*, edited by James Bruce Ross and Mary Martin McLaughlin, Viking Press, 1953, pp.704–11.
2. Castiglione, Baldassare. "Longing for Beauty", "Love and Beauty" and "Invocation of Love." *The Book of the Courtier*, translated by George Bull, Penguin Books, 1976, pp.324–8,330–5.
3. Mirandola, Pico Della. "The Oration on the Dignity of Man" *The Portable Renaissance Reader*, edited by James Bruce Ross and Mary Martin McLaughlin, Viking Press, 1953, pp.476–9.
4. Sidney, Philip. *An Apology for Poetry*, edited by Forrest G. Robinson, The Library of Liberal Arts- Bobbs-Merrill, 1970, pp.13–18.
5. Coffin, Charles M (Ed), *The Complete Poetry and Selected Prose of John Donne*, Modern Library Classics, 2001

COs	Module 1	Module 2
CO 1	H	H
CO 2	H	H
CO 3	H	M

EGBL201T: BRITISH LITERATURE: 17th – 18th C (4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

This course will familiarize students with the historical and literary contexts of the age. With the help of the representative drama, poetry and fiction of the period, the students will be able to comprehend the thoughts, contexts and literary practices of 17th and 18th century England.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Apply the understanding of the historical and literary contexts of the period from 1700 to 1800 in the reading of the texts. (Applying)
- CO 2: Illustrate the evolution of the existing and emergence of new literary genres. (Analysing)
- CO 3: Develop a critical interpretation of the given literary texts. (Creating)

Module 1: Selected Drama (15 Hours)

William Congreve: *The Way of the World*

Module 2: Selected Poetry (10 Hours)

- a. Thomas Gray: "Elegy Written in a Country Churchyard"
- b. Samuel Johnson: "London"

Module 3: Selected Fiction (35 Hours)

- a. Jonathan Swift: *Gulliver's Travels* (Books III and IV)
- b. Laurence Sterne: *The Life and Opinions of Tristram Shandy, Gentleman*

Suggested Readings

1. Collier, Jeremy. *A Short View of the Immorality and Profaneness of the English Stage*. Rutledge, 1698.
2. Copley, Stephen (Ed.) "The Complete English Tradesman" (Letter XXII), "The Great Law of Subordination Considered." (Letter IV), and "The Complete English Gentleman." *Literature and Social Order in Eighteenth Century England*, Routledge, 1984.
3. Martin, Peter (Ed.) "Essay 156." *The Rambler Selected Writings: Samuel Johnson*, Harvard University Press, 2009.

4. Greenblatt, Stephen. *The Norton Anthology of English Literature*, vol.1, 8th edition, W. W. Norton & Company, 2006.

Mapping of COs to Modules

COs	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	M	M	H

EGBT202T: BRITISH LITERATURE: 18th - 19th C (5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)

The paper will acquaint the students with the paradigms of Puritan, Restoration, Neoclassical and Romantic literature. The selected texts will enable the students to understand and trace the changing literary trends of different periods under consideration. It will also focus on the characteristic traits of the age through the prescribed texts.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Illustrate the historical and literary contexts of the eighteenth century and the Romantic age along with the writers. (Understanding)
 CO 2: Examine the literary texts as representative of the historical events. (Analysing)
 CO 3: Develop an insightful consideration regarding the literary texts and their writing style. (Creating)

Module I: Selected Poetry (25 Hours)

- Alexander Pope- "The Rape of the Lock" (Canto 1)
- William Blake 'The Lamb',
- William Wordsworth "Tintern Abbey"
- Percy Bysshe Shelley "Ode to the West Wind"
- John Keats "To Autumn"

Module II: Selected Drama (15 Hours)

Oscar Wilde- *The Importance of Being Earnest*

Module III: Selected Fiction (35 Hours)

- Emily Bronte- *Wuthering Heights*
- Mary Shelley's *Frankenstein*

Suggested Readings:

- Collier, Jeremy. *A Short View of the Immorality and Profaneness of the English Stage*. Routledge, 1698
- William Wordsworth, 'Preface to Lyrical Ballads', in *Romantic Prose and Poetry*, ed. Harold Bloom and Lionel Trilling (New York: OUP, 1973) pp. 594–611.
- John Keats, 'Letter to George and Thomas Keats, 21 December 1817', and 'Letter to Richard Woodhouse, 27 October, 1818', in *Romantic Prose and Poetry*, ed. Harold Bloom and Lionel Trilling (New York: OUP, 1973) pp. 766–68, 777–8.
- Jean-Jacques Rousseau, 'Preface' to *Emile or Education*, tr. Allan Bloom (Harmondsworth: Penguin, 1991).

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO1	H	H	H
CO2	M	H	H
CO3	M	H	H

EGBE203T: BRITISH LITERATURE: 19th to 21st C (5 Credits- 75 hours) (L-T-P: 4-1-0)

Objective(s):

This course intends to acquaint the students with the introductory concepts and seminal texts of the nineteenth century, twentieth century and twenty-first century. Along with the text the course also aims to introduce some of the innovative concepts like Colonialism, Modernism and Postmodernism and relate the notions with the prescribed texts.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Describe the historical and literary contexts of the nineteenth century, twentieth and twenty-first century (Remembering)

CO 2: Critically analyse the representation of the historical events in the given literary texts. (Analysing)

CO 3: Develop critical interpretation of the texts alongside the given historical periods. (Creating)

Module I: Introduction (10 Hours)

Historical overview of the Victorian Age (Class relations, Crises of faith, Empire, Gender roles), the Twentieth Century (World Wars, 'the New Woman' literature) and the Twenty-First Century (Culture and society, Gender and sexuality) a. Module II: Selected Fiction (30 Hours)

- b. Jane Austen - Pride and Prejudice
- c. Charles Dickens – Hard Times
- d. Joseph Conrad - Heart of Darkness
- e. John Fowles The French Lieutenant's Woman
- f. David Mitchell: Cloud Atlas

Module III: Selected Poetry (20 Hours)

- a. Alfred Tennyson: "Ulysses"
- b. Robert Browning: "My Last Duchess"
- c. W.B. Yeats: 'The Second Coming'
- d. T.S. Eliot: 'The Love Song of J. Alfred Prufrock'
- e. Ted Hughes : 'Hawk Roosting'
- f. Seamus Heaney: 'Digging'
- g. Sean O' Brien : "Water Gardens"

Suggested Readings

1. Bowra, Maurice. The Romantic Imagination. Oxford University Press, 1999.
2. Darwin, Charles. "Natural Selection and Sexual Selection". The Descent of Man in The Norton Anthology of English Literature. vol.2.8th. Edited by Stephen Greenblatt. New York: Norton, 2006. pp.1545–9
3. Marx, Karl and Friedrich Engels. "Mode of Production: The Basis of Social Life", "The Social Nature of Consciousness", and "Classes and Ideology". A Reader in Marxist Philosophy. Edited by Howard Selsam and Harry Martel. New York: International Publishers, 1963. pp. 186–8, 190–1, 199–201
4. Mill, John Stuart. The Subjection of Women in Norton Anthology of English Literature. vol. 2. 8th. edited by Stephen Greenblatt. New York: Norton, 2006. chap. 1. pp.1061–9
5. The Drowned Book. 2007 **Mapping of COs to Modules:**

COs	Module I	Module II	Module III
CO 1	M	H	H
CO 2	H	H	H
CO 3	M	H	H

EGIW204T: INDIAN WRITING IN ENGLISH

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to understand various features of Indian Writing in English, acquaint students with the works of significant Indian writers and to help them summarize and critically appreciate literary works.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: *Define* the literature produced in India in English (Remembering)

CO 2: *Explain* and comment on the poems and fictional works produced in India in their various socio-cultural context (Understanding)

CO 3: *Apply* different critical theories involved in the production of the selected indigenous texts (Applying)

Module I: Selected Novels (25 Hours)

- a. R. K. Narayan : *Swami and Friends*
- b. Anita Desai : *In Custody*

Module II: Selected Poetry (15 Hours)

- a. H.L.V. Derozio : "The Orphan Girl"
- b. Kamala Das : "Introduction," "My Grandmother's House"
- c. Nissim Ezekiel: "Enterprise"
- d. Robin S. Ngangom : "The Strange Affair of Robin S. Ngangom"

Module III: Selected Short Fiction and Non Fiction (20 Hours)

- a. Salman Rushdie: 'The Free Radio'
- b. Rohinton Mistry: 'Swimming Lesson'
- c. Shashi Deshpande: 'The Intrusion'

Suggested Readings:

1. Bruce King, 'Introduction', in *Modern Indian Poetry in English* (New Delhi: OUP, 2nd edn, 2005) pp. 1–10.
2. Meenakshi Mukherjee, 'Divided by a Common Language', in *The Perishable Empire* (New Delhi: OUP, 2000) pp. 187–203.
3. Raja Rao, Foreword to *Kanthapura* (New Delhi: OUP, 1989) pp. v–vi.
4. Salman Rushdie, 'Commonwealth Literature does not exist', in *Imaginary Homelands* (London: Granta Books, 1991) pp. 61–70.

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO 1	H	H	H
CO 2	M	H	M
CO 3	H	H	H

EGEC300T: EUROPEAN CLASSICAL LITERATURE (5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)

In this course, students shall understand the basics of prevailing trends and origins of Western Literature. They shall also learn in detail about the process of genre division and its origins. This will help them to not only enhance their existing knowledge about prototypes of Western literary traditions, but also clarify a wide range of references to these classical texts which are seen in the English texts of the later eras.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: Define the concepts of epic, tragedy, comedy, satire, catharsis etc. (Remembering)

CO2: Illustrate the significance and importance of Western Classical Literature (Understanding)

CO3: Utilize the contemporary theories in the critical analysis of various literary texts. (Applying)

Module I: Selected Greek texts (30 Hours)

- a. Homer- *Iliad*

b. Sophocles- *Oedipus the King*

Module II: Selected Roman texts (45 Hours)

- a. Plautus- *Pot of Gold*
 b. Ovid- Selections from *Metamorphoses*-‘Bacchus’, (Book III), ‘Pyramus and Thisbe’ (Book IV) c. Horace- *Satires* I: 4

Suggested Readings:

1. The prescribed texts
2. Plato, *The Republic*, Book X, tr. Desmond Lee (London: Penguin, 2007).
3. Homer- *Iliad*, tr. E.V. Rieu (Harmondsworth: Penguin, 1985).
4. Sophocles- *Oedipus the King*, tr. Robert Fagles in Sophocles: The Three Theban Plays (Harmondsworth: Penguin, 1984).
5. Plautus- *Pot of Gold*, tr. E.F. Watling (Harmondsworth: Penguin, 1965).
6. Ovid- Selections from *Metamorphoses* ‘Bacchus’, (Book III), ‘Pyramus and Thisbe’ (Book IV), tr. Mary M. Innes (Harmondsworth: Penguin, 1975).
7. Horace *Satires* I: 4, in *Horace: Satires and Epistles and Persius: Satires*, tr. Niall Rudd (Harmondsworth: Penguin, 2005).
8. Sharma, Ramesh and Ashima Sona ed. *Classics in Translation : Reflections on Indian and European Classical Literature*. Purbayon, 2021

Mapping of COs to Modules

COs	Module I	Module II
CO1	H	M
CO2	M	H
CO3	M	M

EGAL301T: AMERICAN LITERATURE
(5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)

The objective of this course is to introduce students to a body of literature by the writers of literature of the USA. This course will introduce major American writers in the genres of poetry and fiction. This course expects the students to develop writing and analytical skills as these skills relate to developing a broad knowledge of American literature and its representative texts in relation to their historical and socio-cultural contexts.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Illustrate the pertinent themes pertaining to the American socio-political conditions. (Understanding)
 CO 2: Examine concepts like American Dream, Social Realism and Transcendentalism in relation to the prescribed texts. (Analyse)
 CO 3: Develop a critical understanding of intersectionality of race, class and gender from the readings of the texts prescribed
 (Creating)

Module I: Selected Texts (40 Hours)

- a. Tennessee Williams: *The Glass Menagerie*
 b. Toni Morrison: *Beloved*
 c. Edgar Allan Poe: ‘The Purloined Letter’
 d. William Faulkner : ‘Dry September’

Module II: Selected Poems (35 Hours)

- a. Anne Bradstreet: ‘The Prologue’
 b. Walt Whitman: Selections from *Leaves of Grass*: ‘O Captain, My Captain’, ‘Passage to India’ (lines1–68)

- c. Alexie Sherman Alexie: 'Crow Testament,' 'Evolution'

Suggested Readings

1. Hector St John Crevecoeur, 'What is an American', (Letter III) in *Letters from an American Farmer* (Harmondsworth: Penguin, 1982) pp.66–105.
2. Frederick Douglass, *A Narrative of the life of Frederick Douglass* (Harmondsworth: Penguin, 1982) chaps. 1–7, pp.47–87.
3. Henry David Thoreau, 'Battle of the Ants' excerpt from 'Brute Neighbours', in *Walden* (Oxford: OUP, 1997) chap. 12.
4. Ralph Waldo Emerson, 'Self Reliance', in *The Selected Writings of Ralph Waldo Emerson*, ed. with a biographical introduction by Brooks Atkinson (New York: The Modern Library, 1964).
5. Toni Morrison, 'Romancing the Shadow', in *Playing in the Dark: Whiteness and Literary Imagination* (London: Picador, 1993) pp.29–39.

Mapping of COs to Modules

COs	Module I	Module II
CO1	H	H
CO2	H	H
CO3	H	M

EGDL302T: DIASPORA LITERATURE

(4 Credits- 60 hours) (L-T-P: 3-1-0)

Objective(s)

The scope of the course ranges from a thorough understanding of different connotations related to Diaspora and Diaspora literatures from across the world. The course is expected to create the understanding of phenomena such as home, exile, identity, displacement with the help of the prescribed texts.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Describe Diaspora, its concept, history and its literary association (Understanding)
 CO 2: Apply the themes of these texts to further explore the conscientiousness of the relationship between the 'homeland' and the 'diaspora'. (Applying)
 CO 3: Discover the 'home' country from a different prism through the eyes of writers who have lived in a composite culture.(Analysing)

Module I: Background: (15 Hours)

Diaspora: concept, history, definition, colonial connection, Diasporic identity, Home, Cosmopolitanism, Self; Anxieties of Diaspora-sense of trauma, inbetweenness, dislocation, displacement; Idea of Diaspora Literature

Module II: Selected Fiction (30 Hours)

- a.V.S.Naipaul (Caribbean-British) : *Half a Life* (2001)
 :
 b.Chimamanda Adichie (Nigerian-American)*Americanah*(2013)
 :
 c.Yasmine Gooneratne (Srilankan-Australian) : "How Barry Changed His Image"
 d.Jhumpa Lahiri (American- Indian) : "Unaccustomed Earth"

Module III: Selected Poetry (15 Hours)

- a.Imtiaz Dharker (Pak-British) : "At the Lahore Karhai"
 b.Hana Safi (Mideast-American) : "Bad Brown Girl"
 :
 c.Meena Alexander (Indian American) : "Muse"

Suggested Reading

1. "Introduction: The Diasporic Imaginary" in Mishra, V. (2008).
2. *Literature of the Indian Diaspora*. London: Routledge
3. "Cultural Configurations of Diaspora," in Kalra, V. Kaur, R. and Hutynuk, J. (2005)
4. *Diaspora & Hybridity*. London: Sage Publications.
5. "The New Empire within Britain," in Rushdie, S. (1991). *Imaginary Homelands*. London: Granta Books
6. Meena Alexander. *Illiterate Heart*. Northwestern University Press, 2003.
7. Prescribed texts

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO1	H	M	M
CO2		H	H
CO3	M	H	H

EGPC303T: POSTCOLONIAL LITERATURE

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

This course aims to acquaint the students with the concepts in the area of postcolonial studies in the field of literature. Apart from the historical understanding, they shall be able to connect the various literary references and critical ideas in several such texts. Furthermore, this course will also be relevant to real life situations involving activist concerns.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: Recall the various critical elements in adherence to the Post-colonial literature. (Remembering)

CO2: Illustrate the historical context of Post-colonial literature and the use of racist and colonial undertones in the texts under study. (Understanding)

CO3: Discuss, summarise and critically appreciate the literary and the thematic aspects of the texts under study. (Creating)

Module I: Introduction to Post-colonial Studies (15 Hours)

Historical background of Post-colonial Studies, concept, Decolonization, Globalization, Hybridization, identity, culture, 'othering'.

Module II: Selected Critical Writings (15 Hours)

- a. *Orientalism*: Edward Said (Selections)
- b. *Nation and Narration*: Homi K. Bhabha
- c. 'Passive Resistance' and 'Education': Mahatma Gandhi

Module III: Selected Novels (15 Hours)

- a. *The Shadow Lines*: Amitav Ghosh
- b. *By the Sea*: Abdulrazak Gurnah

Module IV: Selected Drama and Poetry (15 Hours)

- a. *A Dance of the Forests*: Wole Soyinka
- b. "Vultures": Chinua Achebe
- c. "Phenomenal Woman": Maya Angelou
- d. "Names": Derek Walcott

Suggested Readings:

1. The prescribed texts
2. "The Danger of a Single Story" (Transcript) by Chimamanda Adichie.
3. Benson, Eugene and L. Conolly (Eds). *Encyclopaedia of Postcolonial Literatures in English*. Routledge, 2005

4. Moore-Gilbert, Bart et al (Eds.) Postcolonial Theory: Contexts, Practices, Politics. Routledge, 1997
5. Mongia, Padmini. Postcolonial Theory. Oxford, 1996
6. Mukherjee, Meenakshi and Harish Trivedi (Eds.) Interrogating Postcolonialism. Indian Institute of Advanced Studies, 1996.
7. Ashcroft, Bill et al. The Empire Writes Back. Routledge, 2002.
8. Nayar, Pramod K. Postcolonial Literature: An Introduction. Pearson Education India, 2008.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO1	M	H	M	H
CO2	M	H	M	M
CO3	M	L	M	H

EGLC304T: LITERARY CRITICISM

(4 Credits-60 lectures) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to introduce and orient students in the major developments in literary criticisms beginning with Plato through to Philip Sidney, the Romantics like William Wordsworth, Victorians like Mathew Arnild ,Modernists Virginia Woolf and Twentieth Century critics like T.S.Eliot, I.A. Richards and Maggie Humm so as to facilitate them in using their corresponding critical concepts in interpretation of literature.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define key critical terms and concepts. (Remembering)

CO 2: Distinguish between the various ideas of western literary criticism from the time of Aristotle to the Modern Period. (Understanding)

CO 3: Discuss and summarize the key concepts of the various critical texts. (Creating)

Module I: Plato to Sidney (20 Hours)

- a. Aristotle: *Poetics*: "Tragic Hero," "Hamartia," "Peripeteia," "Anagnorisis"
- b. Horace: *Ars Poetica*
- c. Philip Sidney: "An Apology for Poetry" : Four abuses and their defense

Module II: Romantic to Modern Period (20 Hours)

- a. William Wordsworth: "Preface to the *Lyrical Ballads* (1802)"
- b. Mathew Arnold: "The Study of Poetry"
- c. Virginia Woolf: "Modern Fiction"

Module III: Twentieth Century (20 Hours)

- a. T.S. Eliot: Historical Sense, Definition of Poetry and Depersonalization in "Tradition and the Individual Talent"
- b. I.A.Richards : "Four Kinds of Meaning" in *Practical Criticism*
- c. Cleanth Brooks: "The Language of Paradox" in *The Well-Wrought Urn: Studies in the Structure of Poetry*
- d. Maggie Humm: "Feminist Criticism" in *Feminist Criticism: Women as Contemporary Critics*

Suggested Readings

1. C. S. Lewis: Introduction in *An Experiment in Criticism*, Cambridge University Press. 1992
2. M. H. Abrams: *The Mirror and the Lamp*, Oxford University Press. 1971
3. Rene Wellek, Stephen G. Nicholas: *Concepts of Criticism*, Connecticut, Yale University. 1963
4. Taylor and Francis Eds. *An Introduction to Literature, Criticism and Theory*. Routledge. 1996
5. Prescribed texts

Mapping of COs to Modules

COs	Module I	Module II	Module III
Co1	H	H	H
CO2	H	H	H

CO3	H	H	H

EGWW305T: WOMEN'S WRITINGS**(4 Credits-60 hours) (L-T-P: 3-1-0)****Objective(s)**

The course aims at helping students to learn about the formal features of women's writing, including the ways women adopt, adapt, and challenge broader literary traditions. The course explores the conditions under which women wrote and published. It provides opportunities to explore key issues and debates in contemporary scholarship on women's writing.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Illustrate the various thoughts and theories pertaining to feminist writings and feminism. (Understanding)

CO 2: Analyse the various movements related to gender and the progress in gender and literature. (Analysing)

CO 3: Discuss and summarize the meanings, ideas and thoughts regarding gender and its connection with literature. (Creating)

Module I: Selected Poetry (15 Hours)

- Emily Dickinson 'I cannot live with you', 'I'm wife; I've finished that'
- Sylvia Plath 'Daddy', 'Lady Lazarus'
- Eunice De Souza 'Advice to Women', 'Bequest'

Module II: Selected Fiction and Short Fiction (30 Hours)

- Alice Walker: *The Color Purple*
- Charlotte Perkins Gilman: "The Yellow Wallpaper"
- Katherine Mansfield: "Bliss"
- Chitra Banerjee Divakaruni: "Palace of Illusions"

Module III: Selected Non-fiction (15 Hours)

- Mary Wollstonecraft- *A Vindication of the Rights of Woman* (New York: Norton, 1988) chap.1, pp. 11–19; chap.2, pp. 19– 38.
- Ramabai Ranade- 'A Testimony of our Inexhaustible Treasures', in *Pandita Ramabai Through Her Own Words: Selected Works*, tr.MeeraKosambi (New Delhi: OUP, 2000) pp. 295–324.
- Helene Cixous "Laugh of Medusa"

Suggested Readings

- Virginia Woolf, *A Room of One's Own* (NewYork: Harcourt, 1957) chaps.1 and 6.
- Simone de Beauvoir, 'Introduction', in *The Second Sex*, tr. Constance Borde and Shiela Malovany- Chevallier(London: Vintage,2010) pp.3–18.
- Kumkum Sangari and Sudesh Vaid, eds., 'Introduction', in *Recasting Women: Essays in Colonial History* (New Delhi: Kali for Women, 1989) pp. 1–25.
- Chandra Talapade Mohanty, 'Under Western Eyes: Feminist Scholarship and Colonial Discourses', in *Contemporary Postcolonial Theory: AReader*, ed. Padmini Mongia (New York: Arnold, 1996) pp. 172–97.

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO1	H	H	H
CO2	H	H	H
CO3	M	H	H

EGMP306P: Indian and Indigenous Knowledge System -Community Based Minor Project
(4 credits, 60 hours) (L-T-P: 0-1-3)

Course Outcomes:

1. *Infer* the relation between man, society, nature, religion and world in a particular community/ies (understanding)
2. *Analyze* the relation between man, society, nature, religion and world in a particular community (Analyzing)
3. *Apply* the methodology of module 2 in the analysis and report writing. (Applying).

Module I: Theory: Background, Ethics, Thrust Area and Methodology: 10 hrs

Background : Meaning, definition and its academic significance

Ethics : Concept of Ethics, being formal, greetings, take consent of respondent, formal introduction, respect respondent's faith, community, belief, avoid abuses, be impartial, authentic and empirical, be objective

Thrust Areas : Indian and Indigenous Knowledge System

Each student has to pick up any **TWO** of the following areas for project work in a community:

Creation myth : Origin of human being, Gods/Goddesses, Monsters, Demons etc and how they manifest to each other

Religion- concept, religious development, relation between God /Goddesses and man, how god is worshiped, ritual practice etc.

Family: concept, matrilineal or patrilineal, role of members of a family-father, mother, son, daughter, uncle, grandmother, grandfather and their maternal counterparts

Marriage: concept, arranged or elopement, marriage process, marriage rituals, roles of families (groom and bride sites, relatives, community)

Village: concept, structure of the village, caste, clans, occupations, inter village relationship, justice system

Festivals: concept, types, time, duration, purpose

Art: music literature, song, drama, musical instruments, paintings, performing art

Philosophy: idea of life, idea of sin, rebirth, salvation, relation between man and plants, man and animals, man and non-living things

Food: community food, kitchen, cooking method, food taking, food preservation

Language: name, vocabularies, idioms, phrases, adages

Folklore: myths, oral literature, folktales, folk theater etc.

Ecology: Relation between human being and nature; how nature manifests to the former

Methodology: The following can be adopted

Interaction : note respondent's name and narration in short

Questionnaire : printed document in which the respondents can answer/tick

Literature review- folklore, poems, rituals, myth: reading and exploration

Site visits: forts, religious places etc – their interpretation

Photo , audio, video

Module II: Practical: 50 hrs

Field Work: 20 hrs

Report: 30 hrs

Report Components: templates with be provided

Title page with its components: title, logo, name and ID of the students etc

Certificate from the teacher supervisor

Declaration of originality by the student

Field Visit Journal

Content page

Report:

Introduction

Analysis
Finding
Conclusion
Reference

Length : 40 pages

Binding : Spiral

Font/Style:

Name : Times New Roman

Font Size: 12

Line spacing : double

Paper size: A4

Indenting: Left only

Reference method; MLA VIII

Assessment (Out of 100)

Field Visit Journal Template: 10

Name:

Semester:

ID:

Course Name and ID:

S I	Date	Duration (to complete 20 hours)	Place/Community	Action	Sign of contact person

Report: 60

Report Assessment Parameters

Formal Pages (Templates to be provided): 10

Content Analysis : 20

Findings : 30

Presentation: 30

Presentation Assessment Parameters:

Content : 10

Interpretation : 10

Interaction : 10

Total: 100

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Suggested Reading:

1. "A Code of Ethics for Community Learning and Development", Standard Council for Scotland, https://cldstandardscouncil.org.uk/wp-content/uploads/Code_of_Ethics.pdf
2. Philips, Patricia Pullam and Cathy A.Stawarski. *Data Collection: Planning for and collecting all Types of Data.* Pfeiffer, 2008.
3. "How To Write Project Reports in Microsoft Word and LaTeX." University of York, 2002-2022, Version 6, <https://www-users.york.ac.uk/>
4. "Australian Community Workers Ethics and Good Practice Guide," Australian Community Workers Association 2017, <https://www.acwa.org.au/>

COs mapping to syllabus:

COs	Module 1	Module 2
CO1	M	H
CO2	M	H
CO3	M	H

EGLT400T: LITERARY THEORY**(5 Credits- 75 hours) (L-T-P: 4-1-0)****Objective(s)**

This course shall be instrumental in building the foundation of the students for the current line of critical thought in today's world. Students shall have a comprehensive idea of the connections of various philosophies in literary thought, through a postmodern lens. These theories shall also open up the world of interdisciplinary research for them.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define these modern theories. (Remembering)

CO 2: Explain genesis and growth of the modern critical theories in the context of literary texts. (Understanding)

CO 3: Assess the texts in terms of their political, social, psychoanalytical, feminist and economic implications. (Evaluating)

Module I: Marxism (15 Hours)

- a. Antonio Gramsci: "Hegemony (Civil Society) and Separation of Powers"
- b. Louis Althusser: "Ideology and Ideological State Apparatuses"

Module II: Feminism (20 Hours)

- a. Elaine Showalter: "Twenty Years on: A Literature of Their Own Revisited"
- b. Luce Irigaray: "When the Goods Get Together" (from *This Sex Which is Not One*)

Module III: Structuralism and Poststructuralism**(20 Hours)** a. Roland Barthes: "Myth Today"

- b. Michel Foucault: "Truth and Power"

Module IV: Postcolonial Studies (20Hours)

- a. Edward Said: "Introduction" (from *Orientalism*)
- b. Aijaz Ahmad: "Indian Literature: Notes towards the Definition of a Category"

Suggested Reading

1. Terry Eagleton, *Literary Theory: An Introduction* (Oxford: Blackwell, 2008).
2. Peter Barry, *Beginning Theory* (Manchester: Manchester University Press, 2002).
3. Derrida, Jacques. 1970. "Structure, sign and play in the discourse of the human sciences". in *The Languages of Criticism and the Sciences of Man: The Structuralist Controversy*, pp. 247-272, edited by Richard Macksey and Eugenio Donato.
4. Gandhi, Leela. *Postcolonial Theory: A Critical Introduction*. United Kingdom, Taylor & Francis, 2020.
5. Geoffrey Novell Smith (London: Lawrence and Wishart, 1971) pp. 5, 245–6.
6. Elaine Showalter, *A Literature of Their Own: British Women Novelists from Bronte to Lessing* (1977. Rpt. London: Virago, 2003) pp. xi–xxxiii.
7. Prescribed texts.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO1	H	H	M	M
CO2	M	H	M	M

CO3	L	M	H	H

EGLL401T: LANGUAGE AND LINGUISTICS**(5 Credits-75 hours) (L-T-P: 4-1-0)****Objective(s)**

The objective of this course is to introduce students to the background of language, exercise them on its theoretical foundation, phonology and morphology and syntax and semantics.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the historical development of languages, language varieties and language change. (Remembering)

CO 2: Explain the theoretical foundations of language. (Understanding)

CO 3: Determine the morpho-phonemic properties of human speech sounds. (Applying)

CO 4: Assess the word relations pertaining to different languages. (Evaluating)

Module I: Background of Language (18 Hours)

Language and communication; language varieties: standard and non-standard language; language change.

Module II: Theoretical Foundations (18 Hours)

Swiss Structuralism, American Structuralism- Its course and development.

Module III: Phonology and Morphology (19 Hours)

Basic concepts: phoneme, allophone, morpheme, inflectional and derivational morphology, compounding and word formation patterns.

Module IV: Syntax and semantics (20 Hours)

Categories and constituents of phrase structure, IC Analysis; Word relations: synonyms, antonyms, homonyms, metonymy; Interpretations of meanings: denotation, connotation, entailment and presupposition; Maxims of conversation and Speech acts.

Suggested Readings:

1. Mesthrie, Rajend and Rakesh M Bhatt. 2008. *World Englishes: The study of new linguistic varieties*. Cambridge: Cambridge University Press.
2. De Saussure, Ferdinand. 1966. *Course in general linguistics*. New York: McGraw Hill Introduction: Chapter 3. Akmajian, A.,
3. R. A. Demers and R. M. Harnish, *Linguistics: An Introduction to Language and Communication*, 2nd ed.
4. Fromkin, V., and R. Rodman, *An Introduction to Language*, 2nd ed. (New York: Holt, Rinehart and Winston, 1974) 5. Akmajian, A., R. A. Demers and R. M Harnish, *Linguistics: An Introduction to Language and Communication*, 2nd ed. (Cambridge, Mass.: MIT Press, 1984; Indian edition, Prentice Hall, 1991)

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	H	H	H	H
CO 3		M	H	M
CO 4	M		H	H

EGIC402T: Indian and Indigenous Knowledge System - Indian Classical Literature**(5 Credits-75 Hours): (L-T-P: 4-1-0)****Objective(s)**

The objective of this course is to orient students through some selected classical Indian literature, translated into English, to appreciate their aesthetic beauty, their social and cultural interpenetrations and their relevance today.

Course/Learning Outcomes:

- CO1: Summarize the plot of the prescribed texts. (Understanding)
 CO2: Analyze the recurrent themes adopted by classical Indian writers. (Analyzing)
 CO3: Evaluate the role of characters, plots and themes as portrayed in the prescribed texts. (Evaluate)
 CO4: Formulate a critical understanding based on the reading of the prescribed texts. (Creating)

Module I: Selected text of Kalidasa and Vyasa (40 lectures)

- Kalidasa: *Abhijnana Shakuntalam*, tr. Chandra Rajan, in *Kalidasa: The Loom of Time* (New Delhi: Penguin, 1989).
 Vyasa.: 'The Dicing'
 'The Sequel to Dicing'
 'The Book of the Assembly Hall'
 'The Temptation of Karna'
 'The Book of Effort'
 in *The Mahabharata*: tr. and ed. J.A.B. Van Buitenen (Chicago: Brill, 1975) pp. 106–69.

Module II: Selected text of Sudraka and Ilango Adigal (35 lectures)

- Sudraka: *Mrcchakatika*, tr. M.M. Ramachandra Kale (New Delhi: Motilal Banarasadass, 1962).
 Ilango Adigal: 'The Book of Banci', in *Cilappatikaram: The Tale of an Anklet*, tr. R. Parthasarathy (Delhi: Penguin, 2004) book 3.

Suggested Readings

1. Bharata, *Natyashastra*, tr. Manomohan Ghosh, vol. I, 2nd edn (Calcutta: Granthalaya, 1967) chap. 6: 'Sentiments', pp.100–18.
2. Iravati Karve, 'Draupadi', in *Yuganta: The End of an Epoch* (Hyderabad: Disha, 1991) pp.79–105.
3. J.A.B. Van Buitenen, 'Dharma and Moksa', in Roy W. Perrett, ed., *Indian Philosophy, vol. V, Theory of Value: A Collection of Readings* (New York: Garland, 2000) pp.33–40.
4. Vinay Dharwadkar, 'Orientalism and the Study of Indian Literature', in *Orientalism and the Postcolonial Predicament: Perspectives on South Asia*, ed. Carol A. Breckenridge and Peter van der Veer (New Delhi: OUP, 1994) pp.158–95.
5. Sharma, Ramesh and Ashima Sona ed. *Classics in Translation : Reflections on Indian and European Classical Literature*. Purbayon, 2021

Mapping of COs to Syllabus

COs	Module 1	Modulee2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H

EGPL403T: POPULAR LITERATURE

(5 Credits-75 hours) (L-T-P: 4-1-0)

Objective(s)

The course intends to acquaint the students with an overview of popular literature as well as popular culture. The texts under study will lend a better understanding of the themes and issues frequently arising in popular literature. The course will also help the students to examine theoretical frameworks for popular literature and its genres.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Define popular literature and its distinct characters (Remembering)
 CO 2: Critically interpret and understand the elements of popular literature (Understanding)
 CO 3: Apply various interpretative frameworks to their reading of selected works of popular literature (Application)
 CO 4: Analyse the themes and motifs in the works under study (Analysis)

Module I: Selected Fiction (45 Hours)

- a. Lewis Carroll: *Through the Looking Glass*
- b. Agatha Christie: *The Murder of Roger Ackroyd*
- c. Shyam Selvadurai: *Funny Boy*

Module II: Selected Biography (30 Hours)

- a. Durgabai Vyamand Subhash Vyam-: *Bhimayana: Experiences of Untouchability*
- b. Maya Angelou-: *I Know Why the Caged Bird Sings*

Suggested Readings

1. ChelvaKanaganayakam, 'Dancing in the Rarefied Air: Reading Contemporary Sri Lankan Literature' (*ARIEL*, Jan. 1998) rpt,
2. Malashri Lal, Alamgir Hashmi and Victor J.Ramraj, eds., *Post Independence Voices in South Asian Writings* (Delhi: Doaba Publications, 2001) pp. 51–65.
3. Sumathi Ramaswamy, 'Introduction', in *Beyond Appearances?: Visual Practices and Ideologies in Modern India* (Sage:Delhi, 2003) pp. xiii–xxix.
4. Leslie Fiedler, 'Towards a Definition of Popular Literature', in *Super Culture: American Popular Culture and Europe*, ed. C.W. E. Bigsby (Ohio: Bowling Green University Press, 1975) pp. 29–38.
5. Felicity Hughes, 'Children's Literature: Theory and Practice', *English Literary History*, vol.45, 1978, pp. 542–61.

6. Mapping of COs to Modules

COs	Module I	Module II
CO1	H	H
CO2	H	M
CO3	H	H
CO4	H	H

MINOR COURSES

Semes-ter	Category	Course Code	Course Name	Cred-its
1	Minor Course 1	EGBL102T	Basic Language Skills	4
2	Minor Course 2	EGBI103T	Basic Linguistics	4
3	Minor Course 3	EGAW205T	Academic Writing and Composition	4
4	Minor Course 4	EGEL206T	English Language Teaching	4
5	Minor Course 5	EGTS307T	Translation Studies	4
6	Minor Course 6	EGGS308T	Introduction to Gender Studies	4
7	Minor Course 7	EGCS404T	Introduction to Culture Studies	3
7	Minor Course 8	EGRM405T	Research Methodology : Research Paper and Dissertation	2
8	Minor Course 9	EGLA406T	Language, Literature and Culture	3

EGBL102T: BASIC LANGUAGE SKILLS

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to introduce students to language types and contexts, phonetic features and develop reading, comprehension and writing skills.

Course/Learning Outcome

CO1: Define the types of communication and recognize the fundamentals of speaking and writing skills. (Remembering)

CO2: Classify the segmental, supra-segmental and paralinguistic features of speech (Understanding)

CO3: Evaluate the reading and comprehension skills in the English language. (Evaluation)

Module I: Language: Types and Contexts (15 hours)

Verbal and Non-verbal (Spoken and Written); Personal, Social and Business - Barriers and Strategies; Intra Personal, Inter Personal and Group Communication; Monologue, Dialogue, Group Discussion, Effective Communication/ Miss- Communication, Interview, Public Speech.

Module II: Language: Phonetic Features (15 hours)

Segmental features: Organs of speech, vowels and consonants; Supra segmental features: Stress, Rhythm, Intonation; Paralinguistic features: Clarity, pace and pauses, voice modulation

Module III: Reading and Comprehension (15 hours)

Close reading, comprehension, summary paraphrasing, analysis and interpretation, translation (from Indian language to English and vice-versa), literary/knowledge texts.

Module IV: Writing skills (15 hours)

Grammar for writing, vocabulary building, techniques to improve writing skills, letter writing and its types, academic writing vs. journalism, blog writing, editing and revising.

Suggested Readings

1. Varma, Pramodini. Fluency in English - Part II, Oxford University Press, 2015.
2. Bhalla, Prem P. Business English, Pearson, 2016.
3. Kumar, S.P. Language, Literature and Creativity, Orient Blackswan, 2012.
4. K., Alex. Soft Skills. S. Chand & Co. Ltd. 2008.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO1	H	H		H
CO2		H		
CO3			H	M

EGBI103T: BASIC LINGUISTICS

(4 Credits- 60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to introduce students to Linguistics, exercise them on phonology and morphology, syntax and semantics and eventually equipped them with the idea of sociolinguistics.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define basic concepts in linguistics and find the interconnection between language and society. (Remembering)

CO 2: Outline the phonological and the morphological structure of languages. (Understanding)

CO 3: Identify and explain the different levels of language organisation. (Applying)

Module I: Introduction to Linguistics (15 Hours)

Definition of language; Characteristics of language; Definition and scope of linguistics; Different branches of linguistics; Linguistics and traditional grammar; langue and parole; competence and performance; synchrony and diachrony; syntagmatic and paradigmatic; sign, signifier and signified

Module II: Phonology, Morphology (15 Hours)

Organs of speech; speech mechanism; vowel sounds and consonant sounds; phonemic transcription; phonemes, morphemes, allomorphs and morphs; syllable and word formation processes; word stress and sentence intonation;

Module III: Syntax & Semantics (15 Hours)

Syntactic structure of English language- IC analysis, transformational grammar; layers of meaning at the semantic level of language- deep structure and surface structure; Different aspects of meanings, lexical relations, synonymy, hyponymy, antonymy, homonymy, polysemy, denotation, connotation, collocation, association, prototypes; entailment, presupposition

Module IV: Sociolinguistics (15 Hours)

Language and Society, Dialect and Idiolect, Standard Language, Register and Style, Bilingualism and Multilingualism, CodeSwitching and Code-Mixing, Language varieties, dialect, idiolect, register, isoglosses, dialect boundaries, diaglossia, pidgin and creole, speech community, speech event, speech situation, speech acts, Language Shift and Language Death

Suggested Readings

1. Abrams, M.H. *A Handbook of Literary Terms*, 2009, Cengage Learning India, New Delhi
 2. Balasubramoniam, T. *A Textbook for English Phonetics for Indian Students*, Macmillan, New Delhi
 3. Yule, George, *The Study of Language*, fourth edition, Cambridge university Press, 2010 New Delhi.
- Wood, F.T. *An outline history of the English language*, Macmillan, 1941, New Delhi

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO1	H			H
CO2		H		
CO3	M	H	H	

EGAW205T: ACADEMIC WRITING AND COMPOSITION

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The course intends to acquaint the students with an overview of the process of doing research. This will introduce the students to the basics of academic writing as well the steps of doing research. The course will also help the students to develop critical thinking as well as the basic research skills.

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: Define and identify the role of academic writing and its components. (Remembering)
 CO 2: Explain the significance of critical thinking. (Understanding)
 CO 3: Critically examine the applicability of the techniques of the writing process. (Analysing)

Module I: Introduction to writing (15 Hours)

The Writing Process: Introduction to Academic writing, Dos and don'ts of academic writing, Conventions of Academic Writing

Module II: General Principles of Summarizing (15 Hours)

Writing in one's own words: Summarizing and Paraphrasing

Module III: Development of Critical thinking (15 Hours)

Critical Thinking: Synthesis, Analyses, and Evaluation

Module IV: Development of Argument, Citation and reviewing (15 Hours)

Structuring an Argument: Introduction, Interjection, and Conclusion Citing Resources; Editing, Book and Media Review

Suggested Readings

1. Gerald Graff and Cathy Birkenstein, *They Say/I Say: The Moves That Matter in Academic Writing*. W.W.Norton&Company, 2009.
2. Gupta, Renu. *A Course in Academic Writing*. Orient Black Swan, 2017.

3. Hamp-Lyons, Liz. And Heasley, Ben. *Study writing: A Course in Writing Skills for Academic Purposes*. CUP, 2006.
4. Leki, Ilona. *Academic Writing: Exploring Processes and Strategies*. CUP, 1998. **Mapping of Cos to the Modules**

COs	Module I	Module II	Module III	Module IV
CO 1	H	L	H	M
CO 2	L		H	M
CO 3	M	L	H	H

EGEL206T: ENGLISH LANGUAGE TEACHING (4 Credits) (L-T-P: 3-1-0)

Objective(s): The objective of this course is to introduce students to teaching of English language, acquaint them with methods and approaches of the teaching, orient them in grammatical and practical language skills and develop skill in learning language through literature.

Course Outcomes

CO No	NSQF Level (6) Descriptors	Course Outcome Statement	Bloom's Taxonomy
CO1	<i>Professional Theoretical Knowledge:</i> Basic conceptual understanding; ability to recall and identify language teaching theories and approaches.	Define the vast body of Language teaching methodologies	Remembering
CO2	<i>Professional Skills:</i> Acquire specialized knowledge and a range of cognitive and practical skills in selecting appropriate information, methods, tools, and materials.	Demonstrate the different approaches to teaching of English as a second language	Understanding
CO3	<i>Professional Skill, aptitude and responsibility:</i> Apply the acquired specialized knowledge and a range of cognitive and practical skills to accomplish tasks like syllabus design, testing and evaluation by selecting appropriate information, methods, tools, and materials.	Design as well as adapt on the syllabuses of second language teaching and constructing lesson plans for dealing with language learners of different linguistic backgrounds	Creating

Syllabus:

Module I: Introduction to English Language Teaching (10 Hours)

Introduction, Fundamental concepts of Language Teaching, Historical Perspective of ELT, Language Pedagogy. Elements of the Structure of English Language.

Module II: Methods and Approaches of Teaching English (20 Hours)

Theoretical aspects of Language Acquisition and Learning; Language Skills assessment; Psychological approach to language teaching in a bilingual/ multilingual context; Use of Technology in Language Teaching; Educational Technology; Testing and Evaluation.

Module III: Grammar and Practical Language Skills (20 Hours)

Parts of Speech; Articles and Prepositions; Degrees of Comparison; Direct and Indirect Speech; Sentence patterns; Letter Writing; Report Writing; Reading Comprehension; Listening and Speaking; English Speech Sounds – Vowels and Consonants, Stress and Intonation patterns; Language Games; Vocabulary Expansion; Telephonic Conversation; Teaching English for

Academic and Business Purpose.

Module IV: Language through Literature (10 Hours)

Role of Literature in Language Learning; Teaching of Literature; Use of Language Model.

Suggested Readings

1. Ray Mackay, *A Basic Introduction to English Language Teaching*; Oxford, 2018.
2. Penny Ur, *A Course in English language Teaching*, CUP.2010.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2	M	H	M	
CO3	H	H	M	M

EGTS307T: TRANSLATION STUDIES

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s)

The objective of this course is to introduce students to translation studies, general concepts and terms used in translation studies, types/modes of translation and process of translation. At the same time, the course also attempts to give some practical exercises in translation.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Understand the significance and importance of translation in a multilingual and multicultural society like India (Understanding)

CO 2: Examine critically the basic concepts and terms used in translation studies vis-à-vis their use in the practice of translation (Analyzing)

CO 3: Create and offer a critique of works in translation (Creating)

Module I: Introduction to Translation (10 Hours)

Introducing Translation: a brief history and significance of translation in a multi linguistic and multicultural society like India.

Module II: Basic Concepts and Terms used in Translation Studies (10 Hours)

Introducing basic concepts and terms used in Translation Studies through relevant tasks, for example: Equivalence, Language Variety, Dialect, Idiolect, Register, Style, Mode, Codemixing/ Switching, SL, TL, ST, TT

Module III: Types/ modes in Translation (10 Hours)

Semantic/Literal translation Free/sense/literary translation Functional/communicative translation Technical / Official Trans-creation Audio-visual translation

Module IV: The Process of Translation (30 Hours)

Defining the process of translation (analysis, transference, restructuring) through critical examination of standard translated Literary/non literary texts and critiquing subtitles of English and Hindi films.

Practice: Translation in Mass Communication/Advertising, subtitling, dubbing, Exercises to comprehend 'Equivalence in translation': Structures (equivalence between the source language and target language at the lexical (word) and syntactical (sentence) levels. This will be done through tasks of retranslation and recreation, and making comparative study of cultures and languages.

Practice: Tasks of Translation in Business: Advertising Discussions on issues of 'Translation and Gender' by attempting translation for media, films and advertisements from different languages.

Developing skills for Interpreting: understanding its dynamics and challenges. Interpreting: Simultaneous and Consecutive (practical application)

Suggested Readings

1. Baker, Mona, *In Other Words: A Coursebook on Translation*, Routledge, 2001. (Useful exercises for practical translation and training)(Ed.) *Routledge Encyclopedia of Translation Studies*. London and New York: Routledge, 2001. (Readable entries on concepts and terms)
2. Sherry Simon, *Gender in translation: Cultural Identity and the Politics of Transmission*. New York: Routledge, 1996. Catford, I.C. *A Linguistic Theory of Translation*. London: OUP, 1965. Frishberg, Nancy J. *Interpreting: An Introduction*. Registry of Interpreters, 1990.
3. Gargesh, Ravinder and Krishna Kumar Goswami. (Eds.). *Translation and Interpreting: Reader and Workbook*. New Delhi, Orient Longman, 2007.
4. House, Juliana. *A Model for Translation Quality Assessment*. Tübingen: Gunter Narr, 1977. Lakshmi, H. *Problems of Translation*. Hyderabad: Booklings Corporation, 1993.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H	H	H	
CO 2		H	H	H
CO 4	H	H	H	H

EGGS308T: INTRODUCTION TO GENDER STUDIES

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective(s):

The course intends to acquaint the students with an overview of gender equality concerns. This course will also help the students to develop an understanding of gender as it intersects with sexuality, race, ethnicity, religion, class and other critical variables.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: Explain basic concepts relating to gender and provide logical understanding of gender roles. (Understanding)

CO2: Analyse various perspectives of the body and discourse on power relationships. (Analysing)

CO3: Assess the cultural construction of masculinity and femininity and its various consequences. (Evaluating)

Module I: Introduction. (15 Hours)

Sex and Gender, Types of Gender, Gender Roles and Gender Division of Labor, Gender Socialization and Gender Stereotyping, Gender Stratification and Gender Discrimination.

Module II: Gender Perspective of Body. (15 Hours)

Biological, Phenomenological and Socio-Cultural Perspectives of Body, Body as a Site and Articulation of Power Relations, Cultural Meaning of Female Body and Women's Lived Experiences, Gender and Sexual Culture

Module III: Social Construction of Femininity. (15 Hours)

Bio-Social Perspective of Gender, Gender as Attributional Fact, Essentialism in the Construction of Femininity, Challenging Cultural Notions of Femininity, Images of Women in Sports, Arts, Entertainment and Fashion Industry

Module IV: Social Construction of Masculinity. (15 Hours)

Definition and Understanding of Masculinities, Sociology of Masculinity, Social Organization of Masculinity, Politics of Masculinity, Power and Hegemony

Suggested Reading:

1. Butler, Judith. *Gender Trouble: Tenth Anniversary Edition*. N.P., Taylor & Francis, 2002.

- Connell, R.W. *Gender*. Cambridge: Polity Press, 2002.
- Holmes M. *What is Gender*. New Delhi, Sage Publications, 2007
- Kimmel S Michael. *The Gendered Society: Reader*. Oxford: Oxford University Press, 2004
- Oakley A. *Sex, Gender and Society. London*, Temple Smith, 1985
- Millet K. *Sexual Politics*. London, Abacus, 1972.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H	M	L	L
CO 2	L	H	M	M
CO 3	L	M	H	H

EGCS404T: INTRODUCTION TO CULTURAL STUDIES

(3 Credits- 45 hours) (L-T-P: 2-1-0)

Objective(s)

To introduce students with the basic concepts of cultural studies, make them aware of some of the most important thinkers and methodologies in the field and help them analyse texts from many different critical perspectives.

Course/Learning Outcomes

CO 1: Outline culture, cultural identities and politics of production across various human historical conditions. (Understand)

CO 2: Identify the constructed categories of identity, authority and knowledge. (Apply)

CO 3: Examine culture as an asymmetrical entanglement of material and abstract attributes to draw on political theory, psychology and critical theory. (Analyse)

Module I: Introduction and background (20 Hours)

Birth of Cultural Studies-Raymond Williams and Richard Hoggart (Origin, Evolution and Early trends); Birmingham Centre for Contemporary Studies and Stuart Hall

Construction of culture (Socio-political, Religious, Technological)

Representation of culture (Language, Gender, Race, Class, Ethnicity and Kinship);

High and Low culture; Folk Culture; Popular Culture; Mall culture; Media Culture; Consumer Culture; Global Culture

Media and Culture

Culture and Cultural Identities

Module II: Literary Theories and Cultural Studies (15 Hours)

Structuralism; Post Structuralism and Deconstruction; Marxism; Postmodernism; Feminisms and Post-feminisms; Queer Theory; Techno culture; Post humanism

Module III: Understanding culture through literature (10 Hours)

Bell Hooks 'Understanding Patriarchy'

George Orwell 'Shooting an Elephant'

Suggested Readings

- Durham, Meenakshi Gigi, and Douglas M. Kellner, eds. *Media and Cultural Studies: Keywords*. John Wiley & Sons, 2012.
- Grossberg, Lawrence, and Della Pollock, eds. *Cultural Studies-Vol 12.2*. Vol. 12. No. 2. Psychology Press, 1998.
- Hall, Stuart. *Cultural studies 1983: A Theoretical History*. Duke University Press, 2016.
- Longhurst, Brian, et al. *Introducing cultural studies*. Routledge, 2016.
- Turner, Graeme. *British cultural studies: An introduction*. Psychology Press, 2003.
- Williams, Raymond. *Culture and society, 1780-1950*. Columbia University Press, 1983.

Mapping of Cos to Modules

COs	Module I	Module II	Module III
CO1	H	H	H

CO2	M	H	H
CO3	M	H	H

EGRM405T: RESEARCH METHODOLOGY: RESEARCH PAPER AND DISSERTATION**(2 Credits- 30 hours) (L-T-P: 1-1-0)****Objective(s)**

This course aims to equip the student with theoretical and practical knowledge, so that they are introduced into the field of research in English Literature. Not only does this course give the students practical experience of working in a dissertation, it also shows alternative ways of approaching and phrasing their arguments. Finally, it seeks to keep them up to date with the contemporary trends and styles in the same.

Course/Learning Outcomes

CO1: Describe academic writing, research paper/dissertation and its methodology (Understanding)

CO2: Formulate a research argument and develop a research paper/dissertation. (Creating)

Module I: Methodology (15 Hours)

- Introduction to academic/ research writing
- Avoiding Plagiarism in research, Plagiarism checking tools (Ouriginal, Turnitin)
- Selection of a research topic
- Developing an outline of the research
- Choosing an appropriate title for the research
- Writing an abstract
- Review of Literature
- Developing an argument
- Bringing a critical interpretation into writing
- Drawing inferences/ framing a conclusion
- MLA Handbook 8th/9th Edition
- Referencing and Citation, citation tools (Mendeley, Zotero)
- Bibliography
- Research Ethics

Module II: Practical- Writing and editing a Research Work (15 Hours)

- Draft of the abstract
- Draft of all components of Introduction
- First draft of the research work
- Tentative bibliography, annotated bibliography

Suggested Reading

1. Correa, Delia Da Souza & Owens, W.R. The Handbook to Literary Research. Routledge. 2009
2. Kothari, C. R. & Gaurav Garg. Research Methodology: Methods and Techniques. New Age. 2019
3. MLA Handbook for Writers of Research Papers, Eighth Edition. MLA. 2016.

Mapping of COs to Modules:

COs	Module I	Module II
CO1	H	M
CO2	M	H

EGLA406T: LANGUAGE, LITERATURE AND CULTURE**(3 Credits-45 hours) (L-T-P: 2-1-0)****Objective(s)**

The course shall develop the language skills of students by introducing them to the structures of language through a wide variety of literary works. This course will also introduce the students to the general characteristics of the literature of different ages in India. Finally, this course will help the students to develop an understanding of culture and its relation with literature.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: Understand the intrinsic relationship between languages, literature and culture (Understanding)

CO2: Illustrate the structure and function of language and its literary and cultural significance (Ap-

plication) CO3: Analyze the recurrent themes and forms of Indian literature through the ages (An-

Module 1: Language (15 Hours)

Language and Communication: The Definition of Language, the Characteristics of Human language Why Does Language Matter?

Language and Society: Language and Class, Language and Gender; Language and Ethnicity; Language and Identity

Language Variation: Dialect; Idiolect; Slang ;Pidgin; Creole; Jargon; Standard and Non-Standard Language; Bilingualism, Multilingualism; Code-mixing; Code-switching

Module 2: Indian Literature Through the Ages (20 Hours)

This section of the course will involve a study of significant themes and forms of Indian literature through the ages, with the help of prescribed texts.

Prescribed text: *Indian Literature: An Introduction* (Delhi: University of Delhi, 2005).

Different Phases of Indian literatures: Ancient, Medieval, and Modern

Chapter 1: Veda Vyasa, *The Mahabharata*: "The Ekalavya Episode"

Chapter 2: Asadullah Khan Ghalib: "Desires Come by the Thousands"

Chapter 3: Rabindranath Tagore: 'The Cabuliwallah'

Chapter 4: Ismat Chughtai: "Touch-Me-Not"

Chapter 5: Indira Goswami: "The Journey"

Chapter 6: Shrikant Mahapatra: "Folk Songs"

Module 3: Culture and Society in Contemporary India (10 Hours)

The Idea of culture, Definition of culture, High culture, Popular culture, Culture and media, Indian Society and culture

Suggested Readings

1. Roger Fowler, ed., *Essay on Style and Language* (London: Routledge and Kegan Paul Ltd, 1966). Roger Fowler, *The Linguistics of Literature* (London: Routledge and Kegan Paul Ltd, 1971)
2. H. G. Widdowson, *Stylistics and the Teaching of Literature* (London: Longman, 1979).
3. J. A. Fishman, *Sociolinguistics: A Brief Introduction* (Mass: Newbury House Rowley, 1971).
4. R. S. Gupta and K. S. Agarwal. *Studies in Indian Sociolinguistics* (New Delhi: Creative Books, 1996).
5. R. A. Hudson, *Sociolinguistics* (Cambridge: Cambridge University Press, 1980). Geoffrey Leech and Michael Short, *Style in Fiction* (London: Longman, 1981).
6. Sisir Kumar Das, ed., *A History of Indian Literature* (New Delhi: SahityaAkademi, 1995)
7. 'Notes on the History of the Study of the Indian Society and Culture', in *Structure and Change in Indian Society*, ed. Milton Singer and Bernard S Cohn (Chicago: AldinePress, 1968)
8. 'Towards a Definition of Culture', in *India and World Culture* (New Delhi: Sahitya Academy, 1986). Journalism: *Changing Society Emerging Trends* (Delhi: Authorspeak, 2003).

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	L	H	M

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	EGCW104L	Creative Writing	3

2	S E Course 2	EGSS105L	Soft Skills	3
3	S E Course 3	EGEP207L	Editing and Proofreading	3

EGCW104L: CREATIVE WRITING (3 Credits) (L-T-P: 2-1-0)

Objective

To help students understand different types of creative writings, instill creative writing skills and produce clear and coherent writing skills.

Course Outcomes:

CO No.	NSQF Level (6) Descriptor	Course Outcome Statement	Bloom's Taxonomy Level
CO1	Understanding of core concepts, historical development, and foundational techniques in creative writing.	Students understand basic concepts, origins, and scope of creative writing.	Remembering
CO2	Applies creative writing strategies, stylistic devices, and mechanics of language across familiar writing contexts.	Students will be able to apply techniques of creative writing such as style, cohesion, coherence, and figures of speech in different forms of writing.	Applying
CO3	Creates original creative texts by integrating advanced writing skills, genre forms and drafting techniques.	Students will be able to use grammar, vocabulary, and writing techniques to produce letters, blogs, and literary writings.	Creating

Module I: Introduction to Creative Writing (7 Hours)

Introduction; Objectives of Creative writing; History of Creative Writing as an academic pursuit; Scope and Area of Creative Writing

Module II: The Art and Craft of Writing (7 Hours)

Origin of Thought and Birth of an Idea: Inspiration, Imagination and Creativity, Incubation, Implementation and Interpretation; Strategies of a Writer

Module III: Modes of Creative Writing (11 Hours)

Mechanics of Writing: Cohesion, Coherence, Style, Context, Register, Content; Aesthetic function of Writing; Rules for good writing; Things that must be avoided by a Writer; Literal and Figurative Use of Language; Active and Passive style of writing; Direct and Indirect Speech Styles; Personal and impersonal styles of writing; Formal and informal use of language

Module IV: Types of Creative Writing (13 Hours)

Writing a film / book review; Narrative or discursive essay / article; Poetry writing; Short story writing; Dramatic dialogue writing; Writing for the New Media; Poster writing; Advertisement; Newspaper article and editorial; Blogs; Writing for Radio and Television, Memoirs, Pamphlets, Life Writing.

Module V: Preparing for Publication (7 Hours)

Cover Letter Writing, Understanding Editorial Preferences and Submission Guidelines

Mapping of COs with the Syllabus

COs	Module I	Module II	Module III	Module IV	Module V
1	H	H	M	L	L
2	L	M	H	H	M
3	L	L	M	H	H

EGSS105L: SOFT SKILLS

(3 Credits-45 hours) (L-T-P: 2-1-0)

Objective(s)

To help students develop effective communication and presentation skills and to enable them mastering interpersonal, team building and leadership skills.

Course Outcomes

COs	NSQF Level (7) Descriptors	Course Outcome Statement	Bloom's Taxonomy
CO1	Summarizes the knowledge to achieve broad factual/theoretical grasp of soft-skills' importance.	Outline the importance of soft-skills in personal and professional life.	Understanding
CO2	Analyses and evaluates grooming and etiquette for effective self-management and interpersonal skills.	Distinguish different aspects of soft-skills and do's/don'ts of behaviour.	Analysing
CO3	Applies concepts to solve complex workplace problems and demonstrates initiative and leadership.	Integrate ideas on teamwork, leadership, adaptability for workplace growth.	Applying

Module I- Personality and Self: (15 Hours)

Introduction to soft skills; Dimensions and Determinants of personality; Positive self image and negative self image; Building self-esteem and confidence; Defining strengths; Personal values; creative thinking, communication skills-writing skills, speaking skills.

Module II -Building a Social Image: (13 Hours)

Self-grooming; Body Language; Eye contact; Emotional Intelligence; Adaptability; Leadership; Teamwork; Problem solving, Time and stress management, Motivation and Persuasion

Module III -Communication and Team Building: (17 Hours)

Presentation Skills; Group Discussion; Small talk; Public speaking; Interview Skills; Preparation of CV; Business etiquettes; Corporate etiquette; Telephone etiquette; Social etiquette; Technical correspondence, Negotiation Skills

Suggested Readings

1. Chauhan, Gajendra S. Soft Skills: An Integrated Approach to Maximise Personality. Willey. 2015.
2. K., Alex. Soft Skills.S. Chand & Co. Ltd. 2008.
3. Mitra, Barun. Personality Development and Soft Skills. OUP. 2016.
4. Sharma, Prashant. Soft Skills: Personality Development for Life Success. BPB Publications. 2018.
- Butterfield, Jeff. Soft Skills for Everyone. Cengage Learning. 2011.

Mapping of COs to Modules

COs	Module I	Module II	Module III
CO1	H	H	H
CO2	M	H	H
CO3	M	H	H

EGEP207L: EDITING AND PROOFREADING
(3 Credits) (L-T-P: 2-1-0)

Objective:

This course will introduce the students with the basic skills related to the Editing and Proofreading industries and will train them with practical knowledge of the different components of these skills.

Course/Learning Outcomes

CO No.	NSQF Level (6) Descriptor	Course Outcome Statement	Bloom's Taxonomy
CO1	Factual Knowledge	Students will demonstrate an understanding of the basic concepts, scope, and significance of editing and proofreading in the publishing industry.	Understanding
CO2	Process & Analytical Skills	Students will analyse sample manuscripts to evaluate coherence, structure, and adherence to style manuals used in publishing.	Analysing
CO3	Technical & Practical Skills and Professional Competence	Students will execute practical tasks such as proofreading using standard symbols, page-layout understanding, blurb-writing, and basic.	Creating

Module I: Editing (15 Hours)

Basic idea of Editing and Copy editing; Copy-editing in the process of publishing; Role, responsibility and position of a copy editor; Fundamentals of copy editing; Ethics of copy editing; Liaison with other professionals; Essentials of a good copy-editor; Prospects of copy editing

Module II: Proof-reading (10 Hours)

Basic idea of proofreading; Proofreading in the process of publishing; Role and responsibility of a proofreader; Fundamentals of proofreading; Ethics of proofreading; Essentials of a good proofreader; Prospects of proofreading

Module III: Practical guidance and Style manuals (20 Hours)

Components of a book in print; Idea of style-manuals followed by publishers; Common copy-editing and proofreading symbols; Dos and Don'ts of grammar and punctuation; Idea of page-layout and software usage; Idea of cover designing, illustration and software usages; Idea of appendix making; Blurb-writing

Suggested Reading

1. Einsohn, Amy and Marilyn Schwartz. *The Copy Editor's Handbook*, University of California Press, 4th Edition, 2019.
2. Butcher Judith, Caroline Drake, Maureen Leach. *Butcher's Copy-Editing* (South Asia Edition), Cambridge University Press, 4th Edition, 2007.
3. Graves, Robert and Alan Hodge, *The Reader Over Your Shoulder: A Handbook for Writers of English Prose*, Rosetta Books, 2018
4. Clayton, Terry Erle, *Beyond Spell Check*, Red Plough International, 2019
5. Garner, Bryan A. *The Chicago Guide to Grammar, Usage, and Punctuation*, University of Chicago Press, 2016

Mapping of COs with the modules

COs	Module I	Module II	Module III
CO1	H	H	H
CO2	H	H	H
CO3	M	M	H

INTERNSHIP

Semester	Category	Course Code	Course Name	Credits	Page No
2	Internship	EGN106I	Internship	4	
4	Internship	EGIN208I	Internship	4	
5	Internship	EGIN309I	Internship	2	

EGN106I: EDITORIAL, JOURNALISM, COPYWRITING, REPORT WRITING, COMMUNICATION, PUBLISHING, TEACHING ETC.

(4 Credit- 120 hours)

Objective(s)

The objective of this internship is to make students acquainted with broader possible areas for employment after graduation, experience them and acquire skills necessary for them

Course/Learning Outcomes

CO 1: Understand possibility and availability of a broader area for professional development in corporate sectors like publication houses, coaching institutes, training centres, NGOs, INGOS, private and public offices etc. after graduation and create link with them (understanding)

CO 2: Develop bases for corporate professional skills through the course of the internship in the broader areas as stipulated above (creating)

Module 1: Theory (5 Hours)

- Background: meaning, definition of intern and internship
- Significance of internship for a graduate
- Ethics of internship: learning platform, commitment, honesty, objectivity, accountability, discipline, solidarity, competence, respect, responsibility, communication etc.
- Internship Journal Register and assessment parameters

Module 2: Practical (55 Hours)

- The students will be given freedom to choose internship places for the areas specified above. In case they cannot, the Department will forge them the places. There will be a faculty **Internship In-charge** to facilitate the process.
- After allocation, at their place of internship the students will maintain the **Internship Journal Register** (as a part of assessment) as per the template.

INTERNSHIP JOURNAL REGISTER**Name of the Student:****ID:****Department:****Semester:****Place of Internship:**

Date	Day	Time in	Work Description	Time out	Sign of employer

- At the end of the internship, the place of internship will issue a certificate, as per the template; **confidential in a sealed envelope**. The Internship In-charge will communicate the internship places for it.

Name of the Institution	
Ref:	Date:
<u>Performance Certificate</u>	
Certified that _____, from the Department of English, Assam Don Bosco University , has taken internship at this institution in _____ from _____ to _____.	
His/Her performance during the course of the internship is satisfying/moderately satisfying/highly satisfying .	
Seal and Signature	

Assessment: It is mandatory for the students to get pass marks in all the following:

1. Internship Journal Register	:	30
2. Performance Certificate	:	30
<i>Satisfying</i>	:	5
<i>Moderately satisfying</i>	:	10
<i>Highly satisfying</i>	:	15
3. Presentation (to a panel)	:	40
<i>Report (hard copy)</i>	:	20
<i>Presentation (PPT)</i>	:	10
<i>Interaction</i>	:	10

Total:		100

Mapping of COs to Modules

COs	Module I	Module II
CO 1	H	
CO 2		H

EGIN208I: EDITORIAL, JOURNALISM, COPYWRITING, REPORT WRITING, COMMUNICATION, PUBLISHING, TEACHING ETC.

(4 Credit- 120 hours)

Objective(s)

The objective of this internship is to make students acquainted with broader possible areas for employment after graduation, experience them and acquire skills necessary for them

Course/Learning Outcomes

CO1: Understand possibility and availability of a broader area for professional development in corporate sectors like publication houses, coaching institutes, training centres, NGOs, INGOS, private and public offices etc. after graduation and create link with them (understanding)

CO2: Develop bases for corporate professional skills through the course of the internship in the broader areas as stipulated above (creating)

Module 1: Theory (5 Hours)

- Background: meaning, definition of intern and internship
- Significance of internship for a graduate
- Ethics of internship: learning platform, commitment, honesty, objectivity, accountability, discipline, solidarity, competence, respect, responsibility, communication etc.
- Internship Journal Register and assessment parameters

Module 2: Practical (55 Hours)

- The students will be given freedom to choose internship places for the areas specified above. In case they cannot, the Department will forge them the places. There will be a faculty **Internship In-charge** to facilitate the process.
- After allocation, at their place of internship the students will maintain the **Internship Journal Register** (as a part of assessment) as per the template.

INTERNSHIP JOURNAL REGISTER**Name of the Student:****ID:****Department:****Semester:****Place of Internship:**

Date	Day	Time in	Work Description	Time out	Sign of employer

- At the end of the internship, the place of internship will issue a certificate, as per the template; confidential in a sealed envelope. The Internship In-charge will communicate the internship places for it.

Name of the Institution

Ref:

Date: **Performance Certificate**

Certified that _____, from the **Department of English, Assam Don Bosco University**, has taken internship at this institution in _____ from _____ to _____.

His/Her performance during the course of the internship is **satisfying/moderately satisfying/highly satisfying**.

Seal and Signature

Assessment: It is mandatory for the students to get pass marks in all the following:

4. Internship Journal Register	:		30
5. Performance Certificate	:		30
<i>Satisfying</i>	:	5	
<i>Moderately satisfying</i>	:	10	
<i>Highly satisfying</i>	:	15	
6. Presentation (to a panel)	:		40
<i>Report (hard copy)</i>	:	20	
<i>Presentation (PPT)</i>	:	10	
<i>Interaction</i>	:	10	

Total:**100****Mapping of COs to Modules**

COs	Module I	Module II
CO 1	H	
CO 2		H

EGIN309I: EDITORIAL, JOURNALISM, COPYWRITING, REPORT WRITING, COMMUNICATION, PUBLISHING, TEACHING ETC.

(2 Credit- 60 hours)

Objective(s)

The objective of this internship is to make students acquainted with broader possible areas for employment after graduation, experience them and acquire skills necessary for them

Course/Learning Outcomes

CO1: Understand possibility and availability of a broader area for professional development in corporate sectors like publication houses, coaching institutes, training centres, NGOs, INGOS, private and public offices etc. after graduation and create link with them (understanding)

CO2: Develop bases for corporate professional skills through the course of the internship in the broader areas as stipulated above (creating)

Module 1: Theory (5 Hours)

- Background: meaning, definition of intern and internship
- Significance of internship for a graduate
- Ethics of internship: learning platform, commitment, honesty, objectivity, accountability, discipline, solidarity, competence, respect, responsibility, communication etc.
- Internship Journal Register and assessment parameters

Module 2: Practical (25 Hours)

- The students will be given freedom to choose internship places for the areas specified above. In case they cannot, the Department will forge them the places. There will be a faculty Internship In-charge to facilitate the process.
- After allocation, at their place of internship the students will maintain the Internship Journal Register (as a part of assessment) as per the template.

INTERNSHIP JOURNAL REGISTER**Name of the Student:****ID:****Department:****Semester:**

Place of Internship:

Date	Day	Time in	Work Description	Time out	Sign of employer

- At the end of the internship, the place of internship will issue a certificate, as per the template; **confidential in a sealed envelope**. The Internship In-charge will communicate the internship places for it.

Name of the Institution

Ref:

Date: **Performance Certificate**

Certified that _____, from the **Department of English, Assam Don Bosco University**, has taken internship at this institution in _____ from _____ to _____. His/her performance during the course of the internship is **satisfying/moderately satisfying/highly satisfying**.

Seal and signature

Assessment: It is mandatory for the students to get pass marks in all the following:

7. Internship Journal Register	:		30
Performance Certificate			:30
<i>Satisfying</i>	:	5	
<i>Moderately satisfying</i>	:	10	
<i>Highly satisfying</i>	:	15	
8. Presentation (to a panel)	:		40
<i>Report (hard copy)</i>	:	20	
<i>Presentation (PPT)</i>	:	10	
<i>Interaction</i>	:	10	

Total: **100**

Mapping of COs to Modules

COs	Module I	Module II
CO1	H	
CO2		H

RESEARCH PROJECT /DISSERTATION

BA ENGLISH (Honours)				
Semes-ter	Category	Course Code	Course Name	Cred-its
7	Research Project/Dissertation	EGDI407P	Research Project Phase I	6
8	Research Project/Dissertation	EGDI408P	Research Project Phase II	6

BA ENGLISH (Honours) with Research				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	EGDI409P	Dissertation I	18
8	Research Project/Dissertation	EGDI410P	Dissertation II	20

BA ENGLISH (Honours)

ENDI407P: RESEARCH PROJECT PHASE I

(6 credits – 180 hours) (L-T-P: 0-0-12)

In this project (Phase I and II), students will write a **research paper**. This project aims at orienting and training students under a teacher supervisor in the literary research for exploring knowledge yet not discovered or critique the existing knowledge for innovation. This is also an exercise on developing critical faculty of the young minds in organizing, analysing, applying, objectifying, elucidating and creating novel ideas through enquiry that adds to the body of knowledge around literary studies. Here students are expected to set and qualify for the following components: **1) clear and researchable topic, 2) undergo a literature review with critical rigor, 3) set aims and objectives, 4) problematize the topic, 5) frame research questions, 6) adopt a functional methodology, 7) analyze texts/area under enquiry and 8) and draw a innovative objective conclusion** so as to make the paper publishable in referred/indexed journals. However, in this phase as Phase I, the students will complete only the **first four** components. The student will submit a hard-copy to the supervisors and the same will be assessed for qualification on the strength of the four components.

ENDI408P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-12)

The project phase II begins with the assumption that the students have qualified themselves in the initial phase of the research, the first four components. Under the supervisorship of a teacher, the students in this phase are expected to complete the other components of the research paper. This phase thus will combine both the phases and the students will complete the research paper with around 15 pages (approx 7000 words) and submit a hard copy to the supervisors in a prescribed template along with a plagiarism report with not more than 10% similarity index. As a part of its assessment, the paper will be judged on the strength of the components and the students have to pass the same for qualification of the degree BA English (Honours).

BA ENGLISH (Honours) with Research

ENDI409P: DISSERTATION I

(18 Credits -540 Hours) (L-T-P: 0-0-36)

This course aims at orienting and training students under a teacher supervisor in writing a dissertation for exploring knowledge yet not discovered or critique the existing knowledge for innovation. This is also an exercise on developing critical faculty of the young minds in organizing, analysing, applying, objectifying, elucidating and creating novel ideas through enquiry that adds to the body of knowledge around literary studies. In this phase of the dissertation, students are expected to set clear and **researchable topics, aims and objectives, undergo a literature review with critical rigor, problematize the topic, frame research questions, adopt a functional methodology, work on probable chapterization and assume probable**

outcomes, or in short attempt a dissertation proposal to be expanded in the Dissertation Phase II. The student will submit a hardcopy in a prescribed template to the supervisors and the same will be assessed for qualification on the above criteria for developing the critical faculty. There will be no viva-voce/interview in this phase as a part of the assessment.

ENDI410P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

The Dissertation II begins with the assumption that the students have qualified themselves in the initial phase, in terms of the proposal. Under the supervisorship of a teacher, the students in this phase are expected to develop the chapters with clearly set aims and objectives, analysis and come out with clear findings in tune with the aims and objectives set in the proposal in the Phase I. This phase thus will combine both the phases and the students will complete the dissertation with around 30 pages and submit the same in hardcopy in a prescribed template along with a plagiarism report not more than 10% similarity index. As a part of its assessment, the students will have to phase a viva-voce from an expert panel and pass the same for qualification of the degree BA English (Honours) with Research.

ENGLISH COURSES FOR AZARA CAMPUS

Part A: Course Structure

COURSES FOR AZARA CAMPUS

Part A: Course Structure

Semester	Category	Course Code	Course Name	Credits
EEE/ECE/CSE/AIML (1 st Semester); CVE/MNE (2 nd Semester)	Humanities & Social Science Course	EGTW107T	English for Technical Writing	2
BCOM/BBA/BCA/IMBA/IMCA – 3 rd Semester	Ability Enhancement	HSCE221T	Communicative English I	2
BCOM/BBA/BCA/IMBA/IMCA – 4 th Semester	Ability Enhancement	HSCE222T	Communicative English II	2
BCA/IMCA (1 st Semester)	Ability Enhancement	CAGE106T	General English I	2
CVE (6 th Semester)	Open Elective	CVIC0071	Soft Skills and Interpersonal Communication	3
AIML/CSE/EEE/ECE (1 st Semester); CVE/MNE (2 nd Semester)	Lab	EGOP108L	Oral Communication Practice Lab	1
M.Tech CSE/CVE/EEE/ECE/MNE (1 st Semester)	Audit	EGRW0015	English for Research Paper Writing	0
*MCA (3 rd Semester)	Audit	EGCS0110:	Communication Skills	0

* The syllabus for this course is pending approval in the DBOS meeting Autumn 2025.

Part B: Detailed Syllabus

EGTW107T: ENGLISH FOR TECHNICAL WRITING

(2 Credits- 30 hours) (L-T-P: 2-0-0)

Course Objective: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Outcomes:

CO1: *Categorize* the different methods of word formation in language (Analyzing)

CO2: *Determine* the various errors in sentence constructions (Evaluating)

CO3: *Develop* writing skills of students (Creating)

Module I: Vocabulary Building

(6 hours)

The concept of Word Formation

Root words from foreign languages and their use in English

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

Synonyms, antonyms, and standard abbreviations.

Module II: Basic Writing Skills

(6 hours)

Sentence Structures

Use of phrases and clauses in sentences

Importance of proper punctuation

Creating coherence

Organizing principles of paragraphs in documents

Techniques for writing precisely

Module III: Identifying Common Errors in Writing

(5 hours)

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies, Clichés

Module IV: Nature and Style of Sensible Writing

(6 hours)

Describing, Defining, Classifying, Providing examples or evidence, Writing introduction and conclusion

Module V: Writing Practices

(7 hours)

Comprehension, Précis Writing, Essay Writing, Structure & Drafting of Technical Report Writing, Formal Letter/Application Writing, Formal Email Writing,

Suggested Readings

1. *Practical English Usage*. Michael Swan. OUP. 1995.

2. *Remedial English Grammar*. F.T. Wood. Macmillan. 2007

3. *On Writing Well*. William Zinsser. Harper Resource Book. 2001

4. *Study Writing*. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.

Mapping of COs to Syllabus

COS	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	M	M	M
CO2	M	H	H	H	H
CO3	H	H	M	H	H

HSCE221T: COMMUNICATIVE ENGLISH I

(2 Credits – 30 hours)(L-T-P: 2-0-0)

Objective: The objective of this course is to equip the learners with the basic skills of effective communication in English language in all real life contexts, with a reasonable fluency and clarity. The course is intensely practice oriented and it specifically attempts to:

Familiarize the students with the basic tools of oral communication.

Teach the students to use grammar in meaningful contexts.

To enable the students to communicate in English confidently.

Develop negotiation and presentation skills

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: Classify the rules of Grammar & Phonetics for effective communication (Analyse)

CO2: Identify the key negotiation and presentation skills (Apply)

CO3: Develop critical appreciation of a literary text (Create)

Module I: Fundamentals of Communication:

(5 hours)

Definition, types and process of communication; elements and flows of communication; barriers to communication and strategies to overcome them; interpersonal communication; importance of listening skills; non-verbal communication/ body language

Module II: Essential grammar of English: An Introduction

(5 hours)

Parts of speech; Basic sentence structures; Articles; Prepositions; Person and number; Tenses and their uses; Subject –verb agreement; Vocabulary building; Common idioms and phrases

Module III: Basic tools of oral communication in English

(5 hours)

Syllables, stress –pattern and intonation

Consonants, vowels and diphthongs

Differences between spoken and written English

Module IV: Functional English: Structural Conversation Practice

(5 hours)

Telephonic conversation; Agreement, disagreement; Hypothetical conditions, Interjection, exclamation, emotion emphasis; Expressions of hope, disappointment, surprise, concern, worry; Willingness, wish, intention; Commands, requests, advice, promise, threat; Greetings, small talk, congratulations, condolences, offers, invitations

Module V: Select Literary Texts: Reading and Comprehension

(5 hours)

1. "The Gift of the Magi" - O Henry
2. "Night of the Scorpion" – Nissim Ezekiel
3. "The Road Not Taken" – Robert Frost
4. "The Lake Isle of Innisfree" – William Butler Yeats
5. "The Doll's House" – Katherine Mansfield

Module VI: Negotiation and Presentation Skills

(5 hours)

Negotiation techniques, collaborative vs. competitive negotiation, persuasive communication strategies, communication skills for resolving conflicts; public speaking skills, overcoming stage fright, structuring and delivering impactful speeches, presentation skills – designing professional slides using tools like PowerPoint, visual aids –charts, graphs and images; techniques to express effectively in group discussions, how to face an interview – tips and strategies

Suggested Readings:

1. Leech, Geoffrey and Jan Svartvik, *A Communicative Grammar of English*, Third edition, Pearson Education, 2002.
2. Sasikumar, V and Dhamija, P.V, *Spoken English*, Tata McGraw Hill, New Delhi.
3. Taylor, Grant, *English Conversation Practice*, Tata McGraw Hill, 1975.
4. Dixon, Robert J., *Everyday Dialogues in English*, Prentice Hall India, 2006.
5. Apte, Madhabi, *A Course in English Communication*, Prentice Hall India, 2007.
6. Seely, John, *The Oxford Guide to Writing and Speaking*, Oxford.
7. Plathottam, George, *Public Speaking: Resource Book for Effective Communication*, Don Bosco Publications, Guwahati, 2007.
8. An Anthology of Short Stories, prepared by Department of Humanities and Social Sciences, Assam Don Bosco University, for private circulation, 2014.

Mapping of COs to Modules

COs	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	M	H	L	H	H	M
CO 2	H	M	M	M	M	H
CO 3	M	M	L	M	H	H

HSCE222T: COMMUNICATIVE ENGLISH II

(2 Credits – 30 hours) (L-T-P: 2-0-0)

The objective of this course is to:

- To develop an awareness in the students about writing as an exact and formal skill
- To equip them with the components of different forms of writing
- To enable the students to familiarize with the emerging trends in business communication
- To develop strategies for effective cross-cultural collaborations

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

- CO1:** Utilize the different formats of business and digital communication (**Apply**)
- CO2:** Examine the different strategies of cross-cultural communication (**Analyze**)
- CO3:** Develop reading comprehension skills of students (**Create**)

Module I: Digital and Technological Communication (6 hours)

Leadership communication- building trust and credibility through communication; crisis communication- handling media and public relations during crisis; emerging trends in business communication – different digital communication platforms; leveraging AI in communication; social media management and professionalism

Module II: Business Letters (4 hours)

- Introduction—layout, structure, categories of business letter
- Rules of good writing
- Recruitment correspondence—application, CV, interview, offer, acceptance, etc.
- Technical report writing

Module III: Telecommunication (3 hours)

- Fax and email
- Internet, intranet, extranet

Module IV: Internal communication (3 hours)

- Memos - structure, tone; b) Reports - formal, informal; c) Proposals; d) Meetings, minutes, agenda

Module V: Persuasive communication (3 hours)

- Circulars, sales letters
- Publicity materials - Public relations, news release, newsletters
- Notice, advertisements, leaflets

Module VI: Global and Cross-Cultural Communication (6 hours)

Cultural Sensitivity and Adaptability; understanding cultural differences in communication styles; strategies for effective cross-cultural collaboration; Global business etiquette; cross-cultural negotiations; multilingual and multimodal communication; leveraging translation tools for global communication; effective use of digital communication platforms for diverse audiences

Module VII: Select Literary Texts: Reading and Comprehension (5 hours)

1. "Haflong Hills" - Kallol Choudhury
2. "The Solitary Reaper" – William Wordsworth
3. "Fire and Ice" – Robert Frost
4. "Death, Be Not Proud" – John Donne

5. "Cat in the Rain" – Ernest Hemingway

Suggested Readings:

1. Taylor Shirely, *Communication for Business: A Practical Approach*, Fourth edition, Pearson Education, 2005.
2. Rutherford, Andrea J., *Basic Communication Skills for Technology*, Pearson Education, 2001.
3. Mitra, Barun K, *Effective Technical Communication*, OUP, 2006.
4. Sen, Leena, *Communication Skills*, Prentice Hall India, 2007.
5. Brian, M.H. Robinson, et al, *Communicative Competence in Business English*, Orient Longman, 1988.
6. Kaul, Asha, *Effective Technical Communication*, Prentice Hall, 2006.
7. *The Oxford Anthology of Writings from North -East India* (Fiction) edited by Tilottoma Misra, OUP, 2011.

Mapping of COs to Modules

Cos	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5	Mod 6	Mod 7
CO1	H	H	H	H	H	M	M
CO2	M	L	L	L	L	H	H
CO3	H	M	M	M	M	H	H

GENERAL ENGLISH – I

(2 Credits – 30 Hours) (L-T-P: 1-0-1)

The objective of this course is:

- CO1.** To provide learning environment to practice listening, speaking, reading and writing skills. **(Understand)**
- CO2.** To assist the students to carry on the tasks and activities through guided instructions and materials. **(Analyse)**
- CO3.** To effectively integrate English language learning with employability skills and training. **(Evaluate)**
- CO4.** To provide hands-on experience through case-studies, mini-projects, group and individual presentations. **(Create)**

Module I: Vocabulary Building

The concept of word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

Module II: Basic Writing Skills

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

Module III: Identifying Common Errors in Writing

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies

Module IV: Nature and Style of sensible Writing

Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion

Module V: Writing Practices, Comprehension, Précis Writing, Essay Writing

Module VI: Oral Communication (This Module involves interactive practice sessions in Language Lab)

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

Suggested Readings:

1. AICTE's Prescribed Textbook: Communication Skills in English (with Lab Manual), Anjana Tiwari, Khanna Book Publishing Co., 2023.
2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. Remedial English Grammar. F.T. Wood. Macmillan. 2007
5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
7. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
8. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Mapping of COs to Modules

Cos	Mod 1	Mod 2	Mod 3	Mod 4	Mod 5	Mod 6
CO1	H	M	H	L	L	H
CO2	M	M	L	M	M	M
CO3	H	M	M	M	M	H
CO4	L	M	L	H	H	M

CVIC0071 – SOFT SKILLS AND INTERPERSONAL COMMUNICATION
(3 credits – 45 hours) (L-T-P:3-0-0)

The objective of this course is:

- To equip students with the vital communication and soft skills.
- To succeed in the highly competitive international arena.
- To impart fundamental soft skills and their practical social and workplace usage.
- To enable students to identify and overcome the barriers in interpersonal relationships, and to employ oral and written communication, teamwork, leadership, problem-solving and decision-making skills, to gain best results.

COURSE / LEARNING OUTCOMES

At the end of the course, students will be able to:

CO1: Understand the significance and essence of a wide range of soft skills. **(Understand)**

CO2: Apply soft skills in a wide range of routine social and professional settings. **(Apply)**

CO3: Employ soft skills to improve interpersonal relationships. **(Evaluate)**

CO4: Enhance employability and ensure workplace and career success. **(Create)**

Module I: (10 hours)

1. Soft Skills: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurement of Soft Skill Development.
2. Self-Discovery: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue.
3. Positivity and Motivation: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.

Module 2: (12 hours)

1. Interpersonal Communication: Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation.
2. Public Speaking: Skills, Methods, Strategies and Essential tips for effective public speaking.
3. Group Discussion: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective.
4. Non-Verbal Communication: Importance and Elements; Body Language.
5. Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills.

Module3: (11 hours)

1. Interview Skills: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview, Tips for Success.
2. Presentation Skills: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness.
3. Etiquette and Manners – Social and Business.
4. Time Management – Concept, Essentials, Tips.
5. Personality Development – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.

Module 4: (12 hours)

1. Decision-Making and Problem-Solving Skills: Meaning, Types and Models, Group and Ethical Decision-Making, Problems and Dilemmas in application of these skills.
2. Conflict Management: Conflict - Definition, Nature, Types and Causes; Methods of Conflict Resolution.
3. Stress Management: Stress - Definition, Nature, Types, Symptoms and Causes; Stress Analysis Models and 8 Impact of Stress; Measurement and Management of Stress
4. Leadership and Assertiveness Skills: A Good Leader; Leaders and Managers; Leadership Theories; Types of Leaders; Leadership Behaviour; Assertiveness Skills.
5. Emotional Intelligence: Meaning, History, Features, Components, Intrapersonal and Management Excellence; Strategies to enhance Emotional Intelligence.

Suggested Readings:

1. Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

Mapping of COs to Modules

Cos	Mod 1	Mod 2	Mod 3	Mod 4
CO1	M	M	H	H
CO2	M	M	H	H
CO3	H	M	M	M
CO4	M	M	H	H

EGOC6005: ORAL COMMUNICATION PRACTICE LAB

(1Credit)(L-T-P:0-0-2)

(This unit involves interactive practice sessions in Language Lab)

1. Listening Comprehension
2. Pronunciation, Intonation, Stress and Rhythm
3. Common Everyday Situations: Conversations and Dialogues
4. Communication at Workplace
5. Interviews & Speeches
6. Formal Presentations

COURSE/LEARNING OUTCOMES

After the completion of this Lab the students will be able to:

- CO1:** List out the different vowel sounds and consonant sounds (Remembering)
CO 2: Illustrate the stress and intonation patterns in language. (Understanding)
CO3: Identify the erroneous pronunciations. (Applying)
CO4: Compare the pronunciation of similar sounding words. (Analysing)
CO5: Discuss the tips for facing an interview. (Evaluating)
CO6: Determine the common patterns in everyday conversations and dialogues. (Creating)

Suggested Readings:

1. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

2. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

EGRW0015: ENGLISH FOR RESEARCH PAPER WRITING

(Audit Course)

Objectives: Students will be able to:

- *Understand how to improve your writing skills and level of readability*
- *Learn about what to write in each section*
- *Understand the skills needed when writing a Title. Ensure the good quality of paper at very first-time submission.*

Module I: (4 hours)

Planning and Preparation, Word Order, Breaking-up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Module II: (4 hours)

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction.

Module III: (4 hours)

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

Module IV: (4 hours)

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Module V: (4 hours)

Skills are needed when writing the Methods, skills are needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Module VI: (4 hours)

Useful phrases, how to ensure paper is as good as it could possibly be the first-time submission

Suggested Readings:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.
4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg

DEPARTMENT OF MASS COMMUNICATION

PROGRAMME: BACHELOR OF ARTS in MASS COMMUNICATION (BA) DEGREE: BA MASS COMMUNICATION (HONOURS)/ BA ENGLISH (HONOURS) WITH RESEARCH

VISION:

To be a centre of excellence in teaching, learning and research committed to mould ethical and socially responsible media professionals and entrepreneurs who can deliver professional content for diverse media platforms.

MISSION:

The Department of Mass Communication seeks to:

Achieve excellence in teaching, learning and research.

Promote critical thinking and problem-solving skills.

Equip learners by combining the theoretical aspects with creative innovation and entrepreneurship practices.

Mould ethical and socially responsible media professionals and entrepreneurs.

Provide knowledge base and consultancy services to the community in the field of media and communication.

PROGRAM OUTCOMES

PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO 7: **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PROGRAMME SPECIFIC OUTCOMES

PSO 1: **Knowledge of Communication:** An ability to define and identify the various fields of mass communication.

PSO 2: **Developing Critical Understanding:** An ability to understand the theories and practices of communication that prepares learners for future careers in mass media or for further studies.

PSO 3: **Developing Technical Skills:** An ability to apply media technology skills as well hone written and spoken communication skills essential for various media platforms.

PSO 4: **Enhancing Professional Skills:** An ability to analyze and assess responsibilities as professionals in the field of media.

PSO 5: **Creating Multimedia Content:** An ability to create media programmes for varied media audience needs.

MAPPING OF COURSES TO PO/PSOS

SL.	Name of Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
1	Introduction to Media and Communication	H	L	L	M	L		M	H	H	M	M	M
2	Introduction to Journalism	H	H	H	M	H	L	M	M	M	H	H	H

3	Professional Communication	L	H	H	H	M	L	H	L	L	H	M	M
4	History of Media	H	H		M	L		L	H	M	M	M	M
5	Visual Communication	H	H	M	M	M		H	H	M	H	M	H
6	Graphic Design	M	H	H	M	M		H	H	H	H	M	H
7	Community Media and Society	H	H	H	H	M	M	H	M	H	H	H	H
8	Introduction to Video Production	M	H	H	M	H	L	H	H	H	H	H	H
9	Public Relations and Corporate Communications	H	H	H	M	H	L	H	H	H	M	H	M
10	Introduction to New Media	M	H	H	L	H		M	H	M	H	M	H
11	Media, Culture and Society	H	M	M	M	M	L	M	H	M	H	M	M
12	Radio Production	M	H	H	H	M	L	L	H	H	H	H	H
13	Data Journalism	H	H	M	H	H	M	H	H	H	H	H	M
14	Advertising	H	H	H	M	M	L	L	H	H	H	M	M
15	Development Communication	H	H	H	H	M	M	M	M	M	H	M	H
16	Media Laws and Ethics	M	M	M	H	H	H	H	H	L	H	H	L
17	News Reading and Anchoring	H	H	H	H	H	H	H	H	H	H	M	H
18	Folk Media	M	H	H	H	H	M	L	H	M	L	M	L
19	Writing for Media	H	H	M	M	H	L	M	H	H	H	M	L
20	Introduction to Research	H	H	H	M	H	M	H	M	H	H	H	M
21	Communication for Social Behavioural Change	H	H	H	H	H	M	M	H	H	M	H	M
22	Media Management and Entrepreneurship	H	H	M	H	M	M	H	H	H	H	H	L
23	Digital Photography	M	H	M		L		H	H	H	H	H	H
24	Communication and Disaster Management	M	H	H	H	H	H	M	H	H	H	H	M
25	Animation and VFX	H	H	H	M	L		H	H	H	H	H	H
26	Global Media and Politics	H	L	M	H	H	L	L	H	H	L	M	M
27	Film Studies	H	M	L		M		H	H	H	H	H	M
28	Documentary Production	H	H	H	M	M		H	H	H	H	H	H
29	Media in North East India	H	H	H	H	H	H	H	M	H	H	H	H
30	Media Project	H	H	H	H	H	H	H	L	L	H	H	H

DETAILED SYLLABUS MAJOR COURSES

Semes-ter	Category	Course Code	Course Name	Credits
1	Major Course 1	MCIM100T	Introduction to Media and Communication	4
2	Major Course 2	MCIJ101T	Introduction to Journalism	4
3	Major Course 3	MCVC200T	Visual Communication	4
3	Major Course 4	MCAD201T	Advertising	4
4	Major Course 5	MCIV202T	Introduction to Video Production	5
4	Major Course 6	MCPR203T	Public Relations and Corporate Communications	5
4	Major Course 7	MCML204T	Media Laws and Ethics	4
5	Major Course 8	MCDC300T	Development Communication	5
5	Major Course 9	MCDP301T	Digital Photography	5
5	Major Course 10	MCAV302T	Animation and VFX	4
6	Major Course 11	MCFS303T	Film Studies	4
6	Major Course 12	MCMS304T	Community Media and Society	4
6	Major Course 13	MCMS305T	Media, Culture and Society	4
6	Major Course 14	MCMP306P	Media Project	4
7	Major Course 15	MCGM400T	Global Media and Politics	5
7	Major Course 16	MCMM401T	Media Management and Entrepreneurship	5
8	Major Course 17	MCMN402T	Media in North East India	5
8	Major Course 18	MCDJ403T	Data Journalism	5

MCIM100T: INTRODUCTION TO MEDIA AND COMMUNICATION

(4 Credits – 60 hours) (L-T-P: 4-0-0)

Objective:

The objective of the course is to learn the key concepts in communication and mass communication in order to evaluate communication in its many forms and investigate its relationship to society and culture.

Course Outcomes:

At the end of this course students will be able to:

CO 1: Define the basic terms related to Communication (Remembering)

CO 2: Classify different types and models of communication (Understanding)

CO 3: Analysis effects of media on society (Evaluating)

Module I: Media and Everyday Life (12 hours)

Television, Print, Radio, Advertisement, Digital media, The internet – discussion around media and everyday life, Discussions around mediated and non-mediated communication.

Module II: Communication and Mass Communication (13 hours)

Forms of communication, Levels of communication, Mass communication and its process, Normative theories of the Press, Gatekeeping theory, Media and the public sphere.

Module III: Four Models of Communication (15 hours)

Aristotle's Model, SMCR Model, Harold Lasswell's Model, Shannon and Weaver's Model, David Berlo's Model

Module IV: Mass Communication and Effects Paradigm (20 hours)

Direct effects – propaganda and mass society theory, Limited effects – individual difference theory and personal influence theory, Cultural effects – agenda setting; spiral of silence; cultivation analysis, Uses and gratification theory, Critique of the effect's paradigm and emergence of alternative paradigm, Reception theory.

Suggested Readings

Cell Phone Nation: How Mobile Phones Have Revolutionized Business, Politics and Ordinary Life in India, Robin Jeffrey, 2013, Hachette

Handbook of Journalism and Mass Communication, Virbala Aggarwal, 2012, Concept Publishing Company
Introduction to Communication Studies, John Fiske, 2010, Routledge

Mass Communication in India, Keval J. Kumar, 2020, Jaico Publishing House

Mass Communication Theory, Indian Edition, Baran and Davis, 2006, SouthWest Coengage Learning 6.
Mass Communication Theory, McQuail Dennis, Sage Publications

The Indian Media Business, Fourth Edition, Vanita Kohli-Khandekar, 2017, Sage Publications India

Understanding Media Theory, Kevin Williams, 2017, Bloomsbury Academic India

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	L	H	L	M
CO2		L	H	
CO3	L	M		H

MCIJ101T: INTRODUCTION TO JOURNALISM

(4 Credits – 60 hours) (L-T-P: 2-0-2)

Objective:

The primary objective of this course is to offer a comprehensive exploration into the concepts, principles, and practices of journalism, enabling students to gain a profound understanding of the field.

Course Outcomes:

At the end of this course students will be able to:

CO 1: Define the concepts, meanings and functions of journalism (Remembering)

CO 2: Discuss the meaning and functions of news (Understanding)

CO 3: Use the tools and techniques of journalism for writing and producing news stories (Apply).

Module 1: Understanding Journalism (20 hours)

Meaning and Definition of Journalism, Growth of Journalism, Type of Journalism, Functions of journalism, Difference between print, electronic and online journalism, citizen journalism, media role in democracy, public sphere, journalism ethics.

Module 2: Understanding News (20 hours)

Meaning and definition of news, nature, elements of news, sources of news, process: from the event to the reader, Hard news vs. Soft news, basic components of a news story, Attribution, embargo, verification, balance and fairness, brevity, dateline, credit line, by-line.

Module 3: News Structure and Writing Techniques (20 hours)

Types of reporting: Objective, Interpretative and Investigative, Organising a news story, Robert Gunning: Principles of clear writing, Principles of Writing: 5W's and 1H, Inverted pyramid, criteria for newsworthiness, principles of news selection, use of archives, Types of Writing: News, Feature, Interview, Column, Editorial, Review, Letter to Editor.

Suggested Readings

An Introduction to Journalism, Carole Flemming and Emma Hemingway, 2006, Vistaar Publications

Modern Journalism and news writing, Sativa Chadda, 1998, Popular Prakashan

Mass Media in a Changing World, George Rodmann, 2007, McGraw Hill Publication

News writing and reporting for today's media, Itule D. Bruce and Douglas A. Anderson, 2002, McGraw Hill
 Publication 5. News writer's Handbook: An Introduction to Journalism, M.L. Stein, Susan Paterno and R. Christopher Burnett, 2006, Blackwell Publishing

The Newspaper's Handbook, Richard Keeble, 2006, Routledge Publication.

The Journalistic Hand Book, M.V Srivastava, Sterling Publishers

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H	M	
CO2		H	H
CO3		H	H

MCVC200T: VISUAL COMMUNICATION

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective

The main objective of the paper is to make students understand the various means of communication, both oral and visual. It will also make students knowledge about the filed of editing and designing using various fonts, typography and printing. It will also make student knowledge about the importance of sign and symbols, its uses and importance.

Course/Learning Outcomes:

CO 1: Define and analyse the concepts and theories of visual communication (Remembering)

CO 2: Illustrate the fundamentals of design (Understanding)

CO 3: Apply the knowledge of the elements and principles of design to solve real world design problems (Applying)

CO 4: Analyse the various design requirements for various purposes (Analyse)

CO 5: Evaluate how specific visual arts and design convey meaning (Evaluating)

CO 6: Create and compose artistic ideas and works of art with internal and external meaning (Creating)

Module 1: Introduction to Visual Communication (10 Lectures)

Visual communication - Definition; nature and functions, Characteristics and types of visual communication, Advantages and disadvantages, Techniques of visual communication.

Module 2: Design (10 Lectures)

Graphic design, Digital design, Graphic design Vs. Digital design, Typography - Fonts and typefaces, Computer configuration, Scanner, Printer, Paper size - type and quality, Formats and Resolution, Raster vs. Vector images

Module 3: Fundamentals of Design (15 Lectures)

Gestalt theory, Definition, approaches and centrality of design, Elements of Design – symmetry; rhythm; contrast; balance; mass and scale, Perception, Illusions.

Module 4: Principles of Visual Communication (15 Lectures)

Principles of Visual Communication; Colour psychology and theory, Semiotics, Sign and code, Index and symbol, Dyadic and triadic model of sign, Types of code, Branches of semiotics, Denotation, Connotation and Myth.

Suggested Readings

Digital Graphic Design, K.R. Pender, 1997, Butterworth-Heinemann

Designing for Print, C. Conover, 2011, John Wiley and Sons

Good: An Introduction to Ethics in Graphic Design, L. Roberts, 2006, Ava Publishing

Graphic design basics, A. E. Arntson, 2011, Cengage Learning

Lateral Thinking: Creativity Step by Step, Edward De Bono, Harper and Row Publishers

Manual of Graphic Technique 2: For Architects, Graphic Designers, and Artists, Tom Porter and Sue Goodman, Astragal Books

Reading images: The grammar of visual design, G. R. Kress and T. Van Leeuwen, 1996, Psychology Press
 Palmer, Frederic. Visual Elements of Art and Design, 1989, Longman

Seeing Is Believing: An Introduction to Visual Communication, A.A. Berger, 1989, Mayfield Publishing Company

The Complete Guide to Digital Graphic design, B. Gordon and M. Gordon, 2002, Watson-Guptill Publications
Visual Communications: Images with Messages, E. Lester, 1998, Thomson Learning

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	H
CO 4			H	H
CO 5				H
CO 6			H	H

MCAD201T: ADVERTISING

(4 Credit-60 Hours) (L-T-P: 4-0-0)

Objective(s):

The objective of the course is to learn the concepts of advertising and its classification and functions and trace the evolution of branding and understand the concept and characteristics of brands.

Course Outcomes

CO 1: Define the basic terms related to advertising. (Remembering)

CO 2: Demonstrate the scope, functioning of advertising (Understanding)

CO 3: Apply the knowledge of Branding & Planning. (Applying)

Module I: Introduction to Advertising (15 Hours)

Advertising – concept; classification and functions, Media of advertising, Advertising as a key element in the promotional mix of marketing, Evolution of advertising – World and India, Difference between advertising and publicity, Marketing communication and propaganda

Module II: Theoretical Aspects of Advertising (15 Hours)

Geographical Spread, Target Group, Public awareness advertising, Product advertising, Service advertising, Corporate advertising, Public relations advertising, Financial advertising, Global advertising, Political advertising,

Stimulus response theory, Starch model, FLIRT model, AIDA, AIDCA, DAGMAR approach, Aspects of Consumer Behaviour - Analysing Human Behaviour; Market Segmentation

Module III: Brand Management & Strategic Planning (15 Hours)

Evolution of branding, Concept of a brand, Characteristics of brands, The Importance of brand planning Understanding brand management, Theories and models in brand management, Brand Prism Model, Perceptual

Mapping, Brand Name Spectrum, Brand Positioning, Brand Benefits, Consumer Benefits, Brand Matrix and Media Matrix, Introduction to Strategic Planning and Client Servicing

Module IV: Practicum (15 Hours)

Advertising Campaign Development, Market Research, Target Audience Analysis, Campaign Strategy Development, Message Creation, Media Selection, Budgeting, Designing Advertisements: Print Advertising, Storyboarding for TV Commercials, Digital Advertising, Visual and Textual Content Creation, Brand Audit and Analysis, Case Study Analysis, Strategic Planning and Client Servicing Simulation: Strategic Planning in Advertising, Client Servicing in Advertising Agencies, Developing Strategic Advertising Plans, Client Communication and Feedback

Suggested Readings:

Jethwaney, Jaishri and Jain, Shruti (2012). *Advertising Management*.

Ogilvy, David. *Ogilvy on Advertising*, Prion.

Dennison, Dell. *The Advertising Handbook*, Jaico Books

Vilanilam J. V & Verghese A.K. *Advertising Basics*, Sage Publications, India

Clifton Rita & John Simmons. *Brands and Branding*, Profile Books Ltd. UK.

Mapping of Cos to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2	H	H	H	H
CO3		H		H

MCIV202T: INTRODUCTION TO VIDEO PRODUCTION

5 Credits: (75 HOURS) (L-T-P: 3-2-0)

Objective

The objective of this paper is to make the students clear and handy in camera shooting and editing, using various softwares and camera equipments. Students will have more knowledge in writing and sound editing. The students will also be aware of various news broadcasting and genres, news elements and various camera shots too.

Besides learning the techniques of television production, students will also learn to be proficient in the use of video editing software. At the end of the course, students will prepare a short television production/news reading/PSA etc, which will be submitted as a requirement for the completion of the course.

Course/Learning Outcomes:

CO 1: Define the meaning and concept of broadcast media (Remembering)

CO 2: Understand the principles and techniques of broadcast media (Understanding)

CO 3: Demonstrate competency in shooting and editing video (Applying)

CO 4: Critique the issues and debates in news broadcasting and production

(Analysing) CO 5: Produce content for broadcast media (Creating)

Module 1: Basics of Visual Images (10 Lectures)

What is an image, electronic image, television image - Digital image, Editing images, What is a visual? (Still to moving) - Visual Culture - Changing images if visual - Characteristics of Television as a medium.

Module 2: Basics of Sound (15 Lectures)

Concepts of sound-scape, sound culture - Types of sound-Sync, Non-Sync, Natural sound, Ambience Sound - Sound recording techniques - Introduction to microphones - Characteristics of Radio as a medium – Introduction to Audio Production.

Module 3: Writing and Editing Radio News (10 Lectures)

Elements of a Radio News Story: Gathering, Writing/Reporting - Elements of a Radio News Bulletin - Working in a Radio Newsroom - Introduction to Recording and Editing sound.

Module 4: Writing and Editing Television News (15 Lectures)

Basics of a Camera- (Lens & accessories) – Types of Shots - Electronic News Gathering (ENG) & Electronic Field Production (EFP) - Visual Grammar – Camera Movement, Types of Shots, Focusing, Visual Perspective. Elements of a Television News Story: Gathering, Writing/Reporting. Elements of a Television News Bulletins - Basics of Editing for TV.

Module 5: Broadcast News (10 Lectures)

Critical Issues and Debates - Public Service Broadcasters - AIR and DD News - Voice of India? (Analysis of News on National Broadcasters) Changing Character of Television News (24 -hrs news format, News Production cycle, News 'Lingo', News 'Formulae'? News as Event, Performance and Construction.

Suggested Readings:

Broadcast News Writing, Reporting and Producing, 7th Edition, Frank Barnas, 2017, Routledge

Broadcasting in India, P.C Chatterjee, 1987, Sage Publications

Broadcast Journalism, 1st Edition, S C Bhatt, 2007, Har-Anand Publications

Broadcast Journalism: Techniques of Radio and Television News, 7th Edition, Ray Alexander and Peter Stewart, 2016

The Radio Handbook, Routledge, by Carrol Fleming, 2002

The Indian Media Business, Vanita Kohli-Khandekar, 2017, Sage Publications

Television Production and Broadcast Journalism, Philip L. Harris, 2011

Television Production Handbook, 12th Edition, Zettl Herbert, 2014, Wadsworth Publishing Co Inc

The Television Reader, and Routledge, Robert C Allen and Annette Hill, 2004, 10-40

Documentary- 'The future of Television News.'

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H			H
CO2	H	H		H	
CO3	H				
CO4			H		
CO5	M	M	M	M	M

TELEVISION PRODUCTION

Credits: 2 (0-0-2)

Description

Students will acquire introductory skills and knowledge about the art of television production. They will learn to comfortably handle digital video cameras as well as apply the techniques of camera movements and camera angles. They will also learn preproduction, production and post-production techniques. Besides learning the techniques of television production, students will also learn to be proficient in the use of a video editing software. At the end of the course, students will prepare a short television production which will be submitted as a requirement for the completion of the course.

Suggested Assignments:

Public Service Advertisement (PSA), Commercial Advertisement, Talk shows, News Bytes, Music Video, Television Interviews, Shortfilms and documentaries.

MCPR203T: PUBLIC RELATIONS & CORPORATE COMMUNICATION

(5 credit: 75 Hours) (L-T-P: 5-0-0)

Objective(s):

The objective of the course is to understand the concept and genesis of public relation, corporate communication and learn the techniques for effective public relations & corporate communication.

Course Outcomes:

CO 1: Trace the evolution of Public relations & Corporate Communication (Remembering)

CO 2: Discuss the concept and tools of Public relations & Corporate Communication (Understanding)

CO 3: Apply the concepts, principles and tools of Public relations & Corporate Communication (Applying)

Module 1: Public Relations-Concepts and practices (15 lectures)

Introduction to Public Relations, Growth and development of PR, Importance, Role and Functions of PR, Principles and Tools of Public relations, Organisation of Public relations: In-house department vs consultancy, PR in govt. and Private Sectors, Govt's Print, Electronic, Publicity, Film and Related Media Organizations.

Module 2: PR-Publics and campaigns (10 lectures)

Research for PR, Managing promotions and functions, PR Campaign-planning, execution, evaluation, Role of PR in Crisis management, Ethical issues in PR-Apex bodies in PR- IPRA code - PRSI, PSPF and their codes.

Module 3: Corporate Communication (20 lectures)

Definitions, concept and genesis, CC and public affairs, Publics in CC-Financial publics, media, opinion makers, government, elected representatives, Present state of CC, Organising corporate communication activities, Areas of strategic thinking in corporate communication Ethics and laws in corporate communication Lobbying, Sponsorship, Financial communication, Corporate reputation. Corporate Social Responsibility- its importance, CSR focus areas and practices: environmental conservation, energy conservation, disaster management, workplace health and safety, consumer rights advocacy, community development.

Module 4: Practicum (15 lectures)

Public Relations Practice: Develop a PR strategy., Create a press release., PR crisis situation and devise a response plan, PR Campaign Planning and Execution: PR Campaign Planning, Execution Strategies, Evaluation Techniques, Corporate Communication (CC) Strategies, Public Affairs, Financial Communication Develop CSR project proposal, Communication plan to promote the CSR initiative.

Suggested Readings

Effective Public Relations and Media Strategy, 3rd Edition, Reddi C.V. N, 2013, PHI Learning Pvt Ltd
 Handbook of Public Relations, Heath Robert L, 2000, Sage Publications.
 Public Relation Techniques, Jefkins Frank, 1994, Heinmann Ltd
 Public Relations Strategies & Tactics, Wilcox, 2009, Pearson Education
 Communication in Organisations, Fisher, D., 1999, Jaico Publishing House
 Corporate Communication: Principles and Practice, Jaishri Jethwaney, 2018, Sage Publications
 Crisis Communication Strategies: How to Prepare in Advance, Respond Effectively and Recover in Full, 1st Edition, Amanda Coleman, 2020, Kogan Page

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2	H	H	H	H
CO3				H

MCML204T: MEDIA LAWS AND ETHICS

Credits: 4 (2-0-2)

Objectives:

By the end of this course on Media Laws and Ethics, students will be able to understand and apply legal and ethical frameworks that govern media practices, ensuring responsible and ethical decision-making in media-related professions.

Course Outcomes:

CO 1: Discuss media laws and ethics in India and global context (Remembering)
 CO 2: List the salient features of the Indian Constitution in relation to the media (Understanding)
 CO 3: Demonstrate an understanding of the nature of ethics and morality in journalism (Applying)
 CO 4: Critique the ethical issues of the media (Analyzing)

Module 1: Introduction to Indian Constitution (10 Lectures)

Preamble-Salient Features, Fundamental Rights and Duties, Features of Article 19 (1A) and 19 (2), Directive Principles of State Policy, Indian Judiciary and Parliamentary System, Press as fourth estate of democracy.

Module 2: Media Laws (15 Lectures)

Freedom of Press and Reasonable Restriction, Defamation, Contempt of Court, Sedition and Obscenity, Emergence of Censorship, Vernacular Press Act, Right to Information Act, IT Act and Cyber Law 2000, Restrictions on Media, Official Secrets

Act, Judiciary and Contempt of Court, Legislature and its Privileges, IPC and Cr. PC, Censorship and its different forms- Right to Privacy, Laws related to Press & Broadcast Media, Copyright Act: Main features, issues, Books and Newspapers Registration Act, Working Journalists Act, Press Council Act and Role of PCI.

Module 3: Digital Laws (10 Lectures)

Cable TV Network Regulation Act, Cinematography Act, Prasar Bharti Act, Digitization and Conditional Access System (CAS),

Cyber laws: The need for cyber laws, Cyber preparedness across the globe, Regulatory authorities and framework, New IT Rules 2021.

Module 4: Media and Ethical Principles (15 Lectures)

Importance of Media Ethics, Fairness and Objectivity, Code of Ethics in Advertising and Films, Rationale and Evolution of Journalistic Ethics, Journalistic Values: Concept, Importance and Debates, Journalists' Code of Conduct, Resolving Ethical

Dilemmas, Media Regulation, Regulatory practices in developed democracies, Debates and Controversies related to Media Regulation, Regulation of Broadcast, Press and Web, Different forms of Regulation: State Regulation, Self-Regulation, CoRegulation, Press Ombudsman: Readers' Editor.

Module 5: Media Organisations (10 Lectures)

International Bodies: International Press Institute, Role of UNESCO, SAFMA, Press Council, TRAI, BRAI, IBF, CBFC, INS, Editors Guild, IFWJ, IJA, NUJ, IUJ, NBA, BEA, Trade Union Rights in Media.

Suggested Readings:

Constitution of India, I.S. Vidyasagar, 2006, ABD Publishers

Freedom of Press: Under the Indian Constitution, BR Sharma, 1993, Deep and Deep publications

Introduction to the Constitution of India, D.D. Basu, 2004, Prentice-Hall of India.

Good News, Bad News: Journalism Ethics and the Public Interest, Jeremy Iggers, 1998, Oxford University Press

Indian Journalism: Keeping It Clean, Alok Mehta, 2007, Rupa

Media Ethics: Truth, Fairness and Objectivity, Paranjy Guha Thakurta, 2011, OUP

Manna, B. (2006). Mass Media and Related Laws in India. Academic Publishers.

A Compendium of Codes of Conduct for Media Professionals, Prabhakar, M. et. al., 1999, University Book House.

Introduction to the Constitution of India, Durga Das Basu, 1966, SC Sarkar & Sons Pvt Ltd, Calcutta

Press Laws and Media Ethics, Anil K. Dixit, 2006, Reference Press

Principles and Ethics of Journalism and Mass Communication, YK D'souza, 1998, Publishers, New Delhi

The Muzzled Press, KS Padhy, 1994, Kanishka Publishers

The International Libel Handbook: A Practical Guide for Journalists, Ed. Nick Braith Waite, 1995, Butterworth-Heinemann Ltd

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	
CO2	H				
CO3				H	
CO4				H	
CO5					

MCDC300T: DEVELOPMENT COMMUNICATION

(5 Credits – 75 hours) (L-T-P: 5-0-0)

Objective:

The objective of the course is to learn the theoretical overview of the concept of the development and how it relates to the empirical experience in developing countries. It would further explore development communication theories and approaches with relation to media forms ranging from traditional to new media.

Course Outcomes:

At the end of this course students will be able to:

CO 1: Explain the concepts and theories of development and social change (Understanding)

CO 2: Identify the linkages between development, media, and communication (Applying)

CO 3: Examine the role of the media in fostering social change (Analyse)

CO 4: Plan media programmes for development interventions (Creating)

Module 1: Development: Concept, Concerns, Paradigms (15 hours)

Concept of development, Measurement of development, Development versus growth, Human development, Models of development - Basic Needs Model; Gandhian Model, Panchayati Raj, Developing countries versus developed countries, UN Millennium Development Goals.

Module 2: Development Communication (20 hours)

Concept and approaches, Paradigms of development - dominant paradigm; dependency paradigm; alternative paradigm, Development communication approaches, Alternative development communication approaches, Development support communication, Area woods triangle, Social and Behaviour Change Communication.

Module 3: Role of Media in Development (20 hours)

Mass Media as a tool for development, Performance record of each medium- print; radio; television; traditional media, Role of development agencies and NGOs, Critical appraisal of development communication programmes and government schemes SITE; Krishi Darshan; Kheda; Jhabua; MNREGA, ICT and development- e-governance; e-chaupal; national knowledge network; Development support communication in India in the areas of agriculture; health & family welfare, population; women empowerment; poverty; unemployment; literacy; consumer awareness, Right to Information.

Module 4: Practicing Development Communication (20 hours)

Strategies for designing messages for print; community radio; television programmes for rural India, New media technologies for development, Development Journalism, Use of traditional media for development, Critical appraisal of mainstream media's reportage on rural problems and issues.

Suggested Readings:

- Rogers, E.M. (1976). *Communication and development : critical perspectives*. Sage Publications.
- Melkote, S. R., & Steeves, H. L. (2015). *Communication for development : theory and practice for empowerment and social justice* (3rd edition.). SAGE.
- Murthy, D. V. R. (2009). *Development Journalism: What Next?* Kanishka Publishing House.
- Narula, U. (2019). *Development Communication-Theory and Practice*. HAR-ANAND PUBLICATION PVT LTD (REVISED EDITION).
- Scott, M. (2014). *Media and development*. Zed Books.
- Schramm, W. (1964). *Mass Media and National Development: The Role of Information in the Developing Countries*. Stanford University Press.
- Ghosh, R., & Pramanik, A. K. (Eds.). (1999). *Panchayat system in India : historical, constitutional, and financial analysis*. New Delhi : Kanishka Publishers.
- Mathur, K. (2013). *Oxford India Short Introductions Panchayati Raj*. Oxford University Press India.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H	H		
CO2		M	H	
CO3			H	M
CO4				H

MCDP301T: DIGITAL PHOTOGRAPHY

(5 Credits – 75 hours) (L-T-P: 2-1-2)

Objective:

The objective of the course is to learn the techniques and concepts of photography and enable the students to use the still image as an important tool of communication.

Course Outcomes:

At the end of this course students will be able to:

CO 1: Summarize the origin and development of photography. (Understanding)

CO 2: Identify the vital functions of a digital camera. (Applying)

CO 3: Experiment with lighting and composition techniques. (Applying)

CO 4: Develop a photography portfolio and project. (Creating)

Module I: History of photography (15 hours)

Origins and development of photography, early technological advancements, Pioneers of photography, Early and modern cameras, Types of photographic modern photographic cameras

Module II: Digital cameras and photographic lens (15 hours)

Elements of photography, Essential components of digital camera, Digital camera sensors, Digital image capture and file formats, Components of camera lens, Types of lenses, Focal length, Angle of view, Depth of field, Lens filters, Lens defects.

Module III: Photographic Lighting (15 hours)

Exposure triangle, Exposure meter, Working with light, Types of lights, Lighting situations, Light accessories, White Balance, Histogram.

Module IV: Photographic Composition (15 hours)

Elements of photographic design – lines; shape and form; texture; pattern, arranging visual elements in a frame – foreground; background and middle ground; rule of thirds; space, understanding perspective, Framing and formatting, Balance and sense of scale, Rhythm and repetition.

Module V: Post-production and Presentation (15 Lectures)

Overview, Organising photographs, saving digital files, basic image editing, getting one's work noticed, Pictures on the World Wide Web, personal website, getting connected, stock photography.

Suggested Readings:

Comon, P.R. (2011). *Fundamentals of photo composition*. Sterling.

Langford, M., Fox, A., & Smith, R. S. (2015). *Langford's Basic Photography: The Guide for Serious Photographers* (10th ed.). Routledge.

Judge, A. (2013). *Mastering Aperture, Shutter Speed, Iso and Exposure: How They Interact and Affect Each Other*. Createspace Independent Pub.

Edwards, S. (2006). *Photography: A Very Short Introduction*. Oxford University Press; Illustrated edition.

Peterson, B. (2016). *Understanding Exposure* (4th ed.). Amphoto Books; Revised edition.

Taschen (Ed.). (2021). *A History of Photography. From 1839 to the Present (Bibliotheca Universalis)*. Taschen GmbH.

Gaskell, N., & Gujral, D. (2019). *Photography in India: A Visual History from the 1850s to the Present*. Prestel.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H	M		
CO3		L	H	H	
CO4		L	M	M	H

MCAV302T: INTRODUCTION TO ANIMATION AND VFX

(4 CREDIT- 60 HOURS) (L-T-P-: 1-1-2)

Objectives:

The objectives of the course is to learn how to make animation, design give vfx and prepared a practical project with the help of any editing softwares.

COURSE / Learning OUTCOMES

CO 1: Identify the tools and techniques for animation and VFX (Remembering)

CO 2: Understand and apply various techniques of animation and VFX (Understanding)

CO 3: Demonstrate progress in basic animation and VFX skills (Evaluating)

CO 4: Design and develop animation and VFX art-work (Creating)

Module 1: Introduction to a 2D Animation Software (20 hours)

Getting started, Exploring the software, Exploring the Drawing and Painting Tools, Manipulating Objects, Creating an Animation, Basics of Action Script, creating a New Document, Understanding Objects, creating a Table, Understanding Links, Understanding Text Formatting Options.

Module 2: Introduction to a VFX Software (25 hours)

Getting Started, Adobe After Effects Workflow, creating a basic animation using effects and presets, animating text, working with shape layers, animating layers, working with masks, Puppet tools, Roto brush tool, performing colour correction, Rendering and outputting.

As a part of the final project, students will submit any of the following projects. Students are expected to apply the concept, knowledge and skills gained during the course of the study while undertaking this paper. Each student will have to submit at least one of the following projects to complete the course.

Project Evaluation Criteria

Last date of project submission

To be notified by the department

Portfolio Submission and Presentation: To be notified by the department

Suggested Readings:

Adobe Flash Professional CC: Classroom in a Book, Adobe Creative Team, Adobe Press

Adobe After Effects CC: Classroom in A Book, Lisa Fridsma and Brie Gyncild, Adobe Press 3.

Basics Animation 03: Drawing for Animation, Paul Wells, Bloomsbury Publishing India Pvt. Ltd.

How to Make Animated Films, Tony White, Focal Press

Kogent Learning Solutions Inc, After Effects CS6 in Simple Steps. Dreamtech Press

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H

MCFS303T: FILM STUDIES

(L-T-P: 4-0-0)

Objective:

Upon completion of the Introduction to Film Studies course, students will possess the skills to analyze and assess the artistic components, methodologies, and societal implications of films, fostering a well-rounded comprehension of the medium and its cultural significance.

Course Outcomes:

CO 1: Identify the historical background of moving images (Remembering)

CO 2: Discuss the major film movements (Understanding)

CO 3: Interpret the role of cinema in popular culture (Applying)

CO 4: Critique cinema from around the world (Analyzing)

Module 1: Indian Cinema (15 lectures)

Early Cinema and the studio era, 1950s – Cinema and the nation (Guru Dutt, Raj Kapoor and Mehboob), 1970s – The rise of the angry young man, Indian New Wave, Globalisation and India cinema, regional cinema, Cinema in North East India.

Module 2: Film Language (15 lectures)

Visual language – shot; scene; mise-en-scene; deep focus; continuity editing; montage, Sound and colour – diegetic and nondiegetic sound; off-screen sound; sync sound; use of colour as a stylistic element, Early cinema, Genre and the development of classical Hollywood cinema.

Module 3: Film Form and Style (15 lectures)

German Expressionism and Film Noir, Italian Neorealism, French New Wave, Third Cinema and Non-Fiction Cinema, Film Authorship with a special focus on Satyajit Ray/Akira Kurosawa, Introduction to feminist film theory.

Module 4: Film and Censorship (15 lectures)

Melodrama, Stardom, Film Censorship – Impact and Relevance in today's era, The Central Board of Film Certification (CBFC), Directorate of Film Festivals, National Film Archives of India, National Film Development Corporation of India (NFDC).

Suggested Readings:

- A Dialectic Approach to Film Form in Film Form: Essays in Film Theory (Edited and Translated by Jay Leyda), Sergei Eisenstein, 1977, Harvest/Harcourt Brace Jovanovich, Publishers
- Classical Hollywood Cinema: Narrational Principles and Procedures" in Philip Rosen, ed. Narrative, Apparatus, Ideology. 1986, Columbia University Press, New York
- Non-continuity, Continuity, Discontinuity: A Theory of Genres in Early Films in Elsaesser Thomas, ed. Early Cinema: Space, Frame, Narrative, 1990, British Film Institute
- Discourses of Nationalism in Guru Dutt's Pyaasa, Alison Griffiths, 1996, Deep Focus
- Heavenly Bodies: Film Stars and Society in Film and Theory: An Anthology, Richard Dyer, 2000, Blackwell Publishers
- Indian Cinema: Origins to Independence in Geoffrey Nowell Smith, ed. The Oxford History of World Cinema. Oxford University Press, New York
- Pather Panchali in Jeffrey Geiger and R.L. Rutsky, ed. Film Analysis: A Norton Reader, Neepta Majumdar, 2005, WW Norton & Company
- Notes on Film Noir in John Belton ed. Movies and Mass Culture. New Brunswick, 1996, Rutgers University Press, New Jersey.
- The Cult of the Auteur, The Americanization of Auteur Theory, Interrogating Authorship and Genre, in Film Theory: An Introduction., 2000, Blackwell Publishers
- Towards a Third Cinema, in Robert Stam and Toby Miller, eds. Film and Theory: An Anthology. 2000, Blackwell Publishers: Massachusetts and Oxford.
- The Moment of Disaggregation," and "The Developmental Aesthetic" in his Ideology of the Hindi Film: A Historical Construction, Madhava Prasad, 1998, Oxford University Press
- The Ontology of the Photographic Image, what is Cinema Vol. I, Andre Bazin, 1967, University of California Press
- The Actor as Parallel Text in Bombay Cinema in Quarterly Review of Film & Video Vijay Mishra, Peter Jeffery and Brian Shoemith
- The Panoramic Interior," in Bombay Cinema: An Archive of the City, Ranjani Mazumdar, 2007
- Visual Pleasure and Narrative Cinema in Philip Rosen ed. Narrative, Apparatus, and Ideology: A Film Theory Reader, 1986, Columbia University Press

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1		H		M
CO2		H		
CO3			H	
CO4	H			

MCMS304T: COMMUNITY MEDIA AND SOCIETY

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Objective

The main objective of this paper is to make students aware about the rural scenario life, problems, challenges and lack of communication. It will make students aware about the various communication theory and apply them for the development. It will also help the students to know the various way of showcasing their talent line blogging, documentary etc.

Course/Learning Outcomes:

CO 1: Define the meaning and concept of community and rurality. (Remembering)

CO 2: Trace the history of community media. (Understanding)

CO 3: Apply communication channels for community society. (Applying)

Module 1: Village and Community in India: An interface (9 Lectures)

Introduction, Characteristics of Villages, Conventional Portrayal of Village society, Agricultural Communities, Non-agricultural communities, Changes and continuity in media aspects.

Module 2: Community Media- A Historical Trajectory (9 Lectures)

Role of media in any society, Evaluation of the chronology, Community Media: A Background, Uses and Gratification Theory Approach, Agenda Theory Approach.

Module 3: Orality, Community and Society (9 Lectures)

Significance of Oral communication, Formal official communication vs. informal oral communication, Regular interaction between written and oral, Role of Bollywood, Limitations of written.

Module 4: Community Blogging (9 Lectures)

Blogging and Medium of Communication, Blogging and Digital Activism, Blogging for the Need of Community, Blogging and Rural Community, Blogging for development community.

Suggested Readings

Thapar, Romila, "The Penguin History of Early India: From the Origins to AD1300" (New Delhi: Penguin Books 2002)

Biswal, S. (2016, October-December, a). The sun shines bright on digital platforms, Vidura, 8(4), 10-11.

Dalal, R. (2010). Hinduism: An Alphabetical Guide. London: Penguin Books. p. 136.

Freire, P. (1970). Pedagogy of the Oppressed. NY: Continuum Publishing.

Singh Upinder, A History of Ancient and Early Medieval India: From the Stone Age to the 12th Century, Pearson Longman, Delhi, 2008

Zimmerman F., 'Monsoon in Traditional Culture', in Monsoon, eds. Jay S. Fein and Pamela L. Stephens, John Wiley & Sons, New York, Chichester, Brisbane, Toronto, Singapore, 1987, pp. 51-76.

Joyce, M. (2008). Introduction: How to Think About Digital Activism. In Digital Activism Decoded: The New Mechanics of Change (1-14). NY, Amsterdam: International debate education association.

Kirkpatrick, G. (2008). Technology and Social Power. Basingstoke: Palgrave Macmillan.

MCMS305T: MEDIA, CULTURE AND SOCIETY

(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Objective(s):

The objective of the course is to learn the concepts of culture and explore the relationship between media, culture & technologies.

Course Outcomes

At the end of this course students will be able to:

CO 1: Define the key terms related to media, culture and society (Remembering)

CO 2: Understand the linkage between media, culture and society (Understanding)

CO 3: Analyse the ways in which media, culture and society influence each other (Analysing)

Module 1: Understanding Culture (15 lectures)

Concept of Culture, Mass Culture, Popular Culture, Folk Culture, Media and Culture, Culture and Mediation, Culture & Power, Hybridization.

Module 2: Critical Theories (15 lectures)

Frankfurt School, Media as Cultural Industries, Imperialism, Political Economy, Ideology and Hegemony, Culture & Consumption. Culture & Identity. Cultural Materialism.

Module 3: Representation (5 lectures)

Media as Texts, Signs and Codes in Media, Discourse Analysis, Representation of nation, class, caste and gender issues in Media, Media Representation, Media & Identity, Media & Environment.

Module 4: Audiences (15 lectures)

Audiences, Audience as market, Media Audience, Uses and Gratification Approach, Reception Studies, Active Audiences, Women as Audiences Sub Cultures; Music and the popular, Fandom.

Module 5: Media and Technologies (10 lectures)

Folk Media as a form of Mass Culture, live performance; Audience in live Performance, Media technologies; Medium is the Message; Technological Determinism; New Media and Cultural forms.

Suggested Readings:

Media Studies: An Essential Introduction Edited by Philip Rayner, Peter Wall and Stephen Kruger, Routledge (Covers Module II, III, IV and V)

Convergence Culture: Where Old and New Media Collide, Henry Jenkins, 2008, New York University Press

Mass Media and Society: Issues and Challenges K. B. Dutta, 2021, University Book House

Media, Culture, and Society: An Introduction, Paul Hodkinson, 2016, Sage Publications

The New Media Handbook, 1st Edition, Andrew Dewdney and Peter Ride, Routledge 2006

Mass Communication Theory, Fourth Edition, Dennis McQuail, 2000, Sage

Cultural Theory and Popular Culture: An Introduction, John Storey, 2009, Pearson Longman

Traditional Folk Media in India, Parmar S, 1975, Geka Books

The History of the Future: Oculus, Facebook, and the Revolution That Swept Virtual Reality, Blake J. Harris, 2019, Dey Street Books

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	M	M	H
CO2	H	H	H	H	H
CO3		H		H	H

MCGM400T: GLOBAL MEDIA AND POLITICS

(L-T-P: 5-1-0)

COURSE OBJECTIVES:

By the end of this course on Global Media and Politics, students will be able to critically analyze and understand the intricate relationship between media and politics on a global scale, exploring the role of media in shaping public opinion, political processes, and international relations.

COURSE OUTCOMES (CO's)

CO 1: Identify the inter-relation between local, global, international and intercultural issues and trends (Remembering)

CO 2: Understand the relationship between media and political actors (Understanding)

CO 3: Demonstrate understanding of the role and the position of media institutions in the wider context of socio-political relations and conflict (Applying)

CO 4: Critically evaluate media-related issues to contemporary debates in global politics (Analysing)

CO 5: Produce critical media content on contemporary socio-political issues (Creating)

Module 1: Media and International Communication (15 Lectures)

The advent of popular media, Radio and International Communication, Media propaganda in the inter-war years - World War I and World War II.

Module 2: Media and Super Power Rivalry (15 Lectures)

Media during the Cold War; Vietnam War; Disintegration of USSR, Radio free Europe; Radio Liberty; Voice of America, Communication debates: NWICO; McBride Commission and UNESCO, Unequal development and Third World concerns: NorthSouth; Rich-Poor.

Module 3: Global Conflict and Global Media (15 Lectures)

World Wars and Media Coverage post 1990: Rise of Al Jazeera, The Gulf Wars: CNN's satellite transmission, embedded Journalism, 9/11 and implications for the media, Case studies.

Module 4: Media and Cultural Globalization (15 Lectures)

Cultural Imperialism, Cultural politics, Media hegemony and Global cultures, Homogenization, the English language Local/Global, Local/Hybrid.

Module 5: Media and the Global Market (15 Lectures)

Discourses of Globalisation: barrier-free economy; multinationals; technological developments; digital divide, Media conglomerates and monopolies: Ted Turner/Rupert Murdoch, Global and regional integrations: Zee TV as a pan-Indian channel, Bollywood Entertainment: Local adaptations of global programmes KBC; Big Boss; Indian Idol etc.

Suggested Readings:

Communication and Society, Today and Tomorrow "Many Voices One World," 2004, Unesco Publication, Rowman and Littlefield publishers
Globalisation: language, Culture and Media, Indian Institute of Advanced Studies, Patnaik, B.N & Imtiaz Hasnain (ed), 2006, Shimla
International Communication: Continuity and Change, Daya Kishan Thussu, 2003, Oxford University Press
Journalism after 9/11, Barbie Zelizer and Stuart Allan, 2012, Taylor and Francis Publication
Media and Society into the 21st Century: A Historical Introduction, Lyn Gorman and (2nd Edition), David McLean, 2009, Wiley-Blackwell, pp.82-135, 208-283.
Media and communications in third world countries, Zahida Hussain and Vanita Ray, 2007, Gyan Publications
Reporting war: Journalism in wartime, Stuart Allan and Barbie Zelizer, 2004, Routledge Publication
The Globalization of Corporate Media Hegemony, Lee Artz and Yahya R. Kamalipour, 2003, New York Press
War, Media and Propaganda - A Global Perspective, Yahya R. Kamalipour and Nancy Snow, 2004, Rowman and Littlefield Publishing Group

MCOMM401T: MEDIA MANAGEMENT AND ENTREPRENEURSHIP

(5 Credits: 75 Hours) (L-T-P: 5-0-0)

Objective(s):

The objective of the course is to learn the fundamentals of Media management and different schools of thought. Explore the concept, origin, and growth of media management as a field and understand the concept of media entrepreneurship.

Course Objectives:

CO 1: Identify the various principles of media management (Remembering)
CO 2: Understand the concept of media management and entrepreneurship (Understanding)
CO 3: Apply the knowledge and principles of media management and entrepreneurship (Applying)

Module 1: Media Management: Concept and Perspective (20 Lectures)

Fundamentals of management, Management School of Thought, Concept, origin and growth of Media Management, Media as an industry and a profession, Media Ownership, Ownership patterns of mass media in India: sole proprietorship, partnership, private limited companies, public limited companies, trusts, co-operatives, religious institutions (societies) and franchisees (chains), Media policies.

Module 2: Media Industry: Issues & Challenges (15 Lectures)

Media industry as manufacturers- Manufacturing Consent, news and content management. Market Forces, performance evaluation (TAM, TRP, BARC and HITS) and Market shifts.

Module 3: Entrepreneurship Development (20 Lectures)

Entrepreneurship – concept; definition, need and significance, Entrepreneurship growth process, Barriers, Entrepreneurship education model, Entrepreneur – characteristics; types and role demand, Entrepreneurial Motivation and challenges, Types of enterprises - based on capital; product; location; ownership pattern and process.

Module 4: Media Entrepreneurship (20 Lectures)

Concept of Media Entrepreneurship, Characteristics of Media Entrepreneurs, Case Studies, Government Initiatives, Schemes for Entrepreneurship, Media Entrepreneurial Scenario in Northeast India, Scope; opportunities; problems and issues.

Suggested Readings:

Indian Media Business, Vinita Kohli Khandekar, 2008, Sage
Managing Media Organisation, John M. Lavine and Daniel B. Wackman, 1988, Longman Publishing Group
Media Industries-History, Theory and Method, Jennifer Holt and Alisa Perren, (Edited), 2011, Wiley Blackwell
Media Management in the age of Giants, Dennis F. Herrick, 2012, Surjeet Publications

Media Management: Strategy, Business Models and Case Studies, Bernd W Wirtz, 2020, Springer

Media Management, B. K. Chaturvedi, B. N. Mandal, 2009, Global Vision Publishing House

Political Economy of Communications in India, Pradip Ninan Thomas, 2010, Sage

Strategic management in media, Lucy Kung, 2008, Sage Publications

Social Media Management: Technologies and Strategies for Creating Business Value, Amy Van Looy, 2016, Springers.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2	H		H	H
CO3	H	M	H	H

MCMN402T: MEDIA IN NORTHEAST INDIA

(Credit: 5 – 75 hours) (L-T-P: 5-0-0)

Objective:

The main aim of this course will foster a comprehensive understanding of the media landscape in North East India. Students will explore the intricacies and dynamics of the region's media industry, gaining an in-depth knowledge of its unique characteristics, challenges, and opportunities.

Course Objectives

At the end of the course students will be able to:

CO 1: Describe the important socio-political and development realities of Northeast India (Remembering)

CO 2: Trace the growth of media organisations in Northeast India (Understanding)

CO 3: Analyse the emerging trends of the news media industry in the Northeast (Analysing)

Module 1: Introduction to Northeast India (25 Lectures)

Brief History of Northeast India, Geography; People, Language, Culture and Customs, Northeast Politics, Development Policies, Issues and Challenges, Social and Political Movements in Northeast India, Conflict and Peace Process.

Module 2: History of Media in Northeast (25 Lectures)

Growth and Development of Press in the Northeast, Role of Christian Missionaries in the Development of the Press, Basic Features of the Press in Northeast, renowned media persons and writers of the Region, Role of media in development of Northeast.

Module 3: Current Status of Media in Northeast (25 Lectures)

Current media landscape in North-eastern Region, Ownership Pattern and Status of Journalists, Problems and Challenges of the Press in Northeast, New Media in Northeast, Scopes and Prospects of Media Industry in the Region, Film Industry in NE, Production House.

Suggested Readings

Beyond Counter-insurgency: Breaking the Impasse in Northeast India, Sanjib Baruah, 2011, Oxford University Press

History of the Sibsagar Field, A.K. Gureney, Assam Mission, Nowgaon Jubilee Publication.

Governing India's Northeast: Essays on Insurgency, Development and the Culture of Peace, Samir Kumar Das, 2013, Springer

Media, Conflict and Peace in Northeast India, H.K Kabi and N. S Patnaik, 2015, Vij Books Pvt. Ltd, New Delhi Press in Assam—Origin and Development, S.P Baruah, Lawyer's Book Stall, Guwahati

State vs. Society in Northeast India: History, Politics and the Everyday (SAGE Studies on India's North East), First Edition, G. Amarjit Sharma, 2021, Sage Publications

The American Missionaries and North-East India (1836-1900 AD), H.K. Barpujari, 1986, Spectrum Publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H		
CO2		H	H

CO3			H

MCDJ403T: DATA JOURNALISM

(Credit: 4 – 60 hours) (L-T-P: 2-0-2)

Objectives:

The core objective of this course is to provide a thorough knowledge and understanding of the fundamental concepts and principles of data journalism. Students will delve deeply into the intricacies of data-driven reporting and analysis within the context of journalism.

Course Outcomes:

At the end of the course students will be able to:

CO 1: Define the meaning and concept of data journalism (Remembering)

CO 2: Discuss the process and techniques of data journalism (Understanding)

CO 3: Develop infographics for visualisation of stories (Create).

Module 1: Introduction to Data Journalism (20 hours)

Understanding data journalism, visual storytelling, data literacy, types of data, sector-specific data stories, sources of data, alternative data sources, data privacy, challenges of data journalism.

Module 2: Data Gathering (20 hours)

How to find a story in data, planning a data-driven story: hypothesis and questions, web research and data collection, online fact-checking and verification, common data format.

Module 3: Data Interpretation and Visualisation (20 hours)

Purpose of data visualisation, verifying data, Inverted Pyramid of Data Journalism, organising data, scrapping and cleaning, analysing facts sheets, data interpretation, statistical tools and methods, open-source data visualisation tools, data design, ethics of data visualisation.

Suggested Readings:

Cairo, Alberto, 2012, The Functional Art: An Introduction to Information Graphics and Visualization, New Riders

Foreman, John 2013, Data Smart: Using Data Science to Transform Information into Insight, Wiley

Herzog, David, 2015, Data Literacy: A User's Guide, , Sage Publication

John Mair, Richard Keeble and Megan Lucero, 2017, Data Journalism: Past, Present and Future, , The-schoolbook.com

Jonathan Gray Liliana Bounegru, and Lucy Chambers, 2012, The Data Journalism Handbook, Shroff/O'Reilly

Nathalie H. Riche, et.al, 2018, Data-Driven Storytelling, AK Peters/CRC Press

Reilley, Mike and Sunne, Samantha, 2022, Data + Journalism: A Story-driven Approach to Learning Data Reporting, Taylor & Francis Ltd; 1st edition

Richarch, Alex, 2023, Foundations of Data and Digital Journalism, Routledge; 1st edition

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H	H	
CO2		H	H
CO3			H

MINOR COURSES

Semes-ter	Category	Course Code	Course Name	Credits
1	Minor Course 1	MCPC103T	Professional Communication	4
2	Minor Course 2	MCWM104T	Writing for Media	4
3	Minor Course 3	MCHM205T	History of Media	4
4	Minor Course 4	MCNM206T	Introduction to New Media	4

5	Minor Course 5	MCDP307T	Documentary Production	4
6	Minor Course 6	MCCD308T	Communication and Disaster Management	4
7	Minor Course 7	MCFM404T	Folk Media	3
7	Minor Course 8	MCIR405T	Introduction to Research	2
8	Minor Course 9	MCSB406T	Communication for Social Behavioural Change	3

MCPC103T: PROFESSIONAL COMMUNICATION

(4 Credit: 60Hours) (L-T-P: 4-0-0)

Objective(s):

The objective of the course is to develop proficiency in different types of professional writing, and presentation skills.

Course Outcomes:

CO 1: Define the meaning and concept of communication (Remembering)

CO 2: Demonstrate Writing/Presentation skills using a range of materials including text, visual, sounds and technology (Understanding)

CO 3: Develop professional writing skills in business letters, email, press release, articles (Applying)

Module 1: Theories & Language of Communication (5Lectures)

Theory of Communication, Types and modes of Communication, Effective Communication, Mis-Communication, Barriers and Strategies, Verbal and Non-verbal (Spoken and Written), Personal, Social and Business, Intra-personal, Interpersonal and Group communication.

Module 2: Professional writing (15 Lectures)

Principles and elements of professional writing, Types of writing - business letters/correspondences; professional emails; press releases; reports; features/articles, Copy-editing and proof-reading; Digital content curation

Module 3: Professional Presentation Skills (10 Lectures)

Presentation skills, 7P's of presentation, Use of visual aids in a presentation, Non-verbal communication in a presentation situation

Module 4: Speaking & Listening Skills (20 Lectures)

Strategies for effective oral communication, developing the right speaking skills - one-to-one conversations; interview; group and public speaking; handling criticism, Effective listening skills and interpretation

Module 5: Suggestive projects & Presentation (10 Hours)

Assignment, Presentation, Seminar, Group Presentation on communication model, writing business letter, email, press release, report writing, news feature, article, copy editing, monologue, group discussion, interviewing, public speaking and other allotted topics.

Suggested Readings

Active Listening 101: How to Turn Down Your Volume to Turn Up Your Communication Skills, Emilia Hardman, 2012, Kindle Edition

Business Communication, Krishnamacharyulu and Lalitha, 2011, Himalayan Publishing House

Introduction to Communication Studies, John Fiske, 2010, Routledge.

Nonverbal Communication: Science and Applications, David Matsumoto, Mark G. Frank and Sung Hyi Hwang, 2012, Sage Publications.

Skilled Interpersonal Communication: Research Theory and Practice, Owen Hargie, 2010, Routledge

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H			H	
CO 2		H	H	H	
CO 3		H			H

MCWM104T: WRITING FOR MEDIA

(4 Credit: 60 hours) (L-T-P: 2-0-2)

Objectives:

This course is carefully crafted to deliver practical training in various writing techniques specifically tailored for different media platforms.

Course Outcome

At the end of this course students will be able to:

CO 1: Define the meaning and concept of journalistic writings (Remembering)

CO 2: Identify and analyse characteristics and styles of various forms of media writing (Understanding) CO 3: Develop story ideas, write and edit news stories for multimedia platforms (Create).

Module – 1: Introduction to (20 hours)

Concept and principles of Writing, Fundamentals of Writing, Language of writing, Journalistic Writing, Writing Formats, Creative Writing, Interactive Writing, Cinematic Writing, PR Writing, Mass Media Audience, Objectivity and Creativity, Content curation, Digital tools of writing, Ethics in writing.

Module - 2: Techniques of Copy Editing (20 hours)

Concept and meaning of copy editing, tool and techniques of news editing, Headline writing, Types of Headline, News lead, Types of Lead, lead writing, Caption writing, proof reading

Module 3: Practicum (20 Hours)

Planning and developing story ideas, News writing, Feature Writing, Editorial Writing, Column Writing, News Interview, blog writing, letter to editor, Infographic Design.

Suggested Readings

Golsteing, N. (ed), 2004: The Associated Press Style Book, Cambridge, MA: Press

Modern Journalism and news writing, Sativa Chadda, Sativa, 1998, Popular Prakashan, Bombay

News writing and reporting for today's media, Itule D. Bruce and Anderson A. Douglas, 2000, McGraw Hill Publication

Stovall, J. G. (2015). *Writing for the Mass Media*. Ninth Edition. New York: Pearson

Srivastava, M.V. The Journalistic Hand Book. Sterling Publishers

Stovall, J. G. (2015). *Writing for the Mass Media*. Ninth Edition. New York: Pearson. ISBN-13 978-0-13-386327-7

Writing Tools: 50 Essential Strategies for every writer, Peter Roy Clark, 2006, Little Brown

Mapping of COs to Syllabus

CO	Module 1	Module 2	Module 3
CO1	H		H
CO2		H	H
CO3		H	H

MCHM205T: HISTORY OF THE MEDIA

Credits: 4 (2-0-2)

Objectives:

By the end of this course on the History of the Media, students will be able to analyze and critically evaluate the development, impact, and societal implications of various forms of media throughout history.

Course Outcomes:

CO 1: Discuss the history of print media and its role in Indian freedom movement (Remembering)

CO 2: Understand history and development of television industry (Understanding)

CO 3: Analyse the emerging trends in the media and information industry (Analyzing)

CO 4: Evaluate the development of the media and information industry (Evaluating)

Module 1: History of Print Media (15 lectures)

Media and Modernity: Print Revolution, Telegraph, Morse code, Yellow Journalism, Evolution of Press in United States, Great Britain and France, History of the Press in India, Colonial Period, National Freedom Movement, Gandhi and Ambedkar as Journalists and Communicators.

Module 2: Media in the Post-Independence Era (15 lectures)

Emergency and Post Emergency Era, Changing Readership, Print Cultures, Language Press.

Module 3: Sound Media (15 lectures)

Emergence of radio Technology, the coming of Gramophone, Early history of Radio in India, History of AIR: Evolution of AIR Programming, Penetration of radio in rural India-Case studies, Patterns of State Control; the Demand for Autonomy, FM: Radio Privatization, Music: Cassettes to the Internet.

Module 4: Visual Media (15 lectures)

The early years of Photography, Lithography and Cinema, From Silent Era to the talkies, Cinema in later decades, the coming of Television and the State's Development Agenda, Commercialization of Programming (1980s) Invasion from the Skies: The Coming of Transnational Television (1990s), Formation of Prasar Bha-rati.

Suggested Readings

Broadcasting in India page, P.C Chatterjee, 1991, Sage Publication

Cassette Culture. Chicago, Peter Manuel, 1993, University of Chicago Press

India's Newspaper Revolution: Capitalism, Politics and the Indian Language Press, Robin Jeffrey, 2003, Oxford University Press

Journalism in India from the Earliest to the Present Day, Parthasarathy Rangaswamy, 1989, Sterling Publishers

Radio Farm Forum as a Tool of Change in Indian Villages, In, Neurath P. Economic Development of Cultural Change, Vol 10, No. 3 (pp 275-283)

Satellites Over South Asia, David Page and William Crawley, 2001, Sage Publication

Social History of Media: From Gutenberg to the Internet, A. Briggs and P. Burke, 2010, Polity Press

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M	M	
CO 3			H	H
CO 4			M	M

MCNM206T: INTRODUCTION TO NEW MEDIA

Credits: 4 (3-1-0)

Course Objectives:

The objective of this course is to introduce students to the dynamic and evolving field of new media. Through theoretical exploration, practical exercises students will gain a comprehensive understanding of the concepts, theories, and practices that define new media. The course aims to familiarize students with the various forms, platforms, and technologies used in new media, such as social media, content strategy, blogging, online communities, and emerging technologies.

Course Outcomes:

CO 1: Define new media (Remembering)

CO 2: Understanding the concept and meaning of new media (Understanding)

CO 3: Analyse the emerging trends in the new media (Analysing)

CO 4: Apply the principles and techniques of new media for content creation (Applying)

Module 1: Key Concepts and Theory (20 lectures)

Defining new media, terminologies and their meanings – Digital media, new media, online Media; Information society and new media, Technological Determinism, Computer mediated, Communication (CMC), Networked Society, Internet- its Beginnings and Protocols, 1G, 2G, 3G and 4G and 5G, World Wide Web, Information Superhighway, URL, Search Engine working, Hyperlinking, RSS, Social networking, Podcast, OTT, Artificial Intelligence, Pop-ups.

Module 2: Understanding Virtual Cultures and Digital Journalism (20 lectures)

Internet and its Beginnings, Remediation and New Media technologies, Online Communities, User Generated Content and Web 2.0, Networked Journalism, Alternative Journalism; social media in Context, Activism and New Media, new media and virtual identity.

Module 3: Digitization of Journalism (15 lectures)

Introduction to web journalism - features of web journalism - Approaches to web journalism: Web Journalist Vs. Conventional journalist, Linear and Non-linear writing techniques, Linking, Multimedia, Storytelling structures. Authorship and what it means in a digital age, Piracy, Copyright, Copyleft and Open Source, Digital archives.

Module 4: Overview of Web Writing and Content Design (20 lectures)

Contextualized Journalism, Writing Techniques, Linking, Open-Source Overview of Web Writing, Website planning and visual design, Content strategy and Audience Analysis, Brief history of Blogging, Creating and Promoting a Blog Online Communities, New Media and Ethics: Piracy, Copyright.

Suggested Readings:

A Journalist Guide to the Internet: The Net as a Reporting Tool, Christopher Callhan, 2007, Pearson/Allyn and Bacon

An Introduction to Digital Multimedia, Savage, Terry Michael, and Karla E. Vogel, 2013, Jones & Bartlett Publishers

Cyber Media Journalism: Emerging Technologies, Jagdish Chakraborty, 2005, Authors Press, New Delhi

Online Journalism: A Critical Primer, Jim Hall, 2001, Pluto press, London

Understanding New Media, Siapera, Eugenia, 2011, Sage Publications

Understanding Digital Culture, Vincent Miller, 2011, Sage Publications

Writing for Multimedia and the Web: A Practical Guide to Content Development for Interactive Media, Garand, Timothy, 2006, CRC Press

Who Controls the Internet? Illusions of Borderless World, Jack Goldsmith, Jack, and Tim Wu, 2006, Oxford University Press

What is New Media? In The Language of New Media, Lev Manovich, 2001, MIT Press

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2	H	H		
CO3	M	H	H	H
CO4				H

MCDP307T: DOCUMENTARY PRODUCTION

Credits: 4 (4-0-0)

Objective:

At the conclusion of the Documentary Production course, students will have the capability to effectively strategize, create, and analyze documentary films, showcasing their expertise in storytelling methods, technical proficiencies, and ethical considerations that are unique to the documentary genre.

Course Outcomes:

CO 1: Discuss the types of documentaries and production techniques (Remembering)

CO 2: Understand ethical issues related to documentary production (Understanding)

CO 3: Reflect upon and analyse the documentary form (Analyzing)

CO 4: Critically evaluate documentary forms and production techniques (Evaluating)

CO 5: Produce, direct, film and edit documentary productions (Creating)

Module 1: Documentary Theory (20 lectures)

Understanding the Documentary, Observational and Verite documentary, Introduction to Realism Debate, the performative/fictive in Documentary: Using re-enactment/reconstruction, Ethics and Representation.

Module 2: Pre-Production (20 lectures)

Researching the Documentary, Modes of Research: Library, Archives, location, life stories - Ethnography, writing a concept: telling a story, Script Writing, Treatment, writing a proposal and budgeting, Structure and scripting the documentary.

Module 3: People and Techniques (10 lectures)

The Documentary Crew, Equipment, Scripting, Sound for Documentary.

Module 4: Video Documentary Production (10 Hours)

The Documentary Camera, shooting styles, Production details and logistics, Introduction to Editing styles.

Practicum:

Shooting a short film (5-6 minutes) and editing the same.

Suggested Screenings

- Michael Moore: Roger and Me, Nanook of the North by Robert J Flaherty, Nightmail by Basil Wright, Bombay Our City by Anand Patwardhan, Black Audio Collective, City of Photos by Nishtha Jain, Films by PSBT

Suggested Readings:

A New History of Documentary Film, Jack EC Ellis, 2005, Continuum Intl Pub Group,
 "Documentary" in Geoffrey Nowell Smith ed The Oxford History of World Cinema, Charles Musser, 1996, Oxford University Press

Directing the Documentary, Michal Rabigerl, 2004, Focal Press

How to Write a Documentary Double Take by PSBT, Trisha Das

Indian Film, Erik Barnow and Krishnaswamy, 1980, Oxford University Press

The Open Frame Reader: Unreeling the documentary Film Ed. by PSBT, Rajiv Mehrotra, 2006, Rupa Publications

The Truth about Non-Fiction" and "Towards a Poetics of Documentary in Michael Renov ed. Theorizing Documentary AFI Film Readers, Michael Renov, 1993, Routledge Publications

The Techniques of Documentary Film Production, W.Hugh Badley, 1969, Focal Press,

The Truth about Non-Fiction and Towards a Poetics of Documentary in Michael Renov ed, Theorizing Documentary AFI Film Readers, Renov Michael, 1994, Routledge Publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H		H	
CO2	H			
CO3	M	M		
CO4			M	H
CO5				H

MCCD308T: COMMUNICATION AND DISASTER MANAGEMENT

4 Credits – 60 hours) (L-T-P: 2-0-2)

Objectives:

This is designed to provide hands-on training in the field of communication for disaster management. Students will gain valuable experience and skills in effectively communicating during times of crisis and learn essential strategies and techniques for efficient disaster communication.

Course Objectives

At the end of the course students will be able to:

CO 1: Understand approaches of disaster management (Understanding)

CO 2: Analyse media's role in disaster management (Analysing)

CO 3: Design and produce disaster communication materials (Applying)

Module 1: Introduction to Disaster Management (25 hours)

Meaning, concepts and types of disaster, Economy of Disaster, Politics of Disaster, Disaster Preparedness Plan, Risk Analysis, Crisis and Disaster Management, Response: Rescue, Relief and Rehabilitation, Post Disaster effects and Remedial Measures, National Disaster Management Authority (NDMA).

Module 2: ICT for Disaster Communication (25 hours)

Use of ICTs in disaster management/communication, Emergency Response, HAM radio and community radio, Internet, email, mobile, social media, blogging; computer, television, radio, applications like distress communication and deploying bio surveillance, Geo-Informatics Technology, GIS, GPS, Weather forecasting.

Module 3: Natural Disaster and Role of Media (25 hours)

Case study on man-made and major natural disasters and role of media, crisis communication, preparing for a crisis, Communication, Participation, and Activation of Emergency Preparedness Plan, Designing crisis communication plans, Audience-specific strategic message development.

Suggested Readings:

An Introduction to Disaster Management, Natural Disaster and Man-made hazard, S Vaidyanathan, 2020, CBS Publishers and Distributors Pvt. Ltd.

Bhopal - The Inside Story, Chouhan, Alvares L.B, Claude, 2004, Apex Press.

Crisis and Disaster Management Turbulence and Aftermath, Asim Kumar Mukhopahyaya, Kumar, 2015, Generic

Disaster Management, Harsh K Gupta, (Editor), 2003, Universities Press.

Disaster Policy and Politics: Emergency Management and Homeland Security, R. Sylves, 2008, CQ Press

ICTs in Disaster, Aruna Sarangi, 2010, Neha Publishers and Distributors

Understanding Disaster Management in Practice with reference to Nepal, Practical Action, Achyut Luite, 2010

Understanding the Economic and Financial Impacts of Natural Disasters, Charlotte Benson and Edward Clay, 2004, World Bank Publications

Voices from Chernobyl: The Oral History of a Nuclear Disaster, Svetlana Alexievich and Gessen Keith, 1997, Picador

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H		
CO2		H	H
CO3		H	H

MCFM404T: FOLK MEDIA

(3 Credits – 45 hours) (L-T-P: 2-0-1)

Objective:

The objective of the course is to learn the scope and nature of folk media in India along with its role and potential in the contemporary times.

Course Outcomes:

At the end of this course students will be able to:

CO 1: Identify the major forms of folk media in India (Remembering)

CO 2: Explain the nature and scope of folk media (Understanding)

CO 3: Examine the role of folk media in fostering social change (Analyse)

CO 4: Plan and organise folk media performance for varied audiences (Creating)

Module I: Meaning and Nature of Folk Media (7 hours)

Definition, nature and types of folk media, Strengths and Advantages, Current status of folk media in India, Challenges faced by folk media, Few major forms of folk media in India.

Module II: Nature and Scope of Folk Media (8 hours)

Participatory Communication and Folk Media, Folk Media and Its Role in Social Change, UNESCO's Recognition of Folk Media, Case Studies, Traditional Folk Media as Development Media, Differences Between Folk Media and Electronic Media. Impact on rural development, uses in different fields – DFP, Song and Drama Division, NGOs, Social Action Groups

Module III: Folk Media of Northeast India (7 hours)

Various types of folk Media in Northeast India, Various folk forms of Assam and its significance – Bihu songs, Lokageet, Bhaona, Lullabies, Ojapali, Ainaam, Sattriya, Borgeet

Module IV: Street theater and Puppetry (8 hours)

Influence of folk theater on street theater, Role of street theater in the Indian Freedom struggle, street theater as agitational propaganda and social education, origin of puppets, traditional forms of puppets, contemporary forms of puppet, window on the world puppets, use of puppets – entertainment; education; social education

Module V: Practicum(15 hours)

Traditional media in practice: Students will be trained in various techniques of folk media. At the end of the course, students are expected to perform a street play and/or a puppet performance on specific social issues.

Suggested Readings:

Parmar, S. (1975). *Traditional Folk Media in India*. Gekha Books.

Deshpande, S. (Ed.). (2013). *Theatre of the Streets: The Jana Natya Manch Experience* (2nd ed.). Jana Natya Manch.

Bhushan, C. (2004). *Assam: Its Heritage and Culture*. Kalpaz Publications.

Deshpande, S. (2020). *Halla Bol: The Death and Life of Safdar Hashmi* (1st ed.). LeftWord Books.

Banerjee, U. K., Ghosh, S. (2014). *Puppets in India and Abroad*. India: National Book Trust, India.

Kumar, S. (2013). *Role of Traditional Folk Arts as Media of Mass Communication: A Study with Special Reference to Coastal Karnataka*. Germany: Lap Lambert Academic Publishing GmbH KG.

Naskar, R. (2011). The Role of Folk Media and Participatory Communication in Rural Development: An Exploratory Case Study of Combating Child Marriage in Malda. *Global Media Journal*, 2(2), 1–9.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H		H	L	
CO 2	L	H	L		L
CO 3		H		H	L
CO 4				M	H

MCIR405T: INTRODUCTION TO RESEARCH

(2-0-0)

Objectives:

Upon completion of the Introduction to Research course, students will acquire basic understanding of the research, types, functions and different methods of communication research. They will also develop an understanding of various techniques of research which will further create interest for studying research.

Course outcomes

CO 1: Define the meaning of communication research (Remembering)

CO 2: Explain the methods of communication research (Understanding)

Module 1: Introduction to Research (15 Lectures)

Meaning, Definition, Function, Types of Research, Research Approaches, Role of theory in research, Research design, Research question, Hypothesis, Review of Literature.

Module 2: Media and Communication Research (15 Lectures)

Understanding media and communication research, Qualitative-Quantitative Technique, Content Analysis, Survey Method, Observation Methods, Experimental Studies, Case Studies, Historical Research, Ethnography, Netnography.

Suggested Readings:

Mass Media Research, Thomson Wadsworth, Roger D. Wimmer and Joseph R. Dominick, 2006

Media Research Methods; Audiences, institutions, Texts, Bertrand, Ina and Hughes, Peter, 2005, Palgrave

Media Audience Research: A Guide for Professionals, Graham Mython, 2015, Sage Publications

Media Analysis Techniques, Berger, A. Arthur, 2005, Sage Publications

Research Methodology: Methods and Techniques, C.R. Kothari, 2004, New Age International Ltd. Publishers

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	
CO2	M	H

MCSB406T: COMMUNICATION FOR SOCIAL AND BEHAVIOUR CHANGE

(3 Credit – 45 hours) (L-T-P: 3-0-0)

Objective:

The purpose of this course is to offer a comprehensive understanding of the concept of communication for social and behaviour change, delving deeply into its principles and methodologies.

Course/learning Outcomes

At the end of the course students will be able to:

CO 1: Define the concept of Social and Behaviour Change (Remembering)

CO 2: Analyse the discuss various strategic approaches to SBC programing and community intervention (Analyse)

CO 3: Plan and execute SBC programmes and campaigns (Creating)

Module – 1: Introduction to Social and Behaviour (10 hours)

Understanding Social and Behaviour Change, Social norms, Social and community barriers and enablers, community knowledge, attitude and practice, social influencers, stakeholders in social and behaviour change, SBC priorities, SBC Goals: Advocacy, Social Mobilisation, Social Marketing, Behaviour Change, Capacity Building.

Module – 2: Strategic Approach to Social and Behaviour Change (10 hours)

SBC principles and practices, Goals: Advocacy, Social Mobilisation, Social Marketing, Behaviour Change, Capacity Building, Situation Analysis, People Analysis, Context Analysis, Formative Research, Dipstick Research, SBC

Planning, Process and models, Socio-ecological Model, SBC Monitoring, Evaluation and Impact Assessment

Module – 3: Communication Strategy for SBC Programming (15 hours)

Communication design, audience segments, priorities and profiles, communication channels, effective messaging, Budgeting and fundraising for SBC programmes, Pre-test, Communication Toolkits, Designing Knowledge Products and IEC materials.

Suggested Readings

Esta de Fossard, 2015, Communication for Behaviour Change: Writing and Producing Radio Dramas - Vol.1
Kristina Niedderer, Stephen Clune, et al, 2017, Design for Behaviour Change: Theories and practices of designing for change (Design for Social Responsibility)

Kathleen Starr and Leigh Householder, 2019, Why We Resist: The Surprising Truths about Behavior Change: A Guidebook for Healthcare Communicators, Advocates and Change Agents

Martin, S. Hagger, et.al, 2020, The Handbook of Behaviour Change, Cambridge University Press.

Richard E. Petty and John T. Caioppo, 2011, Communication and Persuasion: Central and Peripheral Routes to Attitude Change

Stephen Wendel, 2013, Designing for behaviour change: Applying Psychology and Behaviour Economics, O'Reilly, 1st Edition

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H	H	
CO2		H	H
CO3		H	H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	MCNA105L	News Reading and Anchoring	3
2	S E Course 2	MCRP106L	Radio Production	3
3	S E Course 3	MCGD207L	Graphic Designing	3

MCNA105L: NEWS READING AND ANCHORING

(3 Credits - 90 Hours) (L-T-P: 0-0-3)

Objective

The paper will make the students experience in the field of news reading and anchoring. Module 1 will deal about the news reader, duties, responsibilities and functions. Module 2 will emphasise students about voice over, performance, language skills, presentation skills etc. in the end of the semester students will produce news bulletin where they will edit, give voice over and present news from the studio and from the field.

Course/Learning Outcomes:

CO 1: Identify the various skills necessary to be a professional news anchor (Remembering)

CO 2: Understand the roles and responsibilities of a news presenter (Understanding)

CO 3: Apply news reading and anchoring skills to develop programmes for cross-media platforms (Applying)

CO 4: Articulate the art of anchoring, news reading and reporting (Analysing)

CO 5: Produce news content for multimedia platforms (Creating)

Module 1: News Reading, Anchoring & Presentation (15 hours)

Duties and responsibilities a news reader, 7Ps in News Presentation: Posture, Projection, Pace, Pitch, Pause, Pronunciation and Personality, Learning Interviewing skills, Anchor's role in debates and panel discussions inside Studio and outside, On location anchoring/ Reporting facilitator, Relevance of research and keeping updated with current affairs, Knowing personalities and their background, Understanding ground realities and issues, Art of listening, Analysis of news capsule from camera perspective particularly when it is outdoor reporting, Reporting for various beats: Politics, sports, business, crime, legal/court etc.

Module 2: Voice Over, Narration and Commentary (15 hours)

Basics of Voice: pitch/tone/intonation/inflection, Voice Over: Rhythm of speech, Breathing, Resonance, Studio autocue reading, Voice recording. Understanding of Voice Modulation, command over language, Skills of on-air presence: Connect with audience; Express appropriate emotion; Confidence; Conversational skills; Fluency; Ability to improvise; Solid knowledge base, Detailed analysis of styles used by prominent TV anchors and radio presenters.

Suggested Exercise

- TV/Radio News presentation, News documentaries, Programme Anchoring, Talks shows, News Interview, Online Live Streaming, Field reporting.

Suggested Readings

Cracking The Secrets of TV Presentation, Samia Rahman, 2016, Kindle Edition

Mastering Public Speaking, Dorothy Lynn, 2006, Jaico Publishing House

Mastering the News Media Interview: How to Do Successful Television, Radio and Print Interviews, Stephen C. Rafe, 1991, Grafton

Public Speaking, Pebley O'neal Katherine and Stephanie O'shaughnessy, 2005, Prufrock

Radio Jockeying and News Anchoring, First Edition, Aruna Zachariah, 2009, Kanishka Publishing House

The ABC of News Anchoring, Richa Karla Karla, 2012, Pearson Education India

Working For Media: Handbook for Building a Career in Journalism: Learn the Art of Anchoring, Reporting and NewsMaking, Bharti Nagpal, Kindle Edition

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	
CO2	H	

CO3	H	H
CO4	H	H

MCRP106L: RADIO PRODUCTION

(3 Credits: 90 HOURS)(L-T-P: 0-0-3)

Objectives

The objective of this paper is to make student more aware the role and uses of radio. Its importance in our day to day live. Students will be made to learn practical work on radio, like documentary, PSA etc. at the end of semester students will prepare a shot production for their final work.

Course Outcomes:

CO 1: Understand the skills and techniques of radio production (Understanding)

CO 2: Identify the radio technologies for audio recording and broadcasting (Applying)

CO 3: Discover the skills required for developing content for radio (Analysing)

CO 4: Produce radio programmes for varied audiences (Creating)

Module 1: Stages of Radio Production (10 hours)

Pre-production - idea; research; radio script, Production- creative use of sound; understanding sound recording; sound recording equipment; single and multitrack recording, post-production - understanding audio editing; introduction to basic audio editing skills using a software program.

Module 2: Radio Broadcast Formats (10 hours)

Radio broadcast formats – Public service advertisements (PSAs); jingles; radio magazine; interview, talk show; discussion; feature; documentary.

Module 3: Radio Production Technology (10 hours)

Basics of sound, Microphone - types and selection of microphones, Audio cables and connectors, Hardware for audio recording,

Audio recorders, Headphones, Recording audio in the field, Portable audio mixers, Sound cards, Digital Audio Workstations (DAW).

Suggested Exercise

Produce radio programme format mentioned in module II.

Suggested Readings:

Radio Production, Aspinall R, 1971, Paris: UNESCO.

Indian Broadcasting, Luthra H.R, 1986, Publication Division.

Nine Components of Sound [Video file]. (n.d.). Retrieved from <http://www.filmsound.org/articles/ninecomponents/9components.htm#Pitch>

Radio Programme Production, M. Neelamalar, 2017, PHI Learning Pvt. Ltd

The Radio Handbook, Flemming C, 2002, Routledge, London

Techniques of Radio Production, Mcleish Robert, 2016, Focal Press

The Adventures of Indian Broadcasting, Chatterjee P.C, 1998, Konark

Writing for Radio and Television in India, Kedia Krishan K, 2008, Cyber Tech Publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H		
CO2	H		
CO3		H	
CO4	H		H

MCRP106L: RADIO PRODUCTION

(3 Credits: 45 HOURS)(L-T-P: 0-0-3)

Objectives

The objective of this paper is to make student more aware the role and uses of radio. Its importance in our day to day live. Students will be made to learn practical work on radio, like documentary, PSA etc. at the end of semester students will prepare a shot production for their final work.

Course Outcomes:

CO 1: Understand the skills and techniques of radio production (Understanding)

CO 2: Identify the radio technologies for audio recording and broadcasting (Applying)

CO 3: Discover the skills required for developing content for radio (Analysing)

CO 4: Produce radio programmes for varied audiences (Creating)

Module 1: Stages of Radio Production (10 hours)

Pre-production - idea; research; radio script, Production- creative use of sound; understanding sound recording; sound recording equipment; single and multitrack recording, post-production - understanding audio editing; introduction to basic audio editing skills using a software program.

Module 2: Radio Broadcast Formats (10 hours)

Radio broadcast formats – Public service advertisements (PSAs); jingles; radio magazine; interview, talk show; discussion; feature; documentary.

Module 3: Radio Production Technology (10 hours)

Basics of sound, Microphone - types and selection of microphones, Audio cables and connectors, Hardware for audio recording,

Audio recorders, Headphones, Recording audio in the field, Portable audio mixers, Sound cards, Digital Audio Workstations (DAW).

Suggested Exercise

Produce radio programme format mentioned in module II.

Suggested Readings:

Radio Production, Aspinall R, 1971, Paris: UNESCO.

Indian Broadcasting, Luthra H.R, 1986, Publication Division.

Nine Components of Sound [Video file]. (n.d.). Retrieved from <http://www.filmsound.org/articles/ninecomponents/9components.htm#Pitch>

Radio Programme Production, M. Neelamalar, 2017, PHI Learning Pvt. Ltd

The Radio Handbook, Flemming C, 2002, Routledge, London

Techniques of Radio Production, Mcleish Robert, 2016, Focal Press

The Adventures of Indian Broadcasting, Chatterjee P.C, 1998, Konark

Writing for Radio and Television in India, Kedia Krishan K, 2008, Cyber Tech Publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO1	H		
CO2	H		
CO3		H	
CO4	H		H

MCGD207L: GRAPHIC DESIGNING

(3 credits: 45 hours) (L-T-P: 2-1-1)

Objective:

The core objective of this course is to provide a thorough knowledge and understanding of Image editing software, understanding of tools for image editing. Students will learn the art of designing photoshop etc.

Course/ Learning Outcome:

CO 1: Gain skills in the development of print and on-line publications (Remembering)

CO 2: Demonstrate competency in image editing (Understanding)

CO 3: Engage with the conceptual and technical aspects of design such as logo, banner, brochure, poster-making (Creating)

Module 1: Image Editing Tool (15 Lectures)

Introduction to image editing tool, Getting started with image editing software, Menu Bar, Using the Help, using icons below menu bar, saving documents, Page Setup, Printing of documents, Toolbox, Layers and importance of layers, Filters, Layer Styles, Adjustment Layers, Retouch and Healing Tools, Type Tool, Free Transform Tool, Master Selection Tools, Installing and Managing Brushes and Other Presets, Image editing actions and common effects, Colour correction tools, Print setting

Module 2: Page Layout Tool (15 Lectures)

Introduction to page layout tool, Getting started with Page Layout software, Menu Bar, Using the Help, Using icons below menu bar, Saving documents, Page Setup, Printing of documents, Create; Edit; and Format text and paragraphs, Working with multiple images in a document, Drawing tools, Work with multiple pages; margins and columns, Working with master page, Customizing page layout software, Selecting page size, Working with text, Working with objects and layers, Applying and managing colour, Applying Fills; Strokes; and Effects, Publish work as PDF, Proof-reading, Print setting

Suggested Readings:

Digital Graphic Design, K. R. Pender, 1997, Butterworth-Heinemann.

Designing for Print, C. Conover, 2011, John Wiley and Sons.

Graphic design basics, A. E. Arntson, 2011, Cengage Learning

Good: An Introduction to Ethics in Graphic Design, L. Roberts, 2006, Ava Publishing

Reading images: The grammar of visual design, G. R. Kress and Leeuwen T. Van, 1996, Psychology Press

Seeing Is Believing: An Introduction to Visual Communication, A.A. Berger, 1989, Mayfield Publishing Company 7. The Complete Guide to Digital Graphic design, B. Gordon and M. Gordon, 2002, Watson-Guptill Publications

DT Editorial Services. Illustrator CC in Simple Steps. Dreamtech Press.

Kogent Learning Solutions Inc. CorelDraw X7 in Simple Steps, Dreamtech Press.

Mapping of COs to Syllabus

	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H

INTERNSHIPS

Semes-ter	Category	Course Code	Course Name	Cred-its
2	Internship	MCN107I	Internship	4
4	Internship	MCIN208I	Internship	4
5	Internship	MCIN309I	Internship	2

MCN107I / MCIN208I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 Hours)

All students shall undergo an internship involving media related activities after the exit of 1st year and 2nd year. **However this internship is compulsory only for those students who is willing to exit the course at the end of 1st or 2nd year and desires to earn extra credit.** The purpose of the internship is to give the students an opportunity to have a hands-on field experience to effectively put into practice the theoretical and practical learning from the programme in an area of interest. Students may undergo their internship in a media house of their choice. The student shall be required to discuss the choice of media house with the department and obtain its consent. Before going for the internship, a Letter of Consent from the concerned media house, in the prescribed format, shall be submitted by the student to the Department. After returning from the internship each student shall have to submit a detailed report in a prescribed format. Each student shall also make a presentation of the internship experience and learning in the Department and submit a certificate of successful completion of the internship from the designated authority of the concerned media house. The schedule of the conduct, report submission and evaluation of the internship shall be as notified

by the Department. The components of evaluation of the Internship and their weightages shall be as notified by the department at the beginning of the semester.

MCIN309I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits-60 Hours)

Students will undertake 4-weeks internships in media and communication organizations during the vacation between fourth and fifth semester. They will discuss the choice of media and communication organization with their respective mentors and obtain the consent of the head of the department. Before going for the internship, an Internship Agreement Contact form from the concerned organization will be submitted by the student to their respective mentors. At the end of the internship students will submit a copy of the Internship Completion Certificate to their mentors from the designated authority of the concerned media and communication organization. Students will submit a report of their internship which will include the following documents:

Employer Evaluation: At the end of the internship the supervising employer will be asked to submit a written evaluation of the student's performance.

Journal: Each student will keep a daily journal with an entry for each day spent doing work for the internship.

This journal should be e-mailed to the mentor at the beginning of each work week. In this journal the students should summarize the activities and assignments on which the student worked. The student should also keep track of the number of hours for each week.

Internship Completion Certificate

Work Samples: Examples of work during the Internship.

The department will issue the following documents to the students for the internship:

Internship Application Form: to be submitted to the mentor prior to internship.

Internship Agreement Contract: to be submitted to the mentor prior to internship.

Employer Evaluation of Intern: to be included in the portfolio

Last date of Internship

To be notified by the department

Internship Report Submission and Presentation: To be notified by the department

RESEARCH PROJECTS /DISSERTATIONS

BA MASS COMMUNICATION (Honours)				
Semes-ter	Category	Course Code	Course Name	Cred-its
7	Research Project/Dissertation	MCDI407P	Research Project Phase I	6
8	Research Project/Dissertation	MCDI408P	Research Project Phase II	6
BA MASS COMMUNICATION (Honours) with Research				
Semes-ter	Category	Course Code	Course Name	Cred-its
7	Research Project/Dissertation	MCDI409P	Dissertation I	18
8	Research Project/Dissertation	MCDI410P	Dissertation II	20

BA MASS COMMUNICATION (Honours) MCDI407P: RESEARCH PROJECT PHASE I

(6 credits – 180 hours) (L-T-P: 0-0-12)

In this course, students will gain familiarity with the domains of research and explore various areas related to research writing. The objective is to equip them with the necessary skills to formulate and develop critical ideas into well-structured research papers. Throughout the course, students will be introduced to the essential components of research, including topic selection, literature review, data collection, and referencing. By

mastering these elements, they will be empowered to write research papers suitable for publication in prestigious indexed journals. The specific evaluation criteria for the course will be communicated by the department at the beginning of the semester, providing clear guidance on how students' progress will be assessed.

MCDI408P: RESEARCH PROJECT PHASE II

(6 credits – 180 hours) (L-T-P: 0-0-12)

In this course, after students will gain familiarity with the domains of research and explore various areas related to research writing in phase 1. The objective is to equip them with the necessary skills to formulate and develop critical ideas into wellstructured research papers. Throughout the course, students will be expected to apply some specific methods of communication research such as: Case studies, Ethnographic Study, Content Analysis.in their research work. By mastering these elements, they will be empowered & expected to write research papers suitable for publication in prestigious journals indexed by Scopus, Web of Science, and UGC Care. The focus of the research papers will revolve around media, film studies, development communication, and related subjects. Students will analyze and address relevant issues within these areas, fostering a deeper understanding of their chosen topics. The specific evaluation criteria for the course will be communicated by the department at the beginning of the semester, providing clear guidance on how students' progress will be assessed.

BA MASS COMMUNICATION (Honours) with Research

MCDI409P: DISSERTATION I

(18 Credits -540 Hours) (L-T-P: 0-0-36)

As part of the course students will undertake a research study in the field of media and communication. Students will complete data collection, analysis, and preparation of research reports and submit the final dissertation. The dissertation has to be systematically structured following proper methodology of communication research. Students will have to ensure that the dissertation is prepared keeping in view Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Students are required to make a presentation of the dissertation submitted to the department on the date set by the department.

The Exercise:

During this course, students will have to choose a research topic of their choice, conduct a literature review with bibliography, and develop a research proposal which will be submitted in partial fulfilment for the requirement of Bachelor's degree in Mass Communication. Students will also write and present a research paper.

MCDI410P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

During this phase 2 students will complete data collection, analysis, preparation of research report and submit the final dissertation. The dissertation has to be systematically structured following proper methodology of communication research. Phase - I of the course is carried out in the 2nd Semester where students work upon research proposals, literature review and research methodology. Students will have to ensure that the dissertation is prepared keeping in view Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Students are required to make a presentation of the dissertation submitted to the department on the date set by the department.

DEPARTMENT OF PSYCHOLOGY

PROGRAMME: BACHELOR OF ARTS in PSYCHOLOGY (BA)

DEGREE: BA PSYCHOLOGY (HONOURS)/ BA PSYCHOLOGY (HONOURS) WITH RESEARCH

VISION

To be a centre of excellence in teaching, learning, research and in the practice of psychological counselling, thereby promoting community mental health and psychosocial competence in order to foster cohesion in the society.

MISSION

Department of psychology of Assam Don Bosco University seeks to-

Achieve excellence in teaching, learning, research, practice and extension activities.

To nurture and develop the counselling skills of the students.

To prepare competent counsellors who are socially committed and culturally sensitive and are bound by the ethics of the profession.

To create an environment committed to promoting the application of science of psychological counselling to real world situation.

Program Outcomes:

PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2: **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4: **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5: **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.

PO 6: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.

PO 7: **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes:

PSO 1: **Knowledge of Basic Concepts of Psychology:** To impart knowledge and understanding of the basic concepts, systems, theories of psychology and psychopathology.

PSO 2: **Practical Application Skills:** An ability to apply the theoretical principles of Psychology demonstrating an understanding of behavior, thoughts, and feelings of the individual and the individual in group settings

PSO 3: **Assessment Skills:** Basic professional skills pertaining to psychological testing, assessment and counselling.

PSO 4: **Multicultural Competence:** To recognize, understand, and respect the complexity of multiculturalism in the practice and application of counseling and psychotherapy.

Mapping of Courses with POs/PSOs

Code	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
PCIP101T	Introduction to Psychology	M	L					H	M	M		M
PCSP102T	Social Psychology	H				M			H	M		L
PCPR201T	Psychological Research and Testing	M		M		L	L	L	H	M		
PCDP202T	Developmental Psychology	H		M	L	L		M	H	H	M	M
PCPR203T	Statistics in Psychological Research	H	L	L	L	M	L	M	H	H	H	M
PCBP204T	Bio Psychology			M	M	M	L	H	H	M	M	M
PCOP205T	Organizational Psychology	H				M		M	M		M	
PCGP301T	Geriatric Psychology	H		H		M	L	M	H	L	L	H
PCCP302T	Cognitive Psychology	M	M	L		M		L	L			
PCHP303T	Health Psychology			M	L		L	H	H	M	M	M
PCFP304T	Forensic Psychology	M	H	H	M	M	L	L	M	M	L	H
PCCO305T	Counselling Psychology	H		H		H			M		M	M
PCAP306T	Abnormal Psychology-I	M		M			M	M	H	M		
PCMP307P	Minor Project/Field Study	H	M	H	H	M	H	H	H	H	H	H
PCAB401T	Abnormal Psychology-II											
PCFP402T	Foundations of Psychotherapy	M	L	H	L		M		H	L		L
PCPA403T	Psychotherapeutic Approaches	M	L	L	L	H	L	M	H	M	L	M
PCCP404T	Criminal Psychology	L				M		M		L		M
PCHS103T	History and Systems of Psychology	L					M		M		M	
PCPP104T	Human Resource Management: A	H	L		M		H	H	H	M	M	L

	Psychological Perspective											
PCEM206T	Emotional Intelligence	H	L	M		H	M	L	H	M	M	M
PCEA207T	Eastern Approaches to Psychology	H	M	H	M	H	L	M	H	H	H	M
PCYG308T	Youth, Gender and Identity	L	H	H	H	M	M	M	H	M	L	H
PCPO309T	Positive Psychology	H	M	H	H	M	M	H	H	L	M	H
PCCM405T	Community Psychology	H	L		M		H	H	H	M	M	L
PCPW406T	Psychology for Health and Wellbeing	H	L	M		H	M	L	H	M	M	M
PCAR407T	Advanced Research Methodology and Statistics	H	M	H	M	H	L	M	H	H	H	M
PCCI408T	Culture and Indigenous Psychology	L	H	H	H	M	M	M	H	M	L	H
PCPP108L	Introduction to Psychological Practicum I	H	M	H	L	L	M	H	H	H	H	M
PCPP109L	Introduction to Psychological Practicum II	H	H	M	M	H	L	L	H	H	M	H
PCPP210L	Introduction to Psychological Practicum III	H	M	M	H	H	L	M	H	H	M	H
PCBM105L	Techniques of Behaviour Modification	H	M	H	H	M	M	H	H	L	M	H
PCDP106L	Sports Psychology	H	L		M		H	H	H	M	M	L
PCPR208L	Peer Counselling	H	L	M		H	M	L	H	M	M	M

DETAILED SYLLABUS MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	PCIP101T	Introduction to Psychology	4
2	Major Course 2	PCSP102T	Social Psychology	4
3	Major Course 3	PCPR201T	Psychological Research and Testing	4
3	Major Course 4	PCDP202T	Developmental Psychology	4

4	Major Course 5	PCPR203T	Statistics in Psychological Research	5
4	Major Course 6	PCBP204T	Bio Psychology	5
4	Major Course 7	PCOP205T	Organizational Psychology	4
5	Major Course 8	PCGP301T	Geriatric Psychology	5
5	Major Course 9	PCCP302T	Cognitive Psychology	5
5	Major Course 10	PCHP303T	Health Psychology	4
6	Major Course 11	PCFP304T	Forensic Psychology	4
6	Major Course 12	PCCO305T	Counselling Psychology	4
6	Major Course 13	PCAP306T	Abnormal Psychology-I	4
6	Major Course 14	PCMP307P	Minor Project/Field Study	4
7	Major Course 15	PCAB401T	Abnormal Psychology-II	5
7	Major Course 16	PCFP402T	Foundations of Psychotherapy	5
8	Major Course 17	PCPA403T	Psychotherapeutic Approaches	5
8	Major Course 18	PCCP404T	Criminal Psychology	5

PCIP101T: INTRODUCTION TO PSYCHOLOGY

(4 Credits: 60 hours) (L-T-P: 4-0-0)

Course Objective*To learn the basic/core concepts and subject matters of psychology.***Course Outcomes**

Explain the nature and characteristics of psychological research and perspectives. (Understanding)

Apply research designs and approaches appropriately. (Applying)

Analyse the basic principles and theories of intelligence, learning and memory and motivation. (Analysing)

Evaluate modern and Indian perspectives of psychology (Evaluating)

Module 1: Introduction (16 hours)

Nature of Psychology: Definition, Fields of psychology, Schools of modern psychology, History and Modern perspective Scientific Methodology (with special emphasis. on Experimentation),

Biological basis of human behaviour: Structure of neurons, Neurotransmitters, Overview of nervous system (special emphasis on brain)

Module 2: Learning, Memory and perception (16 hours)

Learning: Classical conditioning, instrumental learning, observational learning (socio-cognitive learning)

Memory: Processes of memory, Models of memory: Parallel Distributed Processing, Information processing model (Sensory register, STM, LTM and concept of working memory), Levels of processing model, Forgetting

Perception: Top down and Bottom-Up processes, Size Constancy, Depth Perception

Module 3: Motivation & Emotion (12 hours)

Approaches to understanding motivation and Types of Motives

Elements of Emotions (components), Emotional Intelligence and Gender, Culture & emotions

Module 4: Individual differences: Personality and Intelligence (16 hours)

Personality: Nature and Theories

Intelligence: Nature and Theories

Suggested Readings

Banyard, P., Davies, M.N.O., Norman, C. & Winder, B. . Essential psychology. New Delhi: SAGE Publications (Eds.) (2010).

Baron, R. & Misra, G. . Psychology. New Delhi: Pearson (2014).

Ciccarelli, S.K. & White, J.N. & Misra, G. Psychology. New Delhi : Pearson Education (2018)..

Morgan, C T., King, R., Weisz, J. & Schopler, J. .Introduction to Psychology (7th Ed). McGraw Hills (2017).

Holt, N., Bremner, A., Sutherland, E., Vliek, M. and Passer, M., & Smith, R. Psychology: The Science of Mind and Behaviour. London: Tata McGraw-Hills. (2015).

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H	H	M	
CO2	M			
CO3		M	H	H
CO4	M	H		H

PCSP102T: SOCIAL PSYCHOLOGY

(4 credits- 60 hours) (L-T-P: 3-1-0)

Course Objective*To familiarize with the psychological perspective of the human interaction and behaviour in social setting.***COURSE OUTCOMES**

Illustrate the interpersonal processes (Understanding)

Apply the keys aspects of individual processes in the social world (Applying)

Examine the individual processes in the social world (Analysing)

Explain the concept group, cooperation and conflict. (Evaluating)

Module 1: Understanding Social Psychology (15 hours)

History of social psychology, Scope of social psychology, and to understand the individual in the social world

Module 2: Individual Processes (15 hours)

Person perception, Attention-theories, biases and errors; Attitude: Formation, change and resistance to change

Module 3: Interpersonal processes (10 hours)

Interpersonal attraction, prosocial behavior, aggression

Module 4: Group dynamics (20 hours)

Key aspects of groups, cooperation and conflict, group decision making

Suggested Readings

Baron, R.A., Byrne, D. & Bhardwaj, G. (2010). Social Psychology (12th ed). New Delhi: Pearson

Chadha, N.K. (2012). Social Psychology. MacMillan: New Delhi

Myers, D.G. (2008). Social Psychology. New Delhi : Tata McGraw-Hill

Mapping of CO's to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	M		
CO-2		H	M	M
CO-3	M		H	H
CO-4	M	H		H

PCPR201T: PSYCHOLOGICAL RESEARCH AND TESTING

(4 credits – 60 hours) (L-T-P: 4-0-0)

Course Objective*To learn the different approaches of research and steps of test construction.***Course Outcomes:**

Understand the various approaches and research traditions in psychological research. (Understanding)

Application of different techniques and tools in psychological research. (Applying)

Analyse the effectiveness of various tools used in different types of research designs in psychological research. (Analysing)

Evaluate the significance of research in psychology and the advantages and disadvantages of the different orientations and research traditions. (Evaluating)

Module I: Introduction to Psychological Research (10 hours)

Basics of Research in Psychology: What is Psychological Research? The Goals of Psychological Research; Principles of Good Research; Ethics in Psychological Research.

Research Traditions: Quantitative and Qualitative; Comparing qualitative and quantitative research traditions.

Module 2: Test Construction (20 hours)

Psychological Testing: Steps of Test Construction, Item Writing, Types of Items, Standardization; Reliability, Validity and Norms of a Psychological Test; applications.

Module 3: Experimental Method (15 hours)

Types of Experimental Methods: Introduction to Experimental and Quasi-experimental Methods. Methods of Data Collection: Sampling (Probability and Non-Probability Sampling Methods).

Module 4: Non-Experimental Methods – I (15 hours)

Case Study, Sociometry, Observation, Surveys, Focus Group Discussion, Interviews.

Suggested Readings:

Chadha, N. K. (2009) Applied Psychometry. Sage Pub: New Delhi.

Dyer, C. (2001) Research in Psychology: A Practical Guide to Research Methodology and Statistics (2nd Ed.) Oxford: Blackwell Publishers

Gregory, R.J. (2006). Psychological Testing: History, Principles, and Applications (4th Ed.). New Delhi: Pearson Education.

Murphy, K.R. &Davidshofer, C. O. (2004). Psychological Testing: Principles & Applications (6th ed.) New Jersey: Prentice Hall.

Neuman, W.L. (2006). Social Research Methods: Qualitative and Quantitative Approaches (6th ed.) Boston: Pearson Education.

Willig, C. (2001). Introducing qualitative research in psychology: Adventures in theory and method. Philadelphia: Open University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		M
CO 2	H		M	
CO 3		M		H
CO 4		H	M	H

PCDP202T: DEVELOPMENTAL PSYCHOLOGY

(4 Credits-60 Hours) (L-T-P: 3-1-0)

Course Objective

To acquire the knowledge of the stages of life span development, theories and sociocultural factors influencing human development.

Course outcomes:

State the concept of and process of human development across the life span. (Remembering)

Explain the various domains of human development (Understanding)

Utilize the knowledge of different theoretical perspectives, developmental tasks, adjustment process and hazards across the lifespan (Applying)

Analyse the sensitivity to socio-cultural context of human development. (Analysing)

Module 1: Understanding Human Development (10 hours)

Define the concept of Human Development. Theories, themes and research designs related to the study of human development

Module 2: Periods of Life Span Development (20 hours)

Prenatal development, Birth and Infancy, Childhood, Adolescence, Adulthood

Module 3: Domains of Human Development (20 hours)

Cognitive development: perspectives of Piaget and Vygotsky; Language development; Physical development; Emotional development; Moral development; Personality development

Module 4: Socio-Cultural Contexts for Human Development (10 hours) Family, Peers, Media & Schooling, Human Development in the Indian context

Suggested Readings:

Berk, L. E. (2010). Child Development (9th Ed.). New Delhi: Prentice Hall.

Mitchell, P. and Ziegler, F. (2007). Fundamentals of development: The Psychology of Childhood. New York: Psychology Press.

Papalia, D. E., Olds, S.W. & Feldman, R.D. (2006). Human development (9th Ed.). New Delhi: McGraw Hill.

Santrock, J. W. (2011). Child Development (13th Ed.). New Delhi: McGraw Hill.

Santrock, J.W. (2012). Life Span Development (13th ed) New Delhi: McGraw Hill.

Saraswathi, T.S. (2003). Cross-cultural perspectives in Human Development: Theory, Research and Applications. New Delhi: Sage Publications.

Sage Publications.

Srivastava, A.K. (1997). Child Development: An Indian Perspective. New Delhi.

Mapping of COs to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	M	M	
CO-2	M	H		M
CO-3		H	H	
CO-4			H	H

PCPR203T: STATISTICS IN PSYCHOLOGICAL RESEARCH

(5 Credits-75 Hours) (L-T-P: 5-0-0)

Course Objective

To learn about the basics of descriptive statistics and its usages, difference between parametric and non-parametric statistics.

Course Outcomes

State the basic concepts of research, identify major research designs and recognize the philosophical foundations of research. (Remembering)

To understand the importance of inferential statistics and scales of measurements. (Understanding)

To analyse the scope and uses of graphical representation of the quantitative data. (Analysing)

To use measures of Central Tendency and Measures of Variability in research. (Applying)

Module 1: Introduction to Statistics (15 Hours)

Statistics: Definition, usages and limitations; Test of Hypothesis, Variables and Constants; Measurement Scales.

Module 2: Organization and Graphic Representation of Data (20 hours)

Organizing of Data: Frequency Distribution, Computation of Percentiles and Percentile Ranks. The Histogram; Frequency Polygon; Bar Diagram; Pie Chart, Cumulative Frequency Graph

Module 3: Measures of Central Tendency (20 hours)

a) Measures of Central Tendency

The Mode, Median and Mean; Properties and Relative Advantages and Disadvantages of the Mode, Median and Mean; Computation of Mean, Median Mode.

b) The Normal Distribution

The Nature and Properties of the Normal Probability Distribution; Standard Scores and the Normal Curve; The Normal Curve as a Model for Sampling Distributions; Divergence from Normality (Skewness and Kurtosis)

Module 4: Correlation (20 hours)

a) Correlation

Meaning of Correlation, Computation of coefficient of correlation as Pearson's Correlation Coefficient; Spearman's Rank-Order Correlation Coefficient.

b) Parametric and Non-Parametric Statistics: t-Test, Chi-Square and ANOVA

Suggested Readings

Ahuja, R. (2001). Research Methods, Jaipur: Rawat.

Alston, M. Bocoles, W., (2003). Research in Social Workers: An Introduction to the Methods (Indian ed.), Jaipur: Rawat.

Baker, T. L. (1994). Doing Social Research, Singapore: McGraw Hill.

Goode, W. J. and Hatt, P. K. (1981). Methods in Social Research, Singapore: McGraw Hill.

Gupta, S. C. (1997). Fundamentals of Statistics, Delhi: Himalaya Publishing House.

Gupta, S.P. (1997). Statistical Methods, New Delhi: Sultan Chand and Sons.

Jacob, K.K., Methods and Fields of Social Work in India, Asia Publishing, Bombay, 1996

Kothari, C. R. (2004). Research Methodology: Methods and Techniques, (2nd ed. reprint), New Delhi: New Age International.

Laldas, D.K. (2000). Practice of Social Research, Jaipur: Rawat.

Mikkelsen, B. (2005). Methods for Development Work and Research-A New Guide for practitioners, New Delhi: Sage.

Sarantakos, S. (2005). Social Research, New York: Palgrave Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	M
CO 2		M		H
CO 3	M	H	H	
CO 4		M	H	H

PCBP204T: BIO-PSYCHOLOGY

(5 Credits- 75 hours) (L-T-P: 5-0-0)

Course Objective

To acquire in-depth knowledge of the biological basis of human behavior.

COURSE OUTCOMES

Identifying and define the biological bases of behavior. (Remembering)

Associating the role of the nervous system with behavior, hunger and thirst. (Understanding)

Examining the impact of bio chemicals in behavior and mental health at a conceptual level. (Applying)

Analyze the biological markers of individual difference in sleep and wake cycles. (Analyzing)

Module 1: Introduction to Bio-psychology (15 hours)

History and scope; Major theoretical perspectives: Rene Descarte, Phinaes Gage, Charles Darwin. Nature versus Nurture controversy; Sub disciplines and allied fields; Methods in Bio Psychology.

Module 2: Neurons and Genetic bases of behavior (15 hours)

Structure of neuron; Nerve impulse and Synaptic transmission; Neurotransmitters; Types of neurons. Genetic bases of behavior: Structure of a gene, DNA and Chromosomes, Types and Functions of Genes, Genotype and Phenotype.

Module 3: Nervous System (20 hours)

Nervous System: Central Nervous System: Brain and Spinal Cord; Peripheral Nervous system: Division; Role of nervous system in controlling behavior.

Biological Basis of Thirst and Hunger: Thirst: Mechanisms of water regulation- Osmotic thirst- Hypovolemic thirst and sodium specific hunger, Hunger: Digestion and food selection-short- and long-term regulation of feeding-Brain mechanisms - Eating Disorders.

Module 4: The Endocrine System and behavior (10 hours)

Endocrine glands; Hormones; Role of endocrine system on emotions and behavior.

Module 5: Circadian Rhythms, Sleep and Dreaming (15 hours)

Rhythms of waking and sleeping: Endogenous cycles- Setting and resetting the biological clock- Mechanisms of the biological clock, Sleep and brain mechanisms: Sleep and other interruptions of consciousness, the onset of sleep and hypnagogic hallucinations, stages of sleep. Paradoxical or REM sleep, Brain mechanisms of wakefulness and arousal: Brain functions in REM sleep- Functions of sleep, dreaming: REM sleep and dreaming. Biological perspectives on dreaming.

Suggested Readings

Carlson, N. R. (2012). Foundations of physiological psychology. (Sixth Edition). Delhi: Pearson Education.S

Passer, M. W. and Smith, R. E. (2010). Psychology: The Science of Mind and Behaviour. New Delhi: Tata McGraw-Hill

Breedlove, S. M., Rosenzweig, M. R., & Watson, N. V. (2007) Biological Psychology: An introduction to behavioral, cognitive, and clinical neuroscience, 5th Edition. Sinauer Associates, Inc., Sunderland, Massachusetts.

Green, S. (1995). Principles of biopsychology. UK: Lawrence Erlbaum Associates Ltd.

Pinel, J. P. J. (2011). Biopsychology, 8th Edition. Pearson Education, New Delhi.

Kalat, J. W. (2015). *Biological psychology*. Cengage Learning.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H		M
CO2		H	M	
CO3	M		H	M
CO4		M	H	H

PCOP205T: ORGANIZATIONAL BEHAVIOUR

(4 Credits: 60 hours) (L-T-P: 4-0-0)

Course Objective

To learn about the core concepts of organizational behaviour, dynamics of individual and group behaviors in an organizational set up.

Course Outcomes:

Identify and state the key concepts of Organizational Behavior. (Remembering)

Explain various organizational contexts in the globalized world. (Understanding)

Apply knowledge of psychological constructs in modifying the organizational environment. (Applying)

List current areas in need of upgrading in the Indian context. (Analyzing)

Module 1: Introduction (10 hours)

Historical antecedents of Organizational Behaviour, Contemporary Trends and Challenges, Organizational Behavior: Challenges in the Indian Setting

Model 2: Individual level processes (20 hours)

Employee attitudes: Job satisfaction, Organizational Commitment, Organizational Citizenship Behaviour
Work Motivation: Early theories- Maslow, McClelland, Two-Factor; Contemporary Theories-Goal setting, Equity, Expectancy; Applications: Job Characteristics Model, Job redesign

Module 3: Dynamics of Organizational Behavior (16 hours)

Organizational Culture, Power and Politics: sexual harassment, organizational politics; Positive Organizational Behavior

Module 4: Leadership (14 hours)

Basic approaches: Trait theories, Behavioral theories, Contingency theories; Contemporary Issues: Approaches to leadership, Contemporary leadership roles, Challenges to the leadership construct; Creating Effective Leaders.

Suggested Readings

- Chadha, N.K. (2007). Organizational Behavior. Galgotia Publishers: New Delhi.
- Furnham Adrian. The Psychology of Behaviour at Work: The Individual in the Organization. Psychology Press. (1997).
- Greenberg, J. & Baron, R.A. (2007). Behaviour in Organizations (9th Ed.). India: Dorling Kindersley.
- Griffin, R.W. & Moorhead, G. (2009). Organizational Behavior: Managing People & Organizations. New Delhi : Biztantra publishers.
- Levy Paul. Industrial/Organizational Psychology: Understanding the Workplace. Worth Publishers. (2009).
- Luthans, F. (2009). Organizational behavior. New Delhi: McGraw Hill.
- Pareek, U. (2010). Understanding organizational behaviour. Oxford: Oxford University Press.
- Robbins, S. P. & Judge, T.A. (2007) Organizational Behavior(12th Ed). New Delhi: Prentice Hall of India.
- Robbins, S. P., & Judge, T. A. (2013). Organisational Behavior (15th editi). England: Pearson Education Limited.
- Rothman Ian, Cooper L. C. (2015). Work and Organizational Psychology. Routledge.
10. Singh, K. (2010). Organizational Behavior: Texts & Cases. India: Dorling Kindersley
- Sinha, J.B.P. (2008). Culture and Organizational Behavior. New Delhi: Sage.
- Wayne F.C., Herman A. (2013). Applied Psychology in Human Resource Management: Pearson New International Edition. Pearson Education Limited.

Mapping of COs to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	H	M	
CO-2		H		M
CO-3	M	M	H	
CO-4			M	H

PCGP301T: GERIATRIC PSYCHOLOGY

(5 Credits: 75 hours) (L-T-P: 4-0-1)

Course Objective

To learn about the concepts related to geriatric psychology such as ageing cognitive decline, depression and socio-cultural factors influencing aging.

Course Outcomes:

- Demonstrate an understanding of the psychological, social and cultural factors that influence ageing and the experience of older adults. (Understanding)
- Apply the knowledge of geriatric psychology to real-world situations such as planning out an intervention programme for older adults to improve the quality of life. (Applying)
- Critically analyse and examine research on ageing and geriatric psychology including identifying limitations and gaps in existing literature. (Analysing)
- Assess and evaluate the ethical and social implications of issues related to ageing such as elder abuse and end-of-life decision making. (Evaluating)

Module 1: Introduction (15 hours)

- Geriatric Psychology - Definition and multidisciplinary nature
- Old Age - Definitions, Myths and Assumptions about Ageism
- Theories of Ageing - Modernisation Theory, Disengagement Theory and Activity Theory
- Relevance of these theories to working with older adults and cultural considerations

Module 2: Health and Well-Being of Older Adults (25 hours)

- Concept of Healthy Ageing - Distinction between typical and pathological patterns of ageing, Factors affecting Healthy Ageing
- Psychosocial Aspects of Ageing - Loneliness, Quality of Life, Activities of Daily Living (Recreation and Use of Leisure Time),
- Self-Concept and Self-Esteem, Coping with grief and bereavement
- Elder Abuse: Typology and Consequences of Elder Abuse - Physical, Economic, Psychological; Characteristics of victims based on gender, marital status, health, living arrangements, problem behaviours

Nature of Degeneration and its psychosocial implications: Diabetes, Cardiovascular Disease, Disability related issues - hearing and ophthalmologic impairment, Neuropsychological diseases - Depression, Dementias, Parkinson's Disease

Module 3: Therapeutic and Preventive Interventions (20 hours)

Physical Interventions: Physiotherapy, Laughter Club, Respite care, Nutrition Care, Education on adoption of healthy Life Style

Psychosocial Interventions: Coping with loss, Building and Maintaining Self-Concept, Active Ageing.

Neuropsychological Intervention: Cognitive Stimulation Therapy for Dementia

Preventive Intervention against Elder Abuse.

Module 4: Application/Practicum (15 hours)

Design and carry out a preventive intervention against elder abuse

OR

Create a Systematic Review/Meta-analysis of the literature on

(1) any of the therapeutic/preventive interventions discussed OR

(2) any concepts under module

OR

Execute any one of the therapeutic interventions at an elder care facility (**The application/practicum needs to be done under strict supervision**)

Suggested Readings

Butler, R.N., Lewis, M.I., Sunderland, T. (1998). Ageing and Mental Health: Positive Psychosocial and Bio-medical Approaches.

Bensadon, B. A. (Ed.). (2015). Psychology and geriatrics: Integrated care for an ageing population. Elsevier Academic Press.

Steffens, D.C., Blazer, D.G., Thakur, M.E. (Eds.). (2015). The American Psychiatric Publishing Textbook Of Geriatric Psychiatry, Fifth Edition.

Kennedy, G.J. (2012). Geriatric Mental Health Care: A Treatment Guide for Health Professionals. Guilford Press

Yates, L. A., Yates, J., Orrell, M., Spector, A., & Woods, B. (Eds.). (2017). Cognitive stimulation therapy for dementia:

History, evolution and internationalism. Routledge.

Kalache, A., & Gatti, A. (2003). Active ageing: a policy framework. Advances in gerontology, 11, 7-18.

World Health Organization. (2002). Active ageing: A policy framework (No. WHO/NMH/NPH/02.8). World Health Organization.

Mapping of CO's to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	H		
CO-2	M		H	H
CO-3		M	H	H
CO-4		H	M	

PCCP302T: COGNITIVE PSYCHOLOGY

(5 Credits-75 Hours) (L-T-P: 5-0-0)

Course Objective

To acquire the knowledge about the cognitive functioning and the relationship between mind, brain and behaviour.

Course Outcomes

Define the basic concepts of cognitive psychology, identify major theoretical foundations and recognize the historical background of cognitive psychology. (Remembering)

To analyze the scope and application of cognitive psychology. (Analysing)

To use measures of cognitive psychology in research and practice. (Applying)

To evaluate different cognitive methods, tools and their appropriate applicability. (Evaluation)

Module 1: Introduction to Cognitive Psychology (15 Hours)

Definition, History of cognitive psychology.

Cognitive Neuroscience: Basic neuroanatomical principles, modern techniques for exploring cognition (EEG, fMRI, PET) Emotional Intelligence, Artificial Intelligence.

Module 2: Memory Processes (25 Hours)

Processes of Memory, Sensory Memory, Short Term and Long-Term Memory, Working Memory

Semantic and Episodic Memory, Level of Processing, Constructive nature of Memory

Forgetting: Incidental and Motivated Forgetting. Process of forgetting (Interference versus Decay Theory), Memory Distortions

Module 3: Attention & Perception (20 Hours)

Basic Concepts of Attention: Divided Attention, Selective Attention, Visual Attention and Auditory Attention. Perception: Subliminal Perception; Gestalt Approach of Perceptual Organisation, Time perception Pattern Recognition: Bottom Up and Top-Down Approach, Perceptual Learning, Depth Perception.

Module 4: Thinking, Problem Solving and Decision Making (15 Hours)

Types of thinking, Components of thinking: images, concepts, creativity. Decision Making: Complex, Uncertain Decision Making Human Problem Solving: Strategies and Heuristics.

Suggested Readings

Galotti, K.M. (2013). Cognitive Psychology In and Out of the Laboratory (5th ed.). Sage Publications Inc.

Robert J. Sternberg (2009). Cognitive Psychology (5th ed.).

Kellogg, R.T. (2007). Fundamentals of Cognitive Psychology. Sage Publication.

Matlin, M. W. (2006). Cognition. John Wiley & Sons, Inc.

Riegler, G.L.R. (2008). Cognitive Psychology: Applying the Science of the Mind. Pearson Education.

Reed, K.S. (2000). Cognition: Theory and Applications. Wadsworth.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H	H		M
CO2	M		H	
CO3		M	H	H
CO4	M		M	H

PCHP303T: HEALTH PSYCHOLOGY

(4 credits: 60 hours) (L-T-P: 4-0-0)

Course Objective

To understand the basics of Health Psychology, Disease Models, Health Behaviours and Health Management system.

Course outcomes

Learn the need to study health psychology and the approaches to change in health behavior (Understanding)

To understand the relationship between psychological factors and physical health and learn how to enhance well-being. (Applying)

Examine the stressors and its impact on the etiology and course of many health-related problems (Analyzing)

Estimate the management of various health related disorders (Evaluating)

Module 1: Introduction to Health Psychology (20 hours)

Introduction to Health Psychology; components of health: social, emotional, cognitive and physical aspects; mind-body relationship; goals of health psychology, Bio-psychosocial model of health.

Module 2: Behavior and health (10 hours)

Characteristics of health behaviour; Barriers to health behaviour; Theories of health behaviour and their implications.

Module 3: Stress (10 hours)

Nature, Sources, Effects of stress on physical and mental health; Coping and stress management.

Module 4: Health Management (20 hours)

Health-enhancing behaviors: Exercise, Nutrition, safety, managing and controlling pain. Health Protective behaviours, Illness Management.

Suggested Readings:

Allen, F. (2011). Health psychology and behaviour. Tata McGraw Hill Edition.
 Dimatteo, M. R., & Martin L. R. (2011). Health psychology. India: Dorling Kindersley.
 Misra, G. (1999). Stress and Health. New Delhi: Concept.
 Sarafino, E.P. (2002). Health psychology: Bio psychosocial interactions (4th Ed.). NY: Wiley.
 Taylor, S.E. (2006). Health psychology, 6th Edition. New Delhi: Tata McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	
CO 2	M	H		
CO 3		M	H	
CO 4	M		M	H

PCFP304T: FORENSIC PSYCHOLOGY

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Objective

To accuire comprehensive knowledge about the core concepts of Forensic Psychology, theories of crime and forensic psychological investigation methods.

Course Outcomes

Understand the importance of nature of crime. (Understanding)
 Apply the methods of forensic psychological investigation related with Forensic Psychology. (Applying)
 Examine the social, psychological theories of crime. (Analyzing)
 Explain the concept of Juvenile delinquency, sexual offenders and serial offenders. (Evaluating)

Module 1: Introduction to Forensic Psychology (12 hours)

Meaning, nature and definition of Forensic Psychology, Historical background, training of a Forensic psychologist, Work ethic of a forensic Psychologist, Psychology & law, Psychologist as an expert witness, Forensic Psychology in Criminal Proceedings, Competency to stand trial, Criminal responsibility, diminished capacity, risk assessment, Eye-witness testimony

Module 2: Theories of crime (18 hours)

Need for scientific understanding of crime, psychoanalytical conceptualization of crime, eysenck's biosocial theory of crime social learning theory of crime, frustrated induced criminality, Neuropsychological theories of crime, Offender profiling; examination of high-risk offenders,

Module 3: Juvenile offenders and Sexual offenders (18 hours)

Nature and definition of Juvenile offenders, sexual offenders and serial offenders, Social risk factors, Psychological risk factors, family background, Intelligence and delinquency,

Module 4: Forensic Psychological Investigation methods (12 hours)

Methods in Forensic Investigation-Polygraph, Brain electrical Oscillations Signature, narcoanalysis, , forensic hypnosis, voicestress analysis, Theories, techniques, instrumentation, methodology, procedure & critical evaluation, Forensic interviewing,

Suggested readings

Nagel.Y.K.,Srivastava K.,Gupta A (2014) Handbook of Forensic Psychology. Author house UK ltd 1663 Liberty Drive. Bloomington, IN 47403. USA

Horton N.A., Heritage.C.L.(2010). Handbook of forensic Neuropsychology. Springer Publishing company. New York

Curt R.Bartol.,Anne M.Bartol (2008) Current perspectives in Forensic Psychology and criminal behaviour. Sage Publications India Pvt.Ltd. B I/ I Mohan cooperative Industrial area. Mathura road,New Delhi 110 044,India

Mapping of CO's to Syllabus

Course Outcomes	Module-1	Module-2	Module-3	Module-4
CO1	H	M		
CO2	H	H	M	
CO3	M		H	H
CO4		M		H

PCCO305T: COUNSELLING PSYCHOLOGY

(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Course Objective

To learn about the foundations of counselling psychology, theoretical perspective and techniques of counselling.

Course outcomes

State counselling and state the goals of counselling. (Remembering)

Explain the process of establishing client-counselor relationship. (Understanding)

Identify counselling techniques as per the current trends. (Applying)

Analyze the basic principles and techniques of counseling approaches. (Analysing)

Module 1: Introduction to Counselling Psychology (12 hours)

Definition and goals of Counselling, Counselling as a profession: training, skills and ethics, The effective counsellor: personality and background of the counselor, Counselling relationship

Module 2: Techniques of Counselling (20 hours)

Psychoanalytic approach, Humanistic approaches, Behavioral approach, Cognitive approach

Module 3: Counselling Applications (20 hours)

Child Counselling, Family Counselling, Career Counselling, Crisis intervention: suicide and grief

Module 4: Contemporary Trends (8 hours)

Indian approaches: yoga and meditation, Counselling and technology, Expressive techniques: art, music, dance.

Suggested Readings

Aguilera, D.C. (1998). Crisis Intervention: Theory and Methodology (8thEd.) Philadelphia: Mosby

Belkin, G. S. (1998). Introduction to Counselling (3rd Ed.) Iowa: W. C. Brown

Burnard, P. (2009). Counseling Skills Training: Book of activities. Viva Books, New Delhi.

Capuzzi, D. & Gross, D. R. (2007). Counselling and Psychotherapy: Theories and Interventions (4th Ed.) New Delhi. Pearson.

Corey, G. (2009) Counselling and Psychotherapy; Theory and Practice. (7th Ed.) New Delhi: Cengage Learning.

Geldard, K. & Geldard, D. (2011). Counselling Children: A Practical Introduction (3rd Ed.) New Delhi: Sage

Gladding, S. T. (2012).

Counselling: A Comprehensive Profession. (7th Ed) New Delhi. Pearson.

In G. Misra (Ed): Psychology in India. Volume 3: Clinical and Health Psychology. New Delhi. ICSSR/Pearson.

Nelson-Jones, Richard. (2008). Basic Counseling Skills: A helper's manual, Second Edition, Sage, South Asia Edition

Rao, S.N. & Sahajpal, P. (2013) Counselling and Guidance. New Delhi: Tata McGraw Hill.

Sharf, R. S. (2012). Theories of Psychotherapy & Counselling: Concepts and Cases (5th Ed). Brooks/ Cole Cengage Learning.

Mapping of CO's to Syllabus

Course Outcomes	M1	M2	M3	M4
CO1	H		M	
CO2	H	M		M
CO3		M	H	
CO4		H	M	H

PCAP306T: ABNORMAL PSYCHOLOGY-I

(4 Credits: 60 hours) (L-T-P: 4-0-0)

Course Objective

To learn the causes, etiology, classification and identify the clinical picture and dynamics of different mental disorders.

Course Outcomes

Classify and categorize psychological disorders. (Understanding)

Apply the diagnostic criteria to categorize Anxiety disorders, Conversion disorders, Dissociative disorders, Developmental disorders, Substance related disorders and eating disorders. (Applying)

Analyze the distinction between normality and abnormality. (Analyzing)

Explain the causal factors of mental health and illnesses. (Evaluating)

Module 1 – Understanding abnormality (12 Hours)

Definition and criteria of abnormality, Causes of Abnormal Behavior: Necessary, Predisposing, Precipitating and Reinforcing causes, classification (latest edition of DSM & ICD), Clinical Assessment, Diathesis Stress Models

Module 2- Clinical States (20 Hours)

Anxiety Disorders – Phobias, Obsessive Compulsive Disorder, Generalized Anxiety Disorder (Clinical Picture and Dynamics of anxiety disorders)

Conversion Disorder (Clinical Picture and Dynamics)

Dissociative Identity Disorder (Clinical Picture and Dynamics)

Module 3: Developmental Disorders (Clinical Picture and Dynamics) (16 Hours)

Mental Retardation, Autism, ADHD, and Learning Disabilities

Module 4: Substance related Disorders and Eating Disorders (12 Hours)

Substance-Related Disorder: Alcohol abuse and Drug abuse (clinical picture and causes)

Eating disorder: Anorexia Nervosa and Bulimia Nervosa

Suggested Readings:

Barlow D.H. and Durand V.M. (2005). Abnormal Psychology: An Integrated Approach (4th Ed.).Wadsworth: New York.

Bennett,P. (2006). Abnormal and Clinical Psychology: An introductory textbook. New York: Open University Press.

Brewer,K. (2001). Clinical Psychology. Oxford : Heinemann Educational Publishers

Carson, R.C., Butcher,J.N.,Mineka,S.& Hooley,J.M. (2008). Abnormal Psychology. New Delhi: Pearson.

Kearney, C. A. & Trull, T. J. (2012). Abnormal Psychology and Life: A dimensional approach. New Delhi : Cengage learning.

Kring, A. M., Johnson, S. L., Davison G.C. & Neale J.M. (2010). Abnormal Psychology (11th Ed.).NY: John Wiley.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H	M		
CO2		H	M	
CO3	M		H	M
CO4		H	M	H

PCAB401T: ABNORMAL PSYCHOLOGY-II

(5 Credits: 75 Hours) (L-T-P: 5-0-0)

Course Objective

To learn about the mental health and illnesses and categories of mental illness as specified in DSM-V and ICD-10.

Course outcomes:

Classify and categorize Schizophrenia, mood disorders, personality and Paraphilia and related disorders, (Understanding)

Apply diagnostic criteria of Schizophrenia, mood disorders, personality disorders and paraphilia and its different types to diagnose and select the appropriate psychological intervention for different adult mental health related issues (Apply)

Analyze the distinction between normality and abnormality. Distinguish clinical features of different mental illnesses various types. (Analyzing)

Evaluate Bio Psycho Social modes and other modes of treatments for Psychological Disorders. (Evaluating)

Module 1: Schizophrenia and related Disorder (20 Hours)

Schizophrenia: Clinical Picture, Types and causal factors

Schizoaffective disorder (Clinical Picture)

Schizotypal disorder (Clinical Picture)

Acute and transient psychotic disorder (Clinical Picture)

Delusional disorder (Clinical Picture)

Module 2: Mood Disorders (15 Hours)

Clinical Picture, subtypes, causal factors and suicide

Module 3: Personality and Sexual Disorders (20 Hours)

Personality Disorders (Clusters of Disorders, Clinical Picture and Dynamics)

Sexual Disorders (Clinical Picture): Gender Identity Disorder, Paraphilia - Paedophilia, Voyeurism, Exhibitionism, Sexual Masochism, Sexual Sadism

Module 4: Prevention and Treatment of Disorders (20 Hours)

Perspectives on Prevention - Primary, Secondary and Tertiary Prevention,

Biological treatment: Pharmacotherapy and Electroconvulsive therapy

Psychological treatment: Psychoanalytic therapy, Behaviour therapy and Cognitive & Behaviour therapy

Suggested Readings

Barlow D.H. and Durand V.M. (2005). Abnormal Psychology: An Integrated Approach (4th Ed.).Wadsworth: New York.

Bennett,P. (2006). Abnormal and Clinical Psychology: An introductory textbook. New York: Open University Press

Brewer,K. (2001). Clinical Psychology. Oxford : Heinemann Educational Publishers

Carson, R.C., Butcher,J.N.,Mineka,S.& Hooley,J.M. (2008). Abnormal Psychology. New Delhi: Pearson.

Kearney, C. A. & Trull, T. J. (2012). Abnormal Psychology and Life: A dimensional approach. New Delhi : Cengage learning.

Kring,A.M.,Johnson,S.L.,Davison G.C. & Neale J.M. (2010). Abnormal Psychology (11th Ed.).NY: John Wiley.

Plante, T.G. (2010). Contemporary Clinical Psychology John Wiley & Sons.

Riskind, J.H., Manos,M.J. and Alloy,L.B. (2004) Abnormal Psychology : Current Perspectives. McGraw Hill

Sadock, B. J. (2015). Kaplan & Sadock's synopsis of psychiatry: behavioral sciences/clinical psychiatry (Vol. 2015, pp. 648655). Philadelphia, PA: Wolters Kluwer.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	H
CO2	H	M	M	H
CO3	H	H	M	M
CO4	H	M	H	M

PCFP402T: FOUNDATIONS OF PSYCHOTHERAPY

(5 credits - 75 Hours) (L-T-P: 5-0-0)

Course Objective

To acquire comprehensive knowledge about assessment and psychotherapeutic intervention techniques.

Course Outcomes

Gather the significance and scope of psychological assessment in diagnosis and intervention (Understanding)

Apply psychotherapeutic concepts and constructs to diagnose and intervene individuals with mental illnesses. (Applying)

Estimate the appropriate assessments for different population as per the diagnoses. (Analyzing)

Evaluate the applicability of different types to psychotherapy to mental health and illnesses. (Evaluating)

Module I: Introduction to Psychotherapy (12 Hours)

Historical background of psychotherapy; Definition, Principles and goals of psychotherapy; Professional training and ethics in clinical practice, Current issues in Psychotherapy

Module 2: Clinical Interviewing (12 Hours)

Nature and purpose of clinical interview, mental status examination; Observing behaviour, clinical judgement; communication strategies, diagnosis and assessment, other approaches to Psychotherapy

Module 3: Major therapeutic models in Psychotherapy (20 Hours)

Therapeutic Models (Behavioural approaches, cognitive therapy and cognitive-behaviour therapy, Psycho-dynamic therapy, Systemic and group approaches, Eclectic and integrative approaches)

Module 4: Intellectual and Neuropsychological Assessment (15 Hours)

Intelligence, Tests batteries: WAIS, WISC, MISIC, BKT

Approaches to neuropsychological assessment: Halstead-Reitan, Luria-Nebraska, PGI-BBD,

Behavioural assessment, Psychological Assessment: Cognitive and Personality Assessment and Case studies in Psychotherapy.

Module 5: Personality Assessment (16 Hours)

Personality: Nature, Objective and assessments: MMPI-2, MCMI-III, EPQ-R. Projective methods of personality assessments: Rorschach, TAT

Suggested Readings

Hecker, J. E., & Thorpe, G. L. (2011). Introduction to Clinical psychology: Science, practice, and ethics, 4th ed. India: Dorling Kindsley.

Korchin, J. S.(). Modern clinical psychology: Principles of intervention in the clinic and community. CBS Publishing

Gregory, R. J. (2000). Psychological testing: History, principles, and applications (3rd Ed.). Boston: Allyn & Bacon. 4. Wolman, B.B. (1965). Handbook of clinical psychology. N.Y: McGraw Hill INC

Arun Kumar, (ed.), Clinical Psychology, Anmol Publication Pvt. Ltd., 2000.

Freedman, A.M., Kaplan, H.I. and Sadock, B.J., Comprehensive Text Book of Psychiatry (IIIrd Edition) Vol. 1.2. William and wilkins, Batrmore, London, 1989.

Anastasi, A., & Urbina, S. (2005). Psychological Testing. 7th ed. Pearson Education: New Delhi, India.
 Barlow, D.H. & Durand, V.M. (2005). Abnormal psychology: An Integrative Approach (4th ed.). Wadsworth/Thompsons. Belmont CA.
 Butcher J.N; Mineka Susan; and Hooley Jill M. (2014) Abnormal Psychology (15th Ed.) Dorling Kindersley Pvt. Ltd. of Pearson Education. New Delhi, India.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	M		M	
CO2	H	H	M		
CO3			M	H	H
CO4		M	H		H

PCPA403T: PSYCHOTHERAPEUTIC APPROACHES

(5 Credit- 75 Hours) (L-T-P: 5-0-0)

Course Objective

To learn about different psychotherapeutic approaches and its clinical application.

Course Outcomes

Classify and categorise major therapeutic approaches. (Understanding)

Apply various approaches of assessment in practice (Applying)

Analyse the distinction among different types of psychotherapy. (Analysing)

Evaluate the applicability of different types to psychotherapy and related professionals to mental health and illnesses.(Evaluating)

Module 1: Overview of Psychotherapy (12 hours)

Definition of Psychotherapy, Qualities of an effective psychotherapist,

Systematic framework of Psychotherapy, Related professions, other approaches to Psychotherapy-Supportive psychotherapy, Zen Psychology, NLP.

Module 2: Psychodynamic Psychotherapy (12 hours)

Psychoanalysis: Background and basic principles Psychoanalytic theory since Freud

Psychodynamic psychotherapy in contemporary clinical psychology

Module 3: Humanistic, Experiential and Family Therapies (16 hours)

Humanistic psychotherapy

Eclectic treatment combinations Family therapy

Group therapy

Module 4: Cognitive Behavioural Interventions (20 hours)

Behaviour therapy techniques

Cognitive modification procedures

Cognitive behaviour therapy: specific applications in various psychological disorders Dialectic Behaviour therapy

Module 5: Relaxation Therapies (15 hours)

Progressive muscular relaxation Autogenic training Biofeedback

Eye Movement desensitization and reprocessing

Suggested Readings:

Encyclopaedia of Psychotherapy (2002). Academic Press

Beck, J.S (1995). Cognitive therapy: Basic and beyond. New York: Guilford Press.

Ellis, A. (1970). The essence of rational psychotherapy: A comprehensive approach to treatment. New York: Institute for Rational Living.

Walen, S.R., Diguseppe, R., & Dryden, W. (1992). A practitioner's guide to rational emotive therapy. Oxford University Press.
 Inc.

Brems, C. (2001). Basic skills in psychotherapy and counselling. Singapore: Brooks/Cole.

Corey, G. (1996). Theory and practice of counselling and psychotherapy (5th ed.). Pacific Grove, CA: Thomson Brooks/ Cole.

Mapping of COs to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	M		
CO2	H	H		M	
CO3		M		M	H
CO4			M	H	H

PCCP404T: CRIMINAL PSYCHOLOGY

(5 Credits – 75 Hours) (L-T-P: 5-0-0)

Course Objective

To acquire knowledge about the nature and theories of crime, serial offenders and the importance of criminological psychological assessment into practice.

Course Outcomes

Understand the importance of nature of crime. (Understanding)

Apply the methods of criminal psychological investigation related with criminal psychology. (Applying)

Examine the social, psychological theories of crime. (Analyzing)

Explain the concept of Juvenile delinquency, sexual offenders and serial offenders. (Evaluating)

Module 1: Crime, Criminal and Criminology (15 hours)

What is Crime? Who is the criminal? Define Crime. Schools of Criminology – The Pre –Classical School, The Classical School,

Neo- Classical school, Positive approach – Radical Positivism and Liberal Positivism, Cesare Lombroso, Enrico Ferri, Raffaele

Garofalo, Gabriel Tarde

Module 2: Theories of Crime (20 hours)

Need for scientific understanding of crime, psychoanalytical conceptualization of crime, Eysenck's biosocial theory of crime social learning theory of crime, frustrated induced criminality, Neuropsychological theories of crime, Offender profiling; examination of high-risk offenders,

Module 3: Psychology and Crime (20 hours)

Meaning, Purpose and scope of criminal Psychology, Criminal profiling, Nature and definition of Juvenile offenders, sexual offenders and serial offenders, Social risk factors, Psychological risk factors, family background, Intelligence and delinquency,

Module 4: Psychological Investigation Methods – Its use in Criminal Behaviour (20 Hours)

Criminal profiling: definition and process of profiling personality, Factors underlining criminal profiling, Merit and demerit of criminal profiling.

Suggested Readings

Nagel.Y.K.,Srivastava K.,Gupta A (2014) Handbook of Forensic Psychology. Author house UK Ltd 1663 Liberty Drive. Bloomington, IN 47403. USA

Horton N.A., Heritage.C.L.(2010). Handbook of forensic Neuropsychology. Springer Publishing company. New York

Curt R.Bartol.,Anne M.Bartol (2008) Current perspectives in Forensic Psychology and criminal behaviour. Sage Publications India Pvt.Ltd. B I/ I Mohan cooperative Industrial area. Mathura road, New Delhi 110 044,India

Mapping of CO's to Syllabus

Course Outcomes	Module-1	Module-2	Module-3	Module-4
CO1	H	H		M
CO2	H		H	M

CO3		M	H	
CO4	M		M	H

MINOR COURSES

Semes-ter	Category	Course Code	Course Name	Cred-its
1	Minor Course 1	PCHS103T	History and Systems of Psychology	4
2	Minor Course 2	PCPP104T	Human Resource Management: A Psychological Perspective	4
3	Minor Course 3	PCEM206T	Emotional Intelligence	4
4	Minor Course 4	PCEA207T	Eastern Approaches to Psychology	4
5	Minor Course 5	PCYG308T	Youth, Gender and Identity	4
6	Minor Course 6	PCPO309T	Positive Psychology	4
7	Minor Course 7	PCCM405T	Community Psychology	3
		PCPW406T	Psychology for health and Wellbeing	
7	Minor Course 8	PCAR407T	Advanced Research Methodology and Statistics	2
8	Minor Course 9	PCCI408T	Culture and Indigenous Psychology	3

PCHS103T: HISTORY AND SYSTEM OF PSYCHOLOGY

(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Course Objective

To acquire comprehensive knowledge about the major concepts, theoretical perspectives, historical trends and empirical findings.

Course outcome:

CO 1: Comparison and Contrast between systems of Psychology and demonstrate fundamental knowledge and comprehension of the major concepts, theoretical perspectives, historical trends and empirical findings (Understanding)

CO 2: Apply Psychology- specific content and effective self-reflection (Applying)
CO 3: Contrast key concepts, principles and overarching themes (Analyzing)

CO 4: Critically evaluate sources of information in the field of Psychology and major psychological systems (Evaluating)

Module-1: Understanding Psyche: Debates and Issues

(10 hours) Free will and Determinism.

Empiricism and Rationality.

Yoga and Vedantic view

Module-2: Schools of Psychology (20 hours)

Early schools of Psychology: Structuralism and Functionalism (Brief Introduction).

Positivist Orientation: Key contribution of Watson, Tolman, Pavlov and Skinner

Cognitive Revolution: Information Processing Model

Module-3: Psychoanalytic and Humanistic Orientation (20

hours) Freudian Psychoanalysis, Cultural Psychoanalysis

(Sudhir Kakar)

The turn towards "social"- Adler, Jung,

Fromm Ego Psychology- Erik Erikson

Humanistic orientation- Carl Rogers, Maslow

Module-4: Contemporary Developments (10 hours) Feminism and Social Constructionism

Suggested Readings:

- Benjamin Jr. (2009). A History of Psychology: Original Sources & Contemporary Research 3rd Edn. Blackwell Publishing.
- Feist&Feist. Theories of Personality McGraw Hill Higher Education.
- King, D.B., Viney, W. & Woody, W.D. (2008). A history of psychology: Ideas and context. (4th Ed.). Pearson education.
- Kurt Pawlik, Gery D'ydwalle (2006). Psychological Concepts: An International Historical Perspective. Taylor Francis Group.
- Leahey, T.H. (2005). A History of Psychology: Main currents in psychological thought (6th Ed.). Singapore: Pearson Education.
- Mc Adams (2000). The Person: An Integrated Introduction to Personality Psychology
- Paranjpe, A. C. (1984). Theoretical psychology: The meeting of East and West. New York: Plenum Press.
- St. Clair, Michael. (1999). Object Relations and Self-Psychology: An Introduction. Wadsworth Publishing Company.
- Schultz & Schultz (1999). A History of Modern Psychology. Harcourt College Publishers/Latest edition available.
- Wolman, B.B. (1979). Contemporary theories & systems in psychology. London: Freeman Book Co.

Mapping of CO's to syllabus

Course Outcome	Module I	Module II	Module III	Module IV
CO1	H	H	M	
CO2	M	H		
CO3	M		H	H
CO4		M	H	H

PCPP104T: HUMAN RESOURCE MANAGEMENT: A PSYCHOLOGICAL PERSPECTIVE

(4 Credits: 60 Hours) (L-T-P: 4-0-0)

Course Objective

To learn about the core concepts of Human Resource Management, various practices and professional competencies from psychological perspective.

Course Outcomes:

- CO 1: To understand human resource management as a profession, its concepts and meaning (Remembering)
- CO 2: Understand the role of human resource management, various practices and evaluation process (Understanding)
- CO 3: Equip learners with knowledge, skills, attitude, professional competencies and social sensitivities essential for a successful career in Human resource management (Applying)
- CO 4: Analyse skills learned and modifications of failures during training or practical applications (Analysing)

Module 1: Introduction to Human Resource Management (HRM) (10 hours)

Personnel management, HRM and HRD, Context and issues in HRM

Module 2: Human Resource Practices (10 hours)

Job analysis; Recruitment and selection; Training; Performance evaluation

Module 3: International human resource management (IHRM) (20 hours)

The context of Globalization, Dimensions of Cultural difference (Hofstede), Policies and practices in the multinational enterprise, Selection of international assignees; Expatriate failure, Cross-cultural training.

Module 4: Organizational change and development (20 hours)

Organizational change: concepts, models (one model), techniques (one for individual and one for group), organizational development: concepts, models (one model), techniques (one for individual and one for group).

Suggested Readings:

- Aamodt, M.G. (2001) Industrial/ Organizational Psychology. Thompson Wadsworth, a division of Thompson learning Inc.
- Bhatnagar, J. & Budhwar, J. (2009). The changing face of people management in India. London: Routledge.
- Briscoe, D. R., Schuler, R. S. & Claus, L. (2009). International human resource management: Policies and practices for multinational enterprises (3rd Ed). New York: Routledge.
- Chadha, N.K. (2005). Human Resource Management- Issues, case studies and experiential exercises. 3rd edition. New Delhi: Sai Printographers.
- DeCenzo, D.A.& Robbins, S.P.(2006). Fundamentals of human resource management. (8th Ed). NY: Wiley.
- Harzing,A-W.K. and Pennington, A. (2011). International human resource management. New Delhi: Sage publications.
- Jex, S.M. & Britt, T.W. (2008) Organizational Psychology: A Scientist- Practitioner Approach. 2nd ed. John Wiley and sons Inc. New York.
- Luthans,F. (2010) Organizational Behaviour. 12th Edition. McGraw Hill.
- Muchinsky, P.M. (2006) Psychology applied to work: An Introduction to Industrial and Organizational Psychology. NC : Hypergraphic press
- Pareek,U. (2010) Understanding Organizational Behaviour. Oxford: Oxford University Press.
- Robbins, S.P., Judge T.A. and Sanghi, S. (2009) Organizational Behaviour. 13th ed. Pearson Education , Inc.
- Schlutz,D. and Schultz, S.E. (2006) Psychology and Work Today. 9th ed. New Jersey, Pearson Education Inc.

Mapping of COs to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	M		
CO-2	M	H	M	
CO-3			M	H
CO-4		M	H	H

PCEM206T: EMOTIONAL INTELLIGENCE

(4 Credits – 60 Hours) (L-T-P: 3-0-1)

Course Objective

To gain comprehensive knowledge about the basic concepts of emotional intelligence in different contexts.

Course Outcomes

Explain different concepts of emotional intelligence. (Understanding)

Apply the theoretical concepts of emotional intelligence into real life settings. (Applying)

Analyse the managing emotions. (Analyzing)

Evaluate Relationships, Conflict Management, And Effective Leadership. (Evaluating)

Module 1: Introduction (15 hours)

Emotional Intelligence, Models of Emotional Intelligence. EQ competencies: self-awareness, self-regulation, motivation, empathy and interpersonal skills. Importance of Emotional Intelligence

Module 2: Knowing One's and Others' Emotions (15 hours)

Levels of emotional awareness. Recognizing emotions in oneself. The universality of emotional expression. Perceiving emotions accurately in others.

Module 3: Managing Emotions (10 hours)

The relationship between emotions, thought and behaviour. Techniques to manage emotions

Module 4: Applications (20 hours)

Workplace. Relationships. Conflict Management. Effective Leadership

Suggested Readings:

Bar-On, R., & Parker, J.D.A.(Eds.) (2000). The handbook of emotional intelligence. San Francisco, California: Jossey Bros.

Goleman, D. (1995). Emotional Intelligence. New York: Bantam Book.

Goleman, D. (1998). Working with Emotional Intelligence. New York: Bantam Books.

Singh, D. (2003). Emotional intelligence at work (2 nd ed.) New Delhi: Response Books.

Mapping of CO's to syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	M	M	
CO-2	H	H		M
CO-3	M		H	H
CO-4		M	H	H

PCEA207T: EASTERN APPROACHES TO PSYCHOLOGY

(4 Credits- 60 Hours) (L-T-P: 4-0-0)

Course Objective

To acquire a comprehensive knowledge about different approaches of Eastern Psychology and their practice.

Course outcomes:

CO 1: Classify among Indian/Chinese/Japanese approaches to psychology. (Understanding)

CO 2: Make use of the appropriate Indian/Chinese/Japanese approaches to psychology in applied settings. (Applying)

CO 3: Examine ancient and contemporary eastern approaches of psychology. (Analyzing)

CO 4: Recommend the suitable approach in applied/research settings. (Evaluating)

Module 1: Introduction (12 hours)

Definitions, nature, differentiation of concepts-eastern, indigenous and Indian psychology; relationship between culture and psychology, emergence of non-western and indigenous perspectives to psychology.

Nature of Indian Psychology, Fundamental assumptions of Indian Psychology, Mind-body complex, Psychology: Eastern and Western Approach, , Current areas of research in Indian psychology.

Module 2: Major Schools of Indian Psychology (20 hours)

Indian approaches to Psychology-Upanishads, Sankhya, Dvaita and Advaita schools; Viewpoints of Upanishads, Bhagavad Gita, Buddhism and Jainism.

Module 3: Major Schools of Eastern Psychology (15 hours)

Chinese approaches to psychology - Taoism and Confucianism, Japanese approaches to Psychology -Morita and Naikan therapies.

Module 4: Indian Approaches to Health and Wellbeing (13 hours)

Concept of Self and Consciousness, Yoga, Ayurveda, goals of life-concept of Purusharthas, personality development-concept of Ashramas.

Suggested Readings

Bankart, C. P. (1996). Talking cures: A History of Western and Eastern Psychotherapies. Pacific Grove, CA: Brooks/Cole.

Ajaya, S. (1983). Psychotherapy East and West. Honesdale (PA): Himalayan International Institute.

Berry, J. W., Poortinga, YpeH. And Pandey, J. (1997). Handbook of cross-cultural psychology, Tth Edition, Vol.1 Theory and method. Boston: Allyn and Bacon. (Chapters3,4 and 8 by J.G.Miller, D. Sinha, P.M. Greenfield)

Jones-Smith, E. (2012). Theories of counselling and psychotherapy: An integrative approach. Thousand Oaks, CA: Sage.

- Garg, Pulin K. K. and Parikh, I. J. (1995). Crossroads of culture: a study in the culture of transience, New Delhi: Sage.
- Kakar, S. (1982). Shamans, mystics and doctors: A psychological enquiry into India and its healing traditions. Bombay: Oxford University Press.
- Paranjpe, A. C. (1998). Self and identity in modern psychology and Indian thought. New York: Plenum.
- Dunn, B. R., Hartigan, J. A., and Mikulas, W. L. (1999). Concentration and mindfulness meditations: Unique forms of consciousness? *Applied Psychophysiology and Biofeedback*, 24 (3), 147-165.
- Kuyken, W., Byford, S., Taylor, R. S., Watkins, E., Holden, E., White, K., Barrett, B., Byng, R., Evans, A., Mullan, E., and Teasdale, J. D. (2008). Mindfulness-based cognitive therapy to prevent relapse in recurrent depression. *Journal of Consulting and Clinical Psychology*, 76(6), 966-978.
- Segal, Z. (2008). Finding daylight: Mindful recovery from depression. *Psychotherapy Networker*.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	M	
CO 2	M	H	H	
CO 3		M		H
CO 4	M		M	H

PCYG308T: YOUTH, GENDER AND IDENTITY

(4 Credits: 60 hours) (L-T-P: 3-0-1)

Course Objective

To learn about the core concepts of psychological, social and cultural factors of gender, identity, sex and sexuality.

Course Outcomes

- CO 1: Demonstrate an understanding of the psychological, social and cultural factors that influence construction and perception of gender, identity, sex and sexuality. (Understanding)
- CO 2: Apply gender and identity theories to real-world situation such as in clinical work and case studies. (Applying)
- CO 3: Critically analyse and examine the impact of gender and identity on interpersonal relationships and communications. (Analysing)
- CO 4: Assess and evaluate the societal and cultural norms that perpetuate gender and identity inequalities. (Evaluating)

Module 1: Introduction (15 Hours)

Concepts of Gender: Theoretical Perspectives - Essentialist, Social Constructionist, & Queer Theory, Gender Identity, Gender Performativity, Beyond the Binary.

Concepts of Identity: Intersectionality and Multiple identities, Marcia's Theory on Identity Formation.

Module 2: Gender, Sex and Sexuality (20 Hours)

Concept of Sex and Sexuality - Definition, Developmental trajectory, Being Intersex, Nature of sexuality and sexual orientation, Queer Disclosure - Coming out of the closet - Psychological Perspective.

Gender Roles and Stereotypes: The rules of gender - how we learn them and how they limit us all.

Psychology, Gender and Sexuality - A Contentious Relationship - Historical perspective

Module 3: Issues in our cultural context (15 hours)

Legal issues - Section 377, Transgender Persons (Protection of Rights) Act 2019, Gender-Based Violence, POSH Act 2013, Surrogacy and Reproductive Health.

Inclusion, Exclusion, Discrimination: Caste, Class, Ethnicity,

Gender, Sex, and Sexuality in North-East India

Module 4: Application / Practical (10 Hours)

Design and carry out an intervention to promote gender equity and inclusion in diverse social contexts. OR

Create a Systematic Review/Meta-analysis of the literature on any one of the topics that have been covered in the course.

Suggested Readings

1. De Beauvoir, S. (2010). *The Second Sex*. Knopf. (Only Chapter 1)
2. Fausto-Sterling, A. (1993). The five sexes. *The sciences*, 33(2), 20-24.
- Butler, J. (2002). *Gender trouble*. Routledge. (Only "Subject of Sex/Gender/ Desire")
- Chopra, R. (2006). Invisible men: Masculinity, sexuality, and male domestic Labor. *Men and Masculinities*, 9(2), 152-167.
- Crenshaw, K. W. (2017). *On intersectionality: Essential writings*. The New Press.
- Bakshi, K., & Dasgupta, R. (2019). *Queer studies: Texts, contexts, praxis*. Orient BlackSwan.
- YW Boston Blog (2017). What is intersectionality, and what does it have to do with me?
- War, R.J., Kharkongor, G.C. (Eds). (2022). *Gender, Sexuality and Society in Northeast India*. MLCU Press.
- Sedgwick, E. K. (2008). *Epistemology of the Closet*. University of California Press.

Mapping of CO's to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	H		
CO-2	M		H	M
CO-3		M	H	H
CO-4		H	M	H

PCCM405T: COMMUNITY PSYCHOLOGY

(3 Credits- 45 Hours) (L-T-P: 2-0-1)

Course Objective

To understand the psychological perspective of the concepts, approaches, models and strategies of community development.

Course Outcome

Comprehend and discuss the concepts, approaches, models and strategies of community development (Understanding)

Ability to apply knowledge and skills acquired in community psychology to address issues of human diversity, social justice, inclusion and community mental health (Applying)

Ability to assess various concerns in a community and apply models and approaches for community development (Evaluating)

Designing an intervention plan for community development and empowerment. (Creating)

Module 1: Introduction to Community Psychology (10 hours)

Definition of community psychology; types of communities; models.

Module 2: Core values (12 hours)

Individual and family wellness; sense of community; respect for human diversity; social justice; empowerment and citizen participation; collaboration and community strengths.

Module 3: Health promotion (11 hours)

Process of community organization for health promotion, importance. Community program for: child and maternal health, physical challenged and old age in the Indian context.

Module 4: Interventions (12 hours)

Community development and empowerment; case studies in Indian context.

Suggested Readings:

- Banerjee, A., Banerji, R., Duflo, E., Glennecke, R., & Khenani, S. (2006). Can Information Campaign start local participation and improve outcomes- A study of primary education in Uttar Pradesh, India, World Bank Policy Research, Working Paper No.3967
- Kloos B. Hill, J Thomas, Wandersman A, Elias M.J. & Dalton J.H. (2012). Community Psychology: Linking Individuals and Communities, Wadsworth Cengage Learning.
- McKenzie, J. F. Pinger, R. R. & Kotecki, J. E. (2005). An introduction to community health. United States: Jones and Bartlett Publishers.
- Misra, G. (Ed). (2010) Psychology in India. Indian Council of Social Science Research. Dorling Kindersley (India) Pvt Ltd. Pearson Education.
- Poland, B. D., Green, L.W. & Rootman, I. (2000) Setting for Health Promotion: Linking Theory and Practice, Sage Publication, New Delhi

Mapping of CO's to Syllabus

Course Outcome	M1	M2	M3	M4
CO-1	H	H	M	
CO-2	H	M	H	
CO-3		M	H	
CO-4			M	H

PCPW406T: PSYCHOLOGY FOR HEALTH AND WELLBEING

(3 Credits: 45 Hours) (L-T-P: 2-1-0)

Course Objective

To gain knowledge about the variety of health enhancing, health protective, and health compromising behavior and their application in illness management and wellbeing.

Course Outcomes:

- Identifying stressors in one's life and how to manage them. (Remembering)
- Learn the importance of inner strength and human values which could help in maintenance of holistic health and gain insights into positive aspects of work. (Understanding)
- Make use of psychological principles to enhance health management not only in their own lives but in community as well. (Applying)
- Examine the stress response and its impact on the etiology and course of many health-related problems. (Analyzing)

Module 1: Illness, Health and Wellbeing (8 hours)

Continuum and Models of health and illness- Bio-Medical, Biopsychosocial, holistic health; health and wellbeing

Module 2: Stress and Coping (7 hours)

Nature and sources of stress; Effects of stress on physical and mental health; Coping and stress management

Module 3: Health Management (8 hours)

Health-enhancing behaviours; Health compromising behaviours; Health Protective behaviours; Illness Management

Module 4: Promoting Human strengths and life enhancement (15 hours)

Classification of human strengths and virtues; cultivating inner strengths: Hope and optimism; Gainful Employment and Me/We Balance

Module 5: Tutorials (7 Hours)

Objective: The aim is to understand the applicability of principles learnt and solidify the understanding so as to develop the ability to design ways of better health management for the community.

Module 1 Illness, Health and Wellbeing (1 hours)

Doubt clearing sessions/Assignments/tests with application-based questions

Module 2 Stress and Coping (2 hours)

Doubt clearing sessions/group activities/workshops/Assignments

Module 3 Health Management (2 hours)

Doubt clearing session/ Case study/Group discussion/Assignments

Module 4 Promoting Human strengths and life enhancement (2 hours)

Doubt clearing sessions/ reflections/Journal writing/Assignments

Suggested Readings

Taylor, S. E. (2012). Health Psychology (8th Edition). New York: McGraw Hill.

Ghosh, M. (2015). Health Psychology-Concepts in Health and Well-being. New Delhi: Dorling Kindersley (India) Pvt. Ltd.

DiMatteo, M.R. & Martin, L.R.(2002). Health psychology.New Delhi: Pearson.

Forshaw, M. (2003).Advanced Psychology: Health Psychology. London: Hodder and Stoughton.

Forshaw, M. (2003). Advanced Psychology: Health Psychology. London: Hodder and Stoughton.

Hick, J.W. (2005).Fifty signs of Mental Health. A Guide To Understanding Mental Health. Yale University Press.

Snyder, C.R., & Lopez, S.J. (2007). Positive Psychology: The scientific and practical explorations of human strengths.Thousand Oaks, CA: Sage.

Carr, A. (2004). Positive Psychology: The science of happiness and human strength.UK: Routledge.

Dalal, A.K & Misra, G. (2006). Psychology of Health and Well-Being: Some Emerging Perspectives, Psychological Studies, 2(2-3)

Dharmshaktu, N.S (2018). Holistic Health and Wellbeing: How to Achieve it, Journal of Preventive, Curative and Community Medicine, 4(2-3).

Mapping of CO's to Syllabus

Course Outcomes	M1	M2	M3	M4
CO-1	H	M		
CO-2	H	H		
CO-3	M		H	H
CO-4		M	H	H

PCAR407T: ADVANCED RESEARCH METHODOLOGY AND STATISTICS

(2 Credits-30 Hours) (L-T-P: 1-0-1)

Course Objective

To learn about the basic concepts of research design, sampling techniques and their appropriate applicability.

Course Outcome

To understand the importance of research design, sampling techniques. (Understanding)

To use the measures of variability and regression prediction in research. (Applying)

To analyse the scope and uses of research design, sampling techniques. (Analysing)

To evaluate different types of research design, sampling techniques and their appropriate applicability. (Evaluating)

Module 1: Research Design (7 Hours)

Meaning, purpose, types of research design-experimental, non-experimental and quasi-experimental design, steps in experimentation.

Module 2: Types of Sampling Techniques (8 Hours)

Meaning, types, advantages and disadvantages, probability and non-probability sampling method, requisites of a good sampling method, sampling error, calculation of sample size.

Module 3: Data Analysis (15 hours)

Measures of Variability and Standard (z) Scores: The Range; The Interquartile and the Semi-Interquartile Range; The Variance; The Standard Deviation; Calculation of Standard Deviation; Properties and Comparison of Measures of Variability; Standard Scores (z-score); Properties of z-scores.

Regression Prediction: Meaning, types, Computation of Regression (SPSS) ; Mediation and Moderation Analysis; Introduction to SPSS: Getting Started with SPSS; Uses of SPSS in Statistics and Research.

Suggested Reading:

- Aron, A., Aron, E.N., & Coups, E.J. (2007). Statistics for Psychology (4th Ed). India: Prentice Hall .
 N.K. Chadha (1991) Statistics for Behavioral and Social Sciences. Reliance Pub. House: New Delhi
 Coakes, S. J., Steed, L., & Ong, C. (2009). SPSS: Analysis Without Anguish Using Version 16.0 for Windows. Milton, QLD: Wiley Students Edition.
 Field, A. (2009). Discovering Statistics using SPSS (3rd Ed). New Delhi :Sage.
 King, B.M. & Minium, E.W. (2007). Statistical Reasoning in the Behavioral Sciences (5th Ed).USA: John Wiley.
 Siegal, S. (1956). Nonparametric Statistics. NY: McGraw Hill.
 Singh, A. K. (1996). Tests, Measurements and Research in Behavioural Sciences. Bharati Bhavan.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	M	
CO 2		H	H	M
CO 3	M	M	H	
CO 4		M	H	H

PCCI408T: CULTURAL AND INDIGENOUS PSYCHOLOGY

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Course Objective

To acquire a comprehensive knowledge about the Culture and Psychology, Cultural Processes, Self-Concept, Intercultural perspective and Indian Psychological perspective and related practices.

Course Outcomes

- To understand the role of culture in understanding behavior. (Understanding)
 Analyse the psychological insights in the Indian thought traditions. (Analysing)
 To evaluate the psychological benefits and costs of cultural competence, migration, globalization and cultural diversity. (Evaluating)
 Discuss models of the family, self-construal and developmental pathways. (Creating)

Module 1: Introduction to Cultural Processes (7 hours)

Culture: Meaning, types, psychic unity and Cultural Relativity
 Cultural Differences, methods and Importance of studying cultural psychology.

Module 2: Culture and Self (15 hours)

Self: Meaning and Definition and its relation with culture, self and identity
 Culture and architecture: The Making and Remaking of Cultures: A Developmental Perspective
 Concept of family and children, models of the family, self-construal and developmental pathways.

Module 3: Intercultural Contacts (13 hours)

Nature, psychological benefits and costs of cultural competence; Migration, globalization and cultural diversity; Management of multicultural identities.

Module 4: Indigenous Psychology (10 hours)

Indian Psychology – Implications and applications; Indian perspective on emotions; indigenization of psychology in India.

Suggested Readings

- Auluck, S. (2002). Self and identity. In G. Misra, and A. K. Mohanty (eds.), Perspectives on indigenous psychology, p. 374-398. New Delhi: Concept Publishing Company.
- Chiu, C., & Hong, Y. (2006). Social Psychology of Culture. New York: Psychology Press.
- Jain, U. (2002). An Indian perspective on emotions. In G. Misra, and A. K. Mohanty (eds.), Perspectives on indigenous psychology, p. 281-291. New Delhi: Concept Publishing Company.
- Misra, G., & Gergen, K. J. (2002). On the place of culture in psychological science. In G. Misra, and A. K. Mohanty (eds.), Perspectives on indigenous psychology, p. 421-439. New Delhi: Concept Publishing Company.
- Roa, K. R. (2011). Indian psychology: Implications and applications. In Cornelissen, R.M. M., Misra, G., Varma, S. (Eds.), Foundation of Indian Psychology: Theories and concepts, Vol. 1. New Delhi: Pearson.
- Sinha, J. B. P. (2002). Towards indigenization of Psychology in India. In G. Misra, and A. K. Mohanty (eds.), Perspectives on indigenous psychology, p. 440-457. New Delhi: Concept Publishing Company.
- Smith, P.B., Bond, M. H., & Kagitcibasi, C. (2006). Understanding Social Psychology across cultures: Living and working in a changing world. London: Sage.

Mapping of CO's to Syllabus

Course Outcome	Module 1	Module 2	Module 3	Module 4
CO1	H		M	
CO2		H	M	
CO3	M			H
CO4		M		H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	PCPP108L	Introduction to Psychological Practicum I	3	746
2	S E Course 2	PCPP109L	Introduction to Psychological Practicum II	3	747
3	S E Course 3	PCPP210L	Introduction to Psychological Practicum III	3	748

PCPP108L: INTRODUCTION TO PSYCHOLOGICAL PRACTICUM I

(3 credits – 90 hours) (L-T-P: 0-0-3)

Course Objective: To learn the basic/core concepts of psychological practicum. **Course Outcomes**

CO1: To understand different types of psychological enquiry. (Understanding)

CO2: To apply the basic concepts of assessment techniques in measuring important psychological constructs. (Applying) CO3: To evaluate the importance of different types of assessment techniques and measurement tools. (Evaluating)

Module I: Introduction to Practicum (10 hours)

Primary modes of psychological enquiry: Experimental method, Observation, Survey, and Interview
Psychometric Properties: Reliability, Validity, Standardization, Sources of error

Module II: Seguin Form Board Test (30 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module III: Müller-Lyer Illusion Experiment (30 hours)

Basic concepts, purpose, development, administration, scoring, interpretation

Module IV: Eysenck's Personality Questionnaire (20 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Suggested Readings

Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.

Kaplan, R. M. & Saccuzzo, D. P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.) New Delhi: New Age International.

Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (2017). *Introduction to Psychology* (7th ed.). New Delhi: Tata McGraw-Hill.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H	H	H
CO 3		H	H	H

PCPP109L: INTRODUCTION TO PSYCHOLOGICAL PRACTICUM II

(3 credits – 90 hours) (L-T-P: 0-0-3)

Course Objective: To learn the basic/core concepts of psychological practicum.

Course Outcomes

CO1: To understand different types of psychological assessment tools. (Understanding)

CO2: To apply the case specific psychological assessment tools. (Applying)

CO3: To evaluate the differences of different types of assessment techniques and measurement tools. (Evaluating)

Module I: Developmental Screening Test (25 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

Module II: Binet Kamat Test of Intelligence (BKT) (40 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

Module III: Vineland Social Maturity Scales (VSMS) (25 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Suggested Readings

Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.

Kaplan, R. M. & Saccuzzo, D. P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.) New Delhi: New Age International.

Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (2017). *Introduction to Psychology* (7th ed.). New Delhi: Tata McGraw-Hill.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H

PCPP210L: INTRODUCTION TO PSYCHOLOGICAL PRACTICUM-III

(3 credits – 90 hours) (L-T-P: 0-0-3)

Course Objective: To learn the basic/core concepts of psychological practicum. **Course Outcomes**

CO1: To understand different methods of psychological assessment. (Understanding)

CO2: To apply different kinds of psychological assessment tools. (Applying)

CO3: To compare different types of psychological assessment tools. (Analyzing)

CO4: To evaluate the appropriate assessment techniques for basic psychological screening. (Evaluating)

Module I: Gesell's Drawing Test (30 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

Module II: Alexander's Passalong Test (35 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

Module III: The World Health Organization quality of life (WHOQOL) (25 hours)

Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Suggested Readings

Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.

Kaplan, R. M. & Saccuzzo, D. P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.) New Delhi: New Age International.

Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (2017). *Introduction to Psychology* (7th ed.). New Delhi: Tata McGraw-Hill.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H

CO 4	H	H	H

PROJECT

PCMP307P: MINOR PROJECT/FIELD STUDY

(4 Credits: 120 Hours) (L-T-P: 0-0-4)

Course Objective*To learn about the practical application clinical skills and therapies in the real-world setting.**Or**To learn about the practical implications of research methodologies and statistics.***Course Outcome:**

Understand the practical application of the theoretical constructs. (Understanding)

Apply the theoretical concepts into practice. (Applying)

Choose the use of an approach(es) to suit the needs of a client/research study. (Evaluating) 4. Build an understanding regarding the meaning and goals of Counselling/research. (Creating)

Minor Project:

A minor project is an opportunity to the student for practical application of the research traditions, research designs, different research methods, data analysis and discussing the result from a scientific perspective.

Field Study:

The summer internship is a compulsory program which the students undertake after the final examinations of B.A. 6th Semester under the supervision and guidance of the site supervisors and the faculty members of the department. The programme is intended to be for a duration 15 days for which the students would be evaluated at the end of the third semester. The students are expected to gain learning experience in the following areas:

- Observation of individual/group counselling sessions

- Conducting mental status examinations

- Exposure to various psychological assessment tools

- Formulation of case reports

Module I: Introduction

Three detailed case studies to be conducted and documented. Documentation will consist of the following: beginning, first evaluation, definition of counselling goal, reason for counselling, protocols of counselling sessions, conclusion and further suggestions.

Module II: Documentation & Evaluation

Findings from the case studies are to be presented to the faculty members and students of the department. The presentation will be followed by a viva voce examination. Details of the components of evaluation and weightage attached to them are to be determined by the department and inform the students at the beginning of the semester.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	M
CO 2	M	M
CO 3	H	H
CO 4	M	H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	PCN107I	Internship	4
4	Internship	PCIN209I	Internship	4
5	Internship	PCIN310I	Internship	2

PCIN107I / EDIN209I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 Hours)

Course Objective*To learn the application of the theoretical understanding into the clinical/counselling/industrial setting.***Course outcomes**

Classify and identify the psychological disturbance (Understanding)

Apply the symptom checklist to identify the symptoms of mental illnesses. (Applying)

Select appropriate psychological referral for different childhood, adolescent and adult mental health related issues. (Analysing)

Evaluate the different models of mental health and illness. (Evaluating)

Internship for Exit after completion of first year or second year

An internship in psychology gives an opportunity to apply theories and principles one has learnt in psychology courses to the “real world” of social service agencies, medical institution, the criminal justice system, business, and industries. During an internship, one can explore career, interest, develop professional skills, observe functioning of community organizations, expand one’s clinical and interpersonal skills, and, in many cases, help others. An internship is a great opportunity to enrich one’s academic experience while making a valuable contribution to the community by making an optimal utilization of their skills. The students have to complete an internship program under supervised guidance of the field supervisor and the faculty members for a period of 30 days for exit at the end of first or second year of graduation program. The students are required to submit an internship report including the attendance log sheet duly signed by the field supervisor, completion certificate, daily case reports (30 days) along with two case histories. During the internship program, the students are expected to gain learning experience in the following areas:

Observation of individual/group counselling sessions

Exposure to various psychological assessment tools

Formulation of case reports

Recording daily activities

Module I: Introduction

The students will be placed in the field for a minimum of thirty days. The fieldwork setting shall be NGO’s, hospitals, clinics, schools, industrial organizations. The students are expected to apply all the psychological skills whenever applicable depending upon the organization and their service. The students should be involved in the activities of the institution and fulfill the responsibilities as requested by the agency supervisor.

Module II: Record and Documentation

Students shall prepare a daily report (along with 2 case/detailed psychological activity reports) of the fieldwork activities and submit it to the concerned faculty supervisor. The faculty supervisor shall provide the necessary feedback and guidance to the students.

At the end of the internship the students shall submit a summary report of the cases taken and activities done during their placement.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	H
CO 3	H	M
CO 4		H

PCIN310I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits: 60 Hours) (L-T-P: 0-0-3)

Course Objective*To learn the application of the theoretical understanding into the clinical/counselling/industrial setting.***Course outcomes**

Classify and categories the psychological disorders as coded in DSM and ICD (Understanding)

Apply diagnostic criteria to diagnose individuals with mental illnesses. (Applying)

Select appropriate psychological intervention for different childhood, adolescent and adult mental health related issues. (Analysing)

Evaluate the different models of mental health and illness. (Evaluating)

An internship in psychology gives an opportunity to apply theories and principles one has learnt in psychology courses to the “real world” of social service agencies, medical institution, the criminal justice system, business, and industries. During an internship, one can explore career, interest, develop professional skills, observe functioning of community organizations, expand one’s clinical and interpersonal skills, and, in many cases, help others. An internship is a great opportunity to enrich one’s academic experience while making a valuable contribution to the community by making an optimal utilization of their skills. The students have to complete an internship program under supervised guidance of the field supervisor and the faculty members for a period of 15 days for exit at the end of first or second year of graduation program. The students are required to submit an internship report including the attendance log sheet duly signed by the field supervisor, completion certificate, daily case reports (15 days) along with two case histories. During the internship program, the students are expected to gain learning experience in the following areas:

Observation of individual/group counselling sessions

Exposure to various psychological assessment tools

Formulation of case reports

Recording daily activities

Module I: Introduction

The students will be placed in the field for a minimum of thirty days. The fieldwork setting shall be NGO’s, hospitals, clinics, schools, industrial organizations. The students are expected to apply all the psychological skills whenever applicable depending upon the organization and their service. The students should be involved in the activities of the institution and fulfil the responsibilities as requested by the agency supervisor.

Module II: Record and Documentation

Students shall prepare a daily report (along with 2 case/detailed psychological activity reports) of the fieldwork activities and submit it to the concerned faculty supervisor. The faculty supervisor shall provide the necessary feedback and guidance to the students.

At the end of the internship the students shall submit a summary report of the cases taken and activities done during their placement.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	H
CO 3	H	M

CO 4		H

RESEARCH PROJECT /DISSERTATION

BA PSYCHOLOGY (Honours)				
Semes-ter	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	PCDI409P	Research Project Phase I	6
8	Research Project/Dissertation	PCDI410P	Research Project Phase II	6
BA PSYCHOLOGY (Honours) with Research				
Semes-ter	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	PCDI411P	Dissertation I	18
8	Research Project/Dissertation	PCDI412P	Dissertation II	20

BA PSYCHOLOGY (Honours)**PCDI409P: RESEARCH PROJECT PHASE I****(6 credits – 180 hours) (L-T-P: 0-0-12)**

The Research Project is an extended essay that represents a question or statement for analysis and interpretation of the results based on existing literature. A research project enables the students to represent their own innovative ideas and critical analysis to represent the existing gaps of literature. Research Project Phase I includes presentation of Title of the Project, Literature Review, Objective, Research Questions, and Methodology of the Study. The evaluation includes presentation of the research work followed by Viva Voce examination (100 Marks).

PCDI410P: RESEARCH PROJECT PHASE II**(6 credits – 180 hours) (L-T-P: 0-0-12)**

The Research Project is an extended essay that represents a question or statement for analysis and interpretation of the results based on existing literature. A research project enables the students to represent their own innovative ideas and critical analysis to represent the existing gaps of literature. Research Project Phase II includes complete presentation of the research work including data analysis, interpretation, conclusion, limitation and future directions. The evaluation includes presentation of the research work followed by Viva Voce examination (100 Marks).

BA PSYCHOLOGY (Honours) with Research**PCDI411P: DISSERTATION I****(18 Credits -540 Hours) (L-T-P: 0-0-36)**

Every student shall undertake a research project work under the supervision and guidance of a faculty member. The student may choose the topic of research and start the preliminary work by the end of the second

semester. The students are expected to complete the Literature Review followed by a Literature Review presentation and the Proposal presentation during the Phase I. Students are expected to complete the data collection. The report of the Phase-I is to be submitted to the department before the date notified. The mode and components of evaluation of Phase I and Phase II of the research project and the weightages (Full Marks: 100) attached to them shall be published by the Department at the beginning of the semester. There shall be a power point presentation along followed by viva voce examination on the research work.

PCDI412P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

Every student shall undertake a research project work under the supervision and guidance of a faculty member. The student may choose the topic of research and start the preliminary work by the end of the 7th semester. The students are expected to complete the Literature Review followed by a Literature Review presentation and the Proposal presentation during the Phase I. Students are expected to complete the data collection by the end of 7th semester. Phase II of the Dissertation should ideally be undertaken during 8th semester. The thesis is to be submitted to the department before the date notified. The mode and components of evaluation of Phase I (Full Marks: 100) and Phase II (Full Marks: 100) of the research project and the weightages attached to them shall be published by the Department at the beginning of the semester. There shall be a power point presentation followed by the viva voce examination on the research project.

DEPARTMENT OF PUBLIC ADMINISTRATION
PROGRAMME: BACHELOR OF ARTS (BA) in PUBLIC ADMINISTRATION (Honours/Honours with Research)

MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits	Page No
1	Major Course 1	PAIP100T	Introduction to Public Administration	4	759
2	Major Course 2	PAAT101T	Administrative Theory	4	760
3	Major Course 3	PAIA200T	Indian Administration	4	761
3	Major Course 4	PAPP201T	Public Policy and Governance	4	762
4	Major Course 5	PADA202T	Development Administration	5	763
4	Major Course 6	PACP203T	Comparative Public Administration	5	764
4	Major Course 7	PAAE204T	Administrative Ethics in Governance	4	765
5	Major Course 8	PAAL300T	Administrative Law	5	766
5	Major Course 9	PAEG301T	Environmental Governance	5	766
5	Major Course 10	PAGO302T	E-Governance	4	768
6	Major Course 11	PARL303T	Rural Local Governance	4	769
6	Major Course 12	PAUL304T	Urban Local Governance	4	769
6	Major Course 13	PASW305T	Social and Welfare administration	4	770
6	Major Course 14	PARW306P	Excursion / survey, and report writing	4	771
7	Major Course 15	PAFA400T	Public Financial Administration	5	772
7	Major Course 16	PAPA401T	Public Personnel Administration	5	772
8	Major Course 17	PAEP402T	Engage policy and Governance	5	773
8	Major Course 18	PAGA403T	Governance & Administration in South East Asia	5	775

MINOR COURSES (PUBLIC POLICY-PP/ HISTORY-HI)

Semester	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	PASP105T	Policy Making – Structures and Processes (PP) Historiography, Early Civilizations, Ancient to Medieval Indian History (HI)	4	777
		PAHI108T		4	784
2	Minor Course 2	PAIC208T	Public Policy Implementation (PP) Modern Indian History (HI)	4	778
		PAMH210T		4	785
3	Minor Course 3	PAIE308T	Policy Education, Impact and Evaluation (PP) World History (HI)	4	778
		PAWH211T		4	787

4	Minor Course 4	PAPP310T	Public Policy in India (PP)	4	779
5	Minor Course 5	PAIC407T	Institutions & complexities in Public Policy Process (PP)	4	780
6	Minor Course 6	PAFP307T	Foreign Policy of India (PP)	4	781
7	Minor Course 7	PAPA104T	Environmental Policy and Administration (PP)	4	782
8	Minor Course 8	PARM405T	Research Methodology (PP)	3	783

SKILL ENHANCEMENT COURSES

Semes-ter	Category	Course Code	Course Name	Credits	Page No
1	S E Course 1	PAOH106L	Office, Home Management and Secretarial Practice	3	788
2	S E Course 2	PACO107L	Corporate Communication	3	789
3	S E Course 3	PAES209L	Ethics & Self Awareness	3	789

INTERNSHIPS

Semes-ter	Category	Course Code	Course Name	Credits	Page No
2	Internship	PAIN109I	Internship	4	
4	Internship	PAIN212I	Internship	4	790
5	Internship	PAIN311I	Internship	2	791

RESEARCH PROJECTS /DISSERTATIONS

BA PUBLIC ADMINISTRATION (Honours)					
Semes-ter	Category	Course Code	Course Name	Credits	Page No
7	Research Project/Disser-tation	PCDI409P	Research Project Phase I	6	791
8	Research Project/Disser-tation	PCDI410P	Research Project Phase II	6	792
BA PUBLIC ADMINISTRATION (Honours) with Research					
Semes-ter	Category	Course Code	Course Name	Credits	Page No
7	Research Project/Disser-tation	PCDI411P	Dissertation I	18	792
8	Research Project/Disser-tation	PCDI412P	Dissertation II	20	

DEPARTMENT OF PUBLIC ADMINISTRATION

PROGRAMME: BA PUBLIC ADMINISTRATION (HONOURS)/BA PUBLIC ADMINISTRATION (RE-SEARCH)

VISION:

Our unwavering commitment is to emerge as a distinguished centre of excellence in the domain of Public Administration, embodying unparalleled standards in learning, teaching, and research. Through the provision of bespoke experiences, we strive to instil profound human values, ultimately nurturing nation-building.

MISSION:

- Strive for academic excellence by delivering high-quality education, research, and practical training in Public Administration, developing a deep understanding of theoretical frameworks and practical applications.
- Cultivate and nurture visionary leaders with the skills to navigate complex public sector challenges, promoting effective governance and upholding the highest standards of ethical conduct in public service roles.
- Encourage cutting-edge research initiatives that address contemporary societal issues, while promoting strong ties with the community and relevant stakeholders to drive positive societal development.
- Provide a personalised learning environment, catering to individual needs and aspirations, maximising student potential for growth, success, and lifelong learning in the field.
- Enhance global awareness and prepare students to contribute effectively in an interconnected world, while dedicating efforts to contribute significantly to nation-building through competent and socially responsible public administrators driving positive change and sustainable development.

PROGRAM OUTCOMES (POs)

PO 1: Knowledge Acquisition: Ability to demonstrate a deep understanding of the principles, theories, and practices in Public Administration, acquired through rigorous academic training, research, and practical experiences.

PO 2: Ethical Decision-making: Ability to exhibit ethical leadership qualities and the ability to make principled decisions while navigating complex public sector challenges, demonstrating a commitment to upholding ethical standards and social responsibility.

PO 3: Practical Application: Equipped with the skills and competencies to apply the theoretical knowledge effectively in real-world scenarios, through internships, projects, and experiential learning opportunities.

PO 4: Interdisciplinary Perspective: Development of a holistic perspective of Public Administration by integrating knowledge from various disciplines, enabling them to analyse public governance issues from a broader societal context.

PO 5: Effective Communication: Ability to demonstrate proficiency in oral and written communication, enabling them to convey complex ideas, policies, and recommendations clearly to diverse stakeholders within the public sector.

PO 6: Problem-solving and Analytical Skills: The ability to be adept at critical thinking, problem-solving, and data analysis enables them to identify and address public administration challenges with innovative and evidence-based solutions.

PO 7: Community Engagement and Impact: The ability to actively engage with local and global communities, demonstrating a commitment to community welfare through participation in service projects, research initiatives, and collaborations with public organisations to effect positive change and contribute to nation-building efforts.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: To exhibit an in-depth understanding of advanced principles, theories, and contemporary practices in Public Administration, acquired through specialised academic training and extensive research exposure.

PSO2: To demonstrate a high level of ethical leadership and decision-making skills, exemplifying their ability to navigate intricate challenges within the public sector while upholding moral standards and social responsibility.

PSO3: To demonstrate exceptional proficiency in applying theoretical knowledge to real-world scenarios, effectively utilising their skills and competencies gained through internships, projects, and experiential learning opportunities.

PSO 4: To develop a comprehensive and integrated analytical perspective in Public Administration, synthesising knowledge from diverse disciplines to address public governance issues from a multidimensional societal context effectively.

LIST OF COURSES

Category	Course Code	Course Name
Major Course 1	PAIP100T	Introduction to Public Administration
Major Course 2	PAAT101T	Administrative Theory
Major Course 3	PAIA200T	Indian Administration
Major Course 4	PAPP201T	Public Policy and Governance
Major Course 5	PADA202T	Development Administration
Major Course 6	PACP203T	Comparative Public Administration
Major Course 7	PAAE204T	Administrative Ethics in Governance
Major Course 8	PAAL300T	Administrative Law
Major Course 9	PAEG301T	Environmental Governance
Major Course 10	PAGO302T	E-Governance
Major Course 11	PARL303T	Rural Local Governance
Major Course 12	PAUL304T	Urban Local Governance
Major Course 13	PASW305T	Social and Welfare Administration
Major Course 14	PARW306P	Excursion/survey, and report writing
Major Course 15	PAFA400T	Public Financial Administration
Major Course 16	PAPA401T	Public Personnel Administration
Major Course 17	PAEP402T	Engaged policy and Governance
Major Course 18	PAGA403T	Governance & Administration in South East Asia
Minor Course 1	PASP105T	Policy Making – Structures and Processes (PP)
	PAHI108T	Historiography, Early Civilizations, Ancient to Medieval Indian History (HI)
Minor Course 2	PAIC208T	Public Policy Implementation (PP)
	PAMH210T	Modern Indian History (HI)
Minor Course 3	PAIE308T	Policy Education, Impact and Evaluation (PP)
	PAWH211T	World History (HI)
Minor Course 4	PAPP310T	Public Policy in India (PP)
Minor Course 5	PAIC407T	Institutions & complexities in Public Policy Process (PP)
Minor Course 6	PAFP307T	Foreign Policy of India (PP)
Minor Course 7	PAPA104T	Environmental Policy and Administration (PP)
Minor Course 8	PARM405T	Research Methodology (PP)
S E Course 1	PAOH106L	Office, Home Management and Secretarial Practice

S E Course 2	PACO107L	Corporate Communication
S E Course 3	PAES209L	Ethics & Self Awareness

Mapping of Courses with POs/PSOs:

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO 4
Major Courses											
Major 1	M		H	M		H	M	M		M	
Major 2		M		M	H			H	H		H
Major 3	H		H	H		H			H		
Major 4	H				H			H		H	H
Major 5		H		H		H	H		H		M
Major 6	M		H		M		H		H	H	
Major 7	M		H	M		H	M	M		M	
Major 8		M		M	H			H	H		H
Major 9	H		H	H		H			H		
Major 10	H				H			H		H	H
Major 11		H		H		H	H		H		M
Major 12	M		H		M		H		H	H	
Major 13		H		H	H		H		H	H	
Major 14		H		H		M		H			
Major 15	M			H				M		H	
Major 16		M	H	H					M	H	
Major 17				H			H	M	H		
Major 18	M				H				H		
Minor Courses											
Minor 1 PP	H		M		H		H	M	H		H
Minor 1 HI		H		H		M		H		H	
Minor 2 PP	M		H		H	H	H		H	H	
Minor 2 HI											
Minor 3 PP	H		H	H	M	H		H	H		H
Minor 3 HI		H		M		H		H		H	
Minor 4 PP	M				H		H		M		H
Minor 5 PP	H		H		H		M		H	H	
Minor 6 PP	M	H		H		H		H		M	
Minor 7 PP				H			H		H		
Minor 8 PP	H		M		M			H			H
Skill Enhancement Courses											
S E 1	M		H					H			H
S E 2		H			M		M		H		
S E 3	H			H		H				H	

DETAILED SYLLABUS MAJOR COURSES

Semes-ter	Category	Course Code	Course Name	Credits
1	Major Course 1	PAIP100T	Introduction to Public Administration	4
2	Major Course 2	PAAT101T	Administrative Theory	4
3	Major Course 3	PAIA200T	Indian Administration	4
3	Major Course 4	PAPP201T	Public Policy and Governance	4
4	Major Course 5	PADA202T	Development Administration	5
4	Major Course 6	PACP203T	Comparative Public Administration	5
4	Major Course 7	PAAE204T	Administrative Ethics in Governance	4
5	Major Course 8	PAAL300T	Administrative Law	5
5	Major Course 9	PAEG301T	Environmental Governance	5
5	Major Course 10	PAGO302T	E-Governance	4
6	Major Course 11	PARL303T	Rural Local Governance	4
6	Major Course 12	PAUL304T	Urban Local Governance	4
6	Major Course 13	PASW305T	Social and Welfare Administration	4
6	Major Course 14	PARW306P	Excursion/survey, and report writing	4
7	Major Course 15	PAFA400T	Public Financial Administration	5
7	Major Course 16	PAPA401T	Public Personnel Administration	5
8	Major Course 17	PAEP402T	Engage policy and Governance	5
8	Major Course 18	PAGA403T	Governance & Administration in South East Asia	5

PAIP100T: INTRODUCTION TO PUBLIC ADMINISTRATION

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students will be able to:

CO1: Recall the various aspects and significance of Public Administration as a theoretical discipline (Remembering).

CO2: Explain various growth and trends in Public Administration (Understanding).

CO3: Identify the various forms and principles of organisations (Applying).

CO4: Examine the Role and functions of the chief Executive, Line, staff, auxiliary agencies and the relationship that exists among them (Evaluating).

Module I: Public Administration as a Discipline (15 hours)

Meaning, Nature, Scope, Dimensions and Significance of the discipline and its relations with social sciences, Public and Private Administration, Evolution of Public Administration

Module II: Growth and Trends in Public Administration (15 hours)

New Public Administration (NPA), New Public Management (NPM), Globalisation and Public Administration, Paradigm Shift from Government to Governance, New Public Service (NPS)

Module III: Organisation and its Principles (15 hours)

Organization: Meaning, Basis and Forms of Organizations. Principles of Organization: Hierarchy, Unity of Command, Span of Control, Coordination, Supervision, Authority and Responsibility, Centralisation and Decentralization, and Delegation.

Module IV: Chief Executive, Leadership and Accountability (15 hours)

Chief Executive: Meaning, Types, Functions and Role; Line, Staff and Auxiliary Agencies; Headquarter and Field relationships; Decision Making; Communication; Leadership; Accountability

Suggested Readings

1. Avasthi, A and Maheshwari, S R (2013) Public Administration. Lakshmi Narain Agarwal: Agra
2. Basu, Rumki (2008) Public Administration: Concepts and Theories. Sterling Publishers: New Delhi
3. Bhagwan, Vishnoo; Bhushan, Vidhya and Mohla, Vandana (2010) Public Administration. S. Chand: Jaipur
4. Bhambri, C. P. (2010) Public Administration Theory and Practice (21st Edition). Educational Publishers: Meerut
5. Bhattacharaya, Mohit (2008) New Horizons of Public Administration. Jawahar Publishers and Distributors: New Delhi
6. Bhattacharya, Mohit (2000) Public Administration. World Press: Calcutta
7. Bhattacharya, Mohit (2012) Public Administration: Issues and Perspective. Jawahar Publishers and Distributors: New Delhi
8. Chakrabarty, Bidyut and Chand, Prakash (2012) Public Administration in a Globalizing World: Theories and Practices. Sage: New Delhi
9. Fadia, B L, Fadia, Kuldeep (2017) Public Administration in India: Sahitya Bhawan: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PAAT101T: ADMINISTRATIVE THEORY

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students will be able to:

CO1: Recall various administrative theories (Remembering).

CO2: Illustrate the different phases in the development of the theoretical constructs of Public Administration (Understanding).

CO3: Identify the philosophy and principles of Public Administration as expounded by various thinkers (Applying).

CO4: Compare and contrast the classical theories with the modern/contemporary theories of Public Administration (Analysing).

Module I (20 hours) Indian and Classical Theories:

Kautilya; Scientific management (Taylor and his associates); Bureaucratic theory of organization (Weber); Administrative management theory (Henry Fayol, Luther Gulick and others).

Module II (20 Hours) Human Relations and Behavioural Theories:

Human Relations theory (Elton Mayo and his Colleagues); Behavioural theory (Chester Barnard and Herbert Simon).

Module III (20 Hours) Administrative Behaviour Theories:

Leadership, Communication, and Motivation (Maslow and Herzberg), Modern Administrative Theories: Minnow Brook Perspectives, New Public Service

Suggested Readings

1. Laxmikanth, M (2017) Administrative Theory. McGraw Hill Education: New Delhi
2. Prasad, D R; Prasad, V S; Satyanarayana, P; and Pardhasaradhi, Y (2017) Administrative Thinkers. Sterling: New Delhi
3. Nicholas Henry (2018) Public Administration and Public Affairs. Routledge.
4. M. Blau, Bureaucracy in Modern Society, (New York: Random House, 1962).
5. R.W. Cox, Public Administration in Theory and Practice, (New Delhi: Prentice Hall, latest edition).
6. D. Ravindra Prasad et.al. Administrative Thinkers, New Delhi, Sterling Publishers Pvt. Ltd (Latest English edition).
7. S.R. Maheshwari Administrative Thinkers, (New Delhi: Macmillan, Latest English edition).
8. Bhattacharaya, Mohit (2008) New Horizons of Public Administration. Jawahar Publishers and Distributors: New Delhi
9. Sapru, R.K. (2013), Administrative Theories and Management Thought. Prentice Hall of India: New Delhi.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2		H	M
CO 3	M	M	H
CO 4		M	H

PAIA200T: INDIAN ADMINISTRATION

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall the significant stages in the evolution of the Indian Administration (Remembering).

CO2: Explain the Roles and Functions of Constitutional Institutions (Understanding).

CO3: Identify the relationship existing between the various organs of Administration (Applying).

CO4: Examine the constitutional provisions and dynamics of the union-state relationship (Analysing)

Module I (15 hours) Evolution & Constitutional Framework:

Evolution of Indian Administration during the Ancient, Medieval and British period;

Constitutional Framework of Indian Administration; and Salient Features of Indian Administration

Module II (15 hours) Union Government:

President; Prime Minister & Council of Ministers; Central Secretariat, Cabinet Secretariat, Cabinet Committees, Prime Minister's Office; Ministry of Home Affairs and Finance Ministry.

Module III (15 hours) Constitutional Institutions, Union State Relations & Control over Administration:

Election Commission of India; Union Public Service Commission; Union State Relations (Legislative, Executive and Financial); Parliamentary, Executive and Judicial Control over Administration

Module IV (15 hours) Citizen and State Interface:

Citizens' Grievances Redressal Institutions and Mechanisms; Institutional Mechanism for Prevention of Corruption: Central Vigilance Commission; Lok Pal and Lok Ayukta; Politician and Civil Servant Relationship.

Suggested Readings

1. Arora, Ramesh K. and Goyal, Rajni (1997) Indian Public Administration: Institutions and Issues. New Age International Publishers: New Delhi
2. Avasthi, A and Avasthi, A P (2004) Indian Administration. Lakshmi Narain Aggarwal: Agra
3. Balfour, Lady Betty (2015) Lord Lytton's Indian Administration 1876-1880 The Untold History. Gyan Books: New Delhi
4. Basu, D D (2013) Introduction to the Constitution of India (21st Edition). Lexus Nexus: New Delhi
5. Chakraborty, Bidyut (2016) Indian Administration. Sage: New Delhi
6. Fadia, B L and Fadia, Kuldeep (2017) Indian Administration, (New Edition). Sahitya Bhawan: Agra
7. Ghuman, B S; Monga, Anil and Johal, Ramanjit Kaur (Eds.) (2012) Corruption and Quality of Governance: Experiences of Select Commonwealth Countries. Aalekh Publishers: Jaipur
8. Kangle R P (1972) The Kautilya Arthshastra. Motilal Banarsidass: New Delhi
9. Kapur, Devesh; Mehta, Pratap Bhanu and Vaishnav, Milan (Eds.) (2017) Rethinking Public Institutions in India. Oxford University Press: New Delhi
10. Maheshwari, S R (2000) Indian Administration. Orient Longman: New Delhi
11. Sharma, M (2007) Indian Administration. Anmol: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	M	
CO 3		M	H	
CO 4			M	H

PAPP201T: PUBLIC POLICY AND GOVERNANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall significance and scope, Public Policy Approaches and Models (Remembering).

CO2: Explain various concepts and theories of Governance (Understanding).

CO3: Identify the Role of various stakeholders in Public Policy Formulation (Applying).

CO4: Examine the various aspects of Policy Implementation, Policy Education and Policy Evaluation. (Analysing)

Module I: Introduction (15 hours) Public Policy:

Concept, Significance and Scope; Public Policy Approaches and Models with special reference to the Incrementalist and Rationalist Paradigms. Policy Cycle, Constraints in the Policy Process.

Module II: Concepts and Theories of Governance (15 hours)

Governance as per the World Bank, UNDP and others; Public Choice Theory, Public Value Theory; Governance as Theory, Governance and Public Governance; Role of State, Market and Civil Society in Governance.

Module III: Role of Various stakeholders in Public Policy formulation (15 hours)

Role of Legislature, Executive, Judiciary, Planning Machinery at the Central, State and local levels

Module IV: Public Policy Implementation, Education and Evaluation (15 hours)

Approaches to Policy Implementation, Role of Executive (with special reference to Bureaucracy), Legislature, Judiciary, Non-Governmental Organisations, Pressure Groups, Issues in Public Policy Implementation, Policy Education, Policy Evaluation: Approaches to Policy Evaluation: Criteria for Evaluation, Issues in Policy Evaluation

Suggested Readings

1. Chakraborti, Rajesh (2017) Public Policy in India. Oxford University Press: New Delhi
2. Chakraborty, Bidyut and Chand, Parkash (2016) Public Policy: Concept, Theory and Practice. Sage: New Delhi
3. Knill, Christoph, and Jale Tosun. Public policy: A new introduction. Bloomsbury Publishing, 2020.
4. Birkland, Thomas A. An introduction to the policy process: Theories, concepts, and models of public policy making. Routledge, 2019
5. Dror, Yehezkel. Public policy making reexamined. Routledge, 2017

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3		M	M	M
CO 4	H			H

PADA202T: DEVELOPMENT ADMINISTRATION

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Show a basic intellectual understanding of development, its approaches and sustainable development (Understanding)

CO2: Recall the concepts of Development Administration, including the ecological and post-globalisation contexts (Remembering)

CO3: Identify the various issues in Development Administration (Applying)

CO4: Classify the various perspectives on Public-Private Partnership, Corporate Social Responsibility, and Inclusive Development, and Sustainable Development Goals (Analysing)

Module I: Introduction (10 hours)

Development and its dimensions; Development and Modernization; Approaches to Development; Ecology of Development

Administration; Sustainable Development and Anti-Development

Module II: Conceptual Constructs (15 hours)

Development Administration – concept, nature, scope and objectives; Features and Significance of Development Administration; Contribution of Ralph Braibanti, Edward Weidner, Fred W. Riggs and Dwight Waldo.

Module III: Issues in Development Administration (25 hours)

Globalization and Development Administration; Emergence of Non-State Actors in Development Administration; Gender Parity in Development; Role of Bureaucracy in Development

Module IV: New Perspectives of Development (25 hours)

Public Private Partnership; Corporate Social Responsibility; Inclusive Development; Sustainable Development Goals (SDGs); Human Development Indicators and Social Audit

Suggested Readings

1. Palekar, S L (2012) Development Administration, PHI Learning: New Delhi
2. Palekar, S L (2012) Development Administration, PHI Learning: New Delhi
3. Farazmand, Ali, ed. Handbook of comparative and development public administration. CRC press, 2019.
4. Heady, Ferrel. Public Administration, A Comparative Perspective. CRC Press, 2001.

5. Ramulu, Ch. Bala (1999) International Organizations and Rural Employment Programs in India: Emerging Trends. Om Publishers: Faridabad, New Delhi
6. Sapru, R K (2008) Development Administration. Sterling : New Delhi
7. Mahajan, Puri, Anupama (2019) Development Administration in India: SAGE Publications India Pvt Ltd
8. Kaushik, Archana (2019) Welfare and Development Administration in India: Global Vision Publishing House: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	M
CO 4				H

PACP203T: COMPARATIVE PUBLIC ADMINISTRATION

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall the meaning, scope, and salient features of comparative Public Administration. (Remembering)

CO2: Explain the relevance of Comparative Public Administration in the context of Liberalization, Privatization and Globalization. (Understanding)

CO3: Identify the various approaches in the Study of Comparative Public Administration (Applying)

CO 4: Compare and contrast the grievance redressal mechanisms in UK, USA and Japan

Module I (25 Hours) Introduction:

Comparative Public Administration: Meaning, Nature, Scope and Significance; Salient Features of Administration in Developed & Developing Countries: UK, USA, Japan and India.

Module II (25 Hours) Relevance:

Relevance of Comparative Public Administration in the era of Liberalization, Privatization and Globalization,

Module III (25 Hours) Approaches, Administrative Systems & Accountability:

Structural-Functional M Approach; and Ecological Approach; Grievance Redressal Mechanism of the UK, USA, Japan, the Local government of the UK, USA, Japan.

Suggested Readings

1. Arora, R K and Sharma, S (Eds.) (1992) Comparative and Development Administration: Ideas and Actions. Arihant Centre for Administrative Change: Jaipur
2. Bhatt, A and Ranjan, R (2010) Comparative Government and Politics (1st Edition). Anmol Publications: New Delhi
3. Chaturvedi, T N (1994) Tulnatmak Lok Prashashan. College Book Depot: Jaipur
4. Dahiya, Sewa Singh and Singh, Ravindra (2012) Comparative Public Administration. Sterling Publishers: New Delhi
5. Farazmand, A (Ed.) (2001) Handbook of Comparative and Development Public Administration (2nd Edition). Marcell Dekker: New York
6. Heady, Ferrel (2001) Public Administration: A Comparative Perspective (6th Edition). Marcel Dekker: New York
7. Nadkarni, Vidya and Noonan, Norman C (Eds.) (2013) Emerging Powers in a Comparative Perspective: The Political and Economic Rise of the BRIC Countries. Bloomsbury Academic: London.
8. Mahajan, Anupama. P., (2022), Sage Publishing: New Delhi.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	M		
CO 2	M		
CO 3		H	
CO 4			H

PAAE204T: ADMINISTRATIVE ETHICS IN GOVERNANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall the concepts of Dharma, Freedom, Equality and Fraternity (Remembering)

CO2: Explain the practices of Satyagraha and truth in the present context (Understanding)

CO3: Identify the ethical principles used in addressing issues of inequalities (Applying)

CO4: Examine the functioning of the institutions like Lokpal and Lokayuktah through case studies (Analyzing)

Module I (20 Hours) Introduction:

Ethics – concept and significance; Key concepts – Right, Duty, Freedom, Equality, Fraternity, Karma, Puru-sharthas, and Dharma. Contribution of Kautilya: Character Building, Contribution of Mahatma Gandhi – Sat-yagraha and Truth.

Module II (20 Hours) Applied Ethics:

Issues of Inequality, Abortion, Foeticide, Suicide, Environment Degradation, Capital Punishment; Significance of Ethical and Moral Values in Governance, Nature of Moral Dilemmas

Module III (20 hours) Ethics in Public Life, Institutional Arrangements for fighting Corruption in India:

Civil Service Neutrality and Anonymity; Code of Ethics and Code of Conduct for Civil Services in India. Cor-ruption – Causes, Remedies; CVC, CBI, Lokpal and Lokayuktah. Measures to Tackle Corruption

Suggested Readings

1. Arora, R K (2008) Ethics in Governance: Innovations Issues and Instrumentalities. Rawat: Jaipur
2. Arora, Ramesh K (Ed.) (2014) Ethics, Integrity and Values in Public Service. New Age International: New Delhi
3. Bhargava, R (2006) Politics and Ethics of the Indian Constitution. Oxford University Press: New Delhi
4. Chakraborty, Bidyut (2016) Ethics in Governance in India. Routledge: New Delhi
5. Chaturvedi, T N (Ed.) (1996) Ethics in Public Life. IIPA: New Delhi
6. Gandhi, Mahatma (2009) Hind Swaraj. Rajpal & Sons: Delhi
7. Godbole, M (2003) Public Accountability and Transparency: The Imperatives of Good Governance. Orient Longman: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	M		
CO 2		H	
CO 3		M	H
CO 4			

PAAL300T: ADMINISTRATIVE LAW

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall the principles of natural justice, rule of law, administrative legislation, and adjudication (Remembering)

CO2: Explain the constitutional law, administrative law and droit administratif (Understanding)

CO3: Identify the merits and demerits of administrative tribunals and especially Central Administrative Tribunals (Applying)

CO4: Examine the evolution, growth and concept of ombudsman, Lokpal and Lokayukta and Central Vigilance Commission (Analyzing)

Module I (20 Hours) Introduction:

Administrative Law: Meaning and reasons for its growth, Distinction between Constitutional Law and Administrative Law and Droit Administratif.

Module II (25 Hours) Basic Tools:

Rule of Law; Principles of Natural Justice; Judicial Review of Administrative Action - concept and writs, Delegated Legislation- concept, rationale, merits and demerits.

Module III (30 hours) Administrative Tribunal and Ombudsman:

Administrative Tribunals-concept, Structure and functions Ombudsman: Institution of Ombudsman: concept and genesis, (Lok Pal and Lokayukta in India-composition, powers, functions and significance).

Suggested Readings

1. Chhabra, S (1990) Administrative Tribunals. Deep and Deep: New Delhi
2. Diwan, P (2007). Indian Constitution (2nd Edition). Law Agency: Allahabad
3. Kagzi, M C J (2008) Indian Administrative Law (2nd Edition). Metropolitan: Delhi
4. Massey, I P (2008) Administrative Law. Eastern Book Company: New Delhi
5. Mehta, S M (1990) Indian Constitutional Law. Deep and Deep: New Delhi
6. Sathe, S P (1998) Administrative Law (6th Edition). Tripathi: Bombay
7. Sharma, S K (2007) Directive Principles and Fundamental Rights. Deep and Deep: New Delhi
8. Werhan, Keith (2020), Principles of Administrative Law, West Academic Books: USA

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	H		
CO 2	H		
CO 3		H	M
CO 4			H

PAEG301T: ENVIRONMENTAL GOVERNANCE

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall the key concepts of environment, natural resources, biodiversity and Conservation and Management of waste. (Remembering)

CO2: Explain the environmental policies, Environmental Impact Assessment, Impact Prediction, Evaluation and Mitigation. (Understanding)

CO3: Identify the Structure, Functions and Role of Central Pollution Control Board, State Pollution Control Board and National Green Tribunal. (Applying)

CO4: Examine the Global Environment Issues, Role of UNEP and Sustainable Development Goals and Environment. (Analyzing)

Module I: Conceptual constructs (20 hours)

Environment, Healthy Environment, Climate, Biodiversity, Waste Management, Ecosystem Balance; Natural Resource Conservation & Management; Environmental Hazards and Risk Management, Population and Environment: Basic Issues, Environmental Impact of Population Growth and Agenda for Action

Module II: Environment Policies and Evaluation (10 hours)

National Environment Policy, 2006; Environmental Impact Assessment; and Impact Prediction, Evaluation and Mitigation

Module III: Environmental Administration (15 hours)

Ministry of Environment; Central Pollution Control Board – Structure, Functions and Role; State Pollution Control Board – Structure, Functions and Role; National Green Tribunal

Module IV: International Perspective (30 hours)

Global Environment Issues – Water Contamination, Atmospheric Pollution, Acid Rain, Noise Pollution and control strategies thereof. Important International conferences on Environment and recent developments; Interstate and International Cooperation for Environment Protection – Role of UNEP; Sustainable Development Goals and Environment

Suggested Readings

1. Bhatt, M S; Ashraf, S; and Illiyan, A (Eds.) (2008) Problems and Prospects of Environment Policy: Indian Perspective. Aakar Books: Delhi
2. Divan, S and Rosencranz, A (2001) Environmental Law and Policy in India (18th Edition). Oxford University Press: New Delhi
3. Dwivedi, O P (1997) India's Environmental Policies, Programmes and Stewardship. Palgrave Macmillan: London, UK
4. Krishnamoorthy, B (2017) Environmental Management: Text and Cases (3rd Edition). PHI Learning: New Delhi
5. Kulkarni, V and Ramachandra, T V (2006) Environmental Management. TERI Press: New Delhi
6. Roberts, J (2011) Environmental Policy (2nd Edition). Routledge: Abingdon, Oxon
7. Uberoi, N K (2007) Environmental Management (2nd Edition). Excel Books: New Delhi
8. UNEP (2015) Embedding the Environment in Sustainable Development Goals. Post 2015 Discussion Paper 1 Version

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4				H

PAGO302T: E-GOVERNANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course students are able to:

CO1: Recall the concepts, Scope and Significance of governance. (Remembering)

CO2: Explain the various perspectives and theories of Governance. (Understanding)

CO3: Identify the various e-governance initiatives undertaken to deliver Public services to the stakeholders. (Applying)

CO4: Developing necessary skills to use and operate e-governance or digital service delivery. (Applying)

CO5: Examine the legal frame works, Issues & Challenges for e-Governance in India. (Analyzing)

Module I: E-Governance Concepts and Initiatives: (15 hours)

Meaning, Definitions, Scope (Including stages and types of interactions in e-Governance) and Significance of e-Governance.

Module II: Perspectives and Theories (15 hours)

Theories of e-Governance (Six perspectives and six theories), Models of e-Governance (The General Information Dissemination Model, the Critical Information Dissemination Model, the Advocacy Model, the Interactive Model)

Module III: Growth of E-Governance (15 hours)

Growth of e-Governance initiatives in India, Pre-National e-Governance Plan and Post NeGP (NeGP 2006), e-Governance Initiatives in the area of Government to Citizens (G2C), Government to Business (G2B) and Government to Government G2G).

Module IV: Legal Framework, Issues & Challenges for e-Governance (15 hours)

I T Act – 2000 (ICT Act and important features of the Act); Information and Cyber Security. e-Readiness; Digital Divide (Gender, Geographic, Economic, Social and Political); Challenges; Resistance to Change, Capacity Building, Adaptation of Technology and Administrative Reforms.

Suggested Readings

1. Bellamy, Christine and John, Taylor (1998) Governing in the Information Age. Open University Press: Buckingham
2. Bhatnagar, S C (2004) E-Government: From Vision to Implementation. Sage: New Delhi
3. Sinha, R P (2006) E- Governance in India. Concept publishing Company: New Delhi
4. Bouwman, Harry; Hooff, Bart van den; Vingaert, Lidwien van de; and Dijk, Jan van (2005)
5. Information and Communication Technology in Organizations: Adoption, Implementation, Uses and Effects, Sage Publications: New Delhi
6. Gosling, P. (1997) Government in the Digital Age. Government Information Quarterly, Vol. 18, No. ER2. Bowerdean: London
7. Heeks, Richard (2006) Implementing and Managing e-Government: An International text. Sage: London
8. Jones, S. G. (Ed.)(1995) Cyber Society, Computer mediated communication and Community. Sage: Thousand Oaks CA

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4				H

PARL303T: RURAL LOCAL GOVERNANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall the meaning and significance of Rural Local Governance and the Community Development Programs. (Remembering)

CO2: Explain the evolution and growth of rural local governance with special reference to Panchayati raj institutions in India. (Understanding)

CO3: Identify the composition, functions and role of Gram Panchayat, Panchayat Samiti and Zila Parishad. (Applying)

CO4: Appraise the role and relationships of rural local democratic decentralized institutions (PRIs) with other institutions.

(Evaluating)

Module I (20 Hours) Introduction:

Rural local governance- meaning and significance; Community development programs and committees and commissions on Panchayati Raj constituted by the Government of India.

Module II (20 Hours) Panchayati Raj Institutions:

73rd Constitutional Amendment Act, 1992; Gram Sabha – composition, functions and role; Gram Panchayat – composition, functions and role; Panchayat Samiti – composition, functions and role; and Zila Parishad – composition, functions and role.

Module III (20 Hours) Institutional Framework for PRIs:

District Rural Development Agency; District Planning Committee; State Election Commission; State Finance Commission. Panchayati Raj Finance; Devolution of powers, functions

Suggested Readings

1. Baluchamy, S (2004) Panchayati Raj Institutions. Mittal Publications: New Delhi.
2. Biju, M R (2008) Panchayati Raj System in India: A Symbol of Participatory Democracy and Decentralized Development. Kaniska Publication: New Delhi.
3. Dharmaraj, Sengmalam (2008) Panchayati Raj System in India. Abhijeet Publications: New Delhi
4. Mahi Pal. (2020). Rural Local Governance And Development, SAGE Publications India Private Limited
5. Dr. S.R Myneni. (2016). Local Self Government, Allahabad Law Agency
6. Dr. Maheshwari. (2020). Local Self Government in India, Laxmi Narayan Agarwal
7. Bidyut Chakrabarty, Rajendra Kumar Pandey. (2018). Local Governance in India, Sage Publications India Private Limited

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	M		
CO 2		M	
CO 3			H
CO 4			M

PAUL304T: URBAN LOCAL GOVERNANCE

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Show the evolution and growth of urban local bodies in India. (Remembering)

CO2: Explain the composition, role, functions and resources of urban local governance. (Understanding)

CO3: Examine the relevance of the various Urban Development Programs and Governance. (Analyse)

CO4: Identify the various issue areas in Urban Governance. (Applying)

Module I: Introduction (15 hours)

Evolution of Local Governance in India, Urbanization: Concept; Trends; Challenges; Rural-Urban relationship.

Module II: Organizational Framework for Urban Governance (15 hours)

74th Constitutional Amendment Act; Structure, Composition and Functions of Metropolitan Committees, Municipal Corporations, Municipal Councils and Nagar Panchayats; State Finance Commission; State Election Commission

Module III: Urban Development Programmes and Urban Governance (15 hours)

Urban Development Programmes like AMRUT, NUHM, etc., SMART cities and other recent trends;

Module IV: Issue Areas in Urban Governance (15 hours)

Sources of Finance of Urban Local Government; Personnel Administration; Bureaucracy and Local Governance, State-Local relations; Globalization and Urban governance; Administrative Reforms in Local Governance

Suggested Readings

1. Ahluwalia, Isher Judge (2014). Transforming our cities: Facing up to India's Growing Challenge: Postcards of Change. HarperCollins: New Delhi
2. Ahluwalia, Isher Judge (2017) Urbanisation in India. Sage: New Delhi.
3. Ahluwalia, Isher Judge; Kanbur, Ravi and Mohanty, P K (2014) Urbanization in India: Challenges, Opportunities and the Way Forward. Sage: New Delhi
4. Aziz, A (1996) Decentralised Governance in Asian Countries. Sage: New Delhi Baud, I S A and Wit, J Dee (Eds.)(2008) New Forms of Urban Governance in India: Shifts, Models, Networks and Contestations. Sage: New Delhi
5. Bhattacharya, Mohit (1976) Management of Urban Government in India. Uppal: New Delhi
6. Sachdeva, Pradeep (2011) Local Government in India. Pearson: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	
CO 4				H

PASW305T: SOCIAL AND WELFARE ADMINISTRATION

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall the Key concepts of Social Administration and its significance in India (Remembering)

CO2: Explain the various scopes, principles and Organisations under Social Welfare Administration. (Understanding)

CO3: Identify the Role, Importance of social welfare, and Personnel Administration in the states in India. (Applying)

CO4: Examine the various Issues and Problems in Social Administration in India (Analysing)

Module I: Social Administration: An Introduction (10 Hours)

Concepts, Meaning, Nature, Scope and Principles, Significance of Social Administration, Social Administration in India, Social change and Social justice, Limitations and Prospects in future

Module II: Social Welfare Administration (20 Hours)

Meaning, Definition, Principles, and Scope of SWA, Policies and Organizations at the Central level - Ministry of Social Welfare; Ministry of Social Justice and Empowerment; Ministry of Minority Affairs; Ministry of Tribal Welfare,

Organisational structure, functions, programmes of Central Social Welfare Board and State Social Welfare Board; National Commissions for SC/ST, OBC, minorities, women

Module III: Directorate of Social Welfare in states (20 Hours)

Role, Importance of social welfare, Personnel Administration: Manpower planning, Induction, Training, Supervision, Staff

Welfare, Service Condition and Staff Morale, Problems faced by social work organisation, Laws related to Personnel Management

Module IV: Issues and Problems in Social Administration (10 Hours)

Social Administration and the Role of Civil Society, Globalization and Role of International Agencies, Role of administrators in Social Administration, Emerging Challenges to Social Administration in India: Administrative inefficiency and demotivation.

Suggested Readings

1. D. R. Sachdeva, Social Welfare Administration in India (New Delhi: Kitab Mahal, 2009)
2. P. D. Sharma and B. M. Sharma, Indian Administration: Retrospect and Prospect (New Delhi: Rawat Publications, 2009).
3. Mohinder Singh, Social Policy and Administration in India (New Delhi: M.D. Publications, 1996)
4. Roger A. Lohmann and Nancy Lohmann, Social Administration (New York: Colombia University Press, 2002)
5. Barbara N. Rogers and others, Comparative Social Administration (New York: Transaction Publications, 2007)
6. D.R. Sachdev, Social Welfare Administration in India (New Delhi: Kitab Mahal, 1992)
7. Ella Weinfurther Reed (ed), Social Welfare Administration, originally published in 1961 (New York: Colombia University, Press, digitalized in 2005)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	
CO 4				H

PARW306P: FIELD BASED LEARNING / MINOR PROJECT: Excursion/ A survey in Urban/Rural areas and report writing (4 Credits - 120 Hours) (L-T-P: 0-0-4)

PAFA400T: PUBLIC FINANCIAL ADMINISTRATION

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Understand the various aspects of Public Financial Administration in general and in the Indian context in particular (Understanding)

CO2: Explain the public budgeting and financial resource mobilization strategies in the Indian context (Understanding)

CO3: Identify the functions and relations of financial institutions. (Applying)

CO4: Examine the role of the Comptroller and Auditor General and Legislative Control over finances in Public Financial Administration. (Analyzing)

Module I: Introduction (15 hours)

Meaning and Significance of Public Finance and Public Financial Administration, Budget: Concept, Principles and Budget as an Instrument of Financial Administration,

Module II: Budgetary systems, Concept and Types of Budgets (20 hours)

Traditional Budgeting; Performance Budgeting; and Zero-Base Budgeting, Budget Preparation, Authorization and Execution with special reference to India

Module III: Financial Institutions and Union–State Financial relations (20 hours)

Union Ministry of Finance: organization, functions and role. Finance Commission: composition, functions and role, Monetary and Fiscal Policies and their significance. Union-State Financial Relations

Module IV: Resource Mobilization, Tax Administration and Financial Control (20 hours)

Resource Mobilization: Tax and Non-Tax Sources, Public Borrowings and Deficit Financing, Tax Administration: Principles; Issues and Reforms, Concept of Audit: Role of Comptroller and Auditor General. Legislative control over finances with special reference to Parliamentary Committees

Suggested Readings

1. Burkhead, J (1956) Government Budgeting. Wiley Sons: New York.
2. Chand, P (2010) Control of Public Expenditure in India (2nd Edition). Allied Publishers: New Delhi. Chand, P (2010). Performance Budgeting (2nd Edition). Allied Publishers: New Delhi.
3. Frank, Howard A (2006) Public Financial Management (1st Edition). CRC Press, Taylor & Francis Group: New York
4. Gupta, B N (2006) Indian Federal Finance and Budgetary Policy. Chaitanya Publishing House: Allahabad
5. Indian Administrative Reforms Commission (1969) Report on Centre-State Relations. Manager of Publications, Government of India, New Delhi.
6. Laxmikanth, M. (2022), Public Administration, Tata McGraw Hill Publication: New Delhi.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		M
CO 3			H	
CO 4				H

PAPA401T: PUBLIC PERSONNEL ADMINISTRATION

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Understand Key concepts and knowledge relating to Public Personnel Administration. (Understanding)

CO2: Explain the concepts and types of Career Systems, Classifications, Recruitment and Training. (Understanding)

CO3: Identify the Constitutional Provisions and the working of the recruitment agencies at the Union and state levels. (Applying)

CO4: Examine various mechanisms and their role in Public Personnel Administration and the role of Employee associations and other adjudications institutions (Analysing)

Module I: Introduction: Public Personnel Administration (10 hours)

Meaning, Nature and Scope; Issues in Public Personnel Administration: Neutrality, Ethics and Accountability.

Module II: Civil Service System: Career Systems (10 hours)

Concepts and types; Classification – Concepts and types; Recruitment; Training; Salary; Code of Conduct

Module III: Public Personnel system in India-I (20 hours)

Constitutional Provisions; Recruitment agencies at the Union and State levels; Recruitment, training, career advancement; position classification, discipline, performance appraisal, promotion, pay and service conditions.

Module IV: Human Resources and Personnel Management (20 hours)

Importance of Human resource development, Significance of Personnel Management, Advantages and Disadvantages of Bureaucratic System, Merit system and Spoils System, Hindrances to career development.

Module V: Personnel Mechanism (15 hours)

Employer-Employees Relations, Grievance, Redressal mechanism, Right to Form Associations, Joint-Consultative Council; Central Administrative Tribunal; Recent Civil Service Reforms.

Suggested Readings

1. Bhayana, S S and Singh S (2016) Public Personnel and Financial Administration (4th Edition). New Academics: Jalandhar
2. Sharma M. K., Personnel Administration, Anmol Publications Pvt Ltd
3. Bidyut Chakrabarty, Prakash Chand (2017) Public Administration: : From Government To Governance by Bidyut Chakrabarty Prakash Chand, Orient Blackswan Pvt Ltd
4. Davar, Rustom S (2008) Personnel Management and Industrial Relations in India (2nd Edition). Vikas Publishing House: New Delhi
5. Flippo, Edwin B (2008) Principles of Personnel Management (4th Edition). McGraw Hill: Kogakusha
6. Saxena, A P (2010) Training and Development in Government. Indian Institute of Public Administration: New Delhi
7. Maheshari, S R (2006) Public Administration In India: The Higher Civil Service, OUP India: New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M				
CO 2		M			
CO 3			H		
CO 4				H	H

PAEP402T: ENGAGED POLICY AND GOVERNANCE

(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Understand key concepts of Participatory Governance, and Relations between Participatory Governance and Deepening of Democracy (Understanding)

CO2: Explain the Pitfalls in Participatory Governance and the debate on democracy versus development (Understanding)

CO3: Identify issues related to Community engagement at the Grassroots Level (Applying)

CO4: Examine Issues of Local Engagement and Participation (Analysing)

Module I: Participatory Governance: An Overview (15 hours)

The Rationale of Participation: Concepts and Challenges; New Governance Paradigm: The Emerging Partnerships/Engagement Initiatives; Relations between Participatory Governance and Deepening of Democracy

Module II: Democracy, Social Inclusion and Development (20 hours)

Democracy and Development; Cross-country analysis of democracy and development between India and China; Political Regimes, Political Participation and Social Inclusion; Innovations and Pitfalls in Participatory Governance

Module III: Engaged Governance (15 hours)

Government Transparency in Policy Decisions; Engaging the Community at Grassroots Level; Electronic Platforms for Receiving and Implementing Public Input

Module IV: Participatory Local Governance (25 hours)

Participatory Governance Toolkits; Measuring Engagement or Participation; Issues in Engagement and Participation; Case

Studies a) Kudumbashree in Kerala, India b) Grameen Bank in Bangladesh c) Participatory Budgeting, Brazil d) Watershed Development Programme in Ralegansiddhi, India

Suggested Readings

1. Alexander, Jeffrey C. 2006. The Civil Sphere. New York: Oxford University Press.
2. Baiocchi, G., P. Heller, et al. 2011. Bootstrapping Democracy: Transforming Local Governance and Civil Society in Brazil. Stanford; Stanford University Press.
3. Barber, Benjamin. 1984. Strong Democracy: Participatory Politics for a New Age. Berkeley: University of California Press.
4. Boulding, C. and B. Wampler 2010. "Voice, Votes, and Resources: Evaluating the Effect of Participatory Democracy on Well-being." World Development 38(1): 125-135.
5. Bowler, S. and T. Donovan 2002. "Democracy, Institutions and Attitudes About Citizen Influence on Government." British Journal of Political Science 32(02): 371-390.
6. Diamond, L. J. 1999. Developing Democracy: Toward Consolidation. Baltimore, MD: Johns Hopkins University Press.
7. Fung A., E. Wright, et al. 2003. Deepening Democracy: Institutional Innovations in Empowered Participatory Governance. London: Verso Books.
8. Grindle, Merilee, 2007, Going Local: Decentralization, Participation, and the Promise of Good Governance. Princeton University Press.
9. Heller, P. 2000. "Degrees of Democracy: Some Comparative Lessons from India." World Politics 52(4): 484-519.
10. Isaac, T.M. Thomas and Patrick Heller. 2003. "Democracy and Development: Decentralized Planning in Kerala." In Deepening Democracy: Institutional Innovations in Empowered Participatory Governance. The Real Utopias Project IV. London: Verso.
11. Sen, Amartya. 1999. Development as Freedom. Oxford: Oxford University Press.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4

CO 1	M			
CO 2		M		
CO 3			H	
CO 4				H

PAGA403T: GOVERNANCE & ADMINISTRATION IN SOUTH EAST ASIA
(5 Credits – 75 Hours) (L-T-P: 4-1-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Show the historical background of South East Asia, its geo-political status, the Nature of Governance and Administration (Understanding)

CO2: Explain the Political structures and forms of Southeast Asian countries (Understanding)

CO3: Identify Contemporary issues in Southeast Asia (Applying)

CO4: Appraise the importance of South-East Asia in International Politics and relations (Evaluating)

Module I: Introduction to Southeast Asia (15 hours)

Southeast Asia and its formation; Historical background; Southeast Asia's geo-political status; nature of governance and administration of Southeast Asia; Case studies

Module II: Governance and administration of Southeast Asian Countries (20 hours)

Political structures and forms of Southeast Asian countries; Government Systems; Administrative Governance; Political governance; Economic governance; Debate on Southeast Asia as a model of governance and administration for the rest of the World; Case studies

Module III: Contemporary issues in Southeast Asia (20 hours)

Democracy vs Dictatorship; Religion and politics of divide; Terrorism; Population Explosion; Environmental Problem; Aggression and Territorial Disputes; Poverty and underdevelopment; Case studies

Module IV: Importance of Southeast Asia in international politics and relations (20 hours)

Economic Influence; Political Changes and impacts; Master Plan on ASEAN connectivity and achievements; International responses and reactions to Southeast Asia; Case studies

Suggested Readings

1. Kesavan, K. V., Singh, D. (2010). South and Southeast Asia: Responding to Changing Geo-political and Security Challenges. India: Institute of Southeast Asian Studies.
2. Mendoza, M. L., Gonzalez, E. T. (2003). Governance in Southeast Asia: Issues and Options. Philippines: Philippine Institute for Development Studies.
3. Ba, D. Alice and Beeson, Mark (2017). Contemporary Southeast Asia: The Politics of Change, Contestation, and Adaptation. United Kingdom: Bloomsbury Publishing.
4. Mccloud, D. G. (2018). Southeast Asia: Tradition and Modernity in The Contemporary World, Second Edition. United Kingdom: Taylor & Francis.
5. Kingsbury, D. (2016). Politics in Contemporary Southeast Asia: Authority, Democracy and Political Change. United Kingdom: Taylor & Francis.
6. Liow, J. C. (2016). Religion and Nationalism in Southeast Asia. United Kingdom: Cambridge University Press.
7. Acharya, A. (2013). The Making of Southeast Asia: International Relations of a Region. Singapore: Cornell University Press.
8. Kingsbury, D. (2016). Politics in Contemporary Southeast Asia: Authority, Democracy and Political Change. UK: Taylor & Francis.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3			H	
CO 4				H

MINOR COURSES**MINOR COURSES (PUBLIC POLICY-PP/ HISTORY-HI)**

Semes-ter	Category	Course Code	Course Name	Credits
1	Minor Course 1	PASP105T	Policy Making – Structures and Processes (PP)	4
		PAHI108T	Historiography, Early Civilizations, Ancient to Medieval Indian History (HI)	4
2	Minor Course 2	PAIC208T	Public Policy Implementation (PP)	4
		PAMH210T	Modern Indian History (HI)	4
3	Minor Course 3	PAIE308T	Policy Education, Impact and Evaluation (PP)	4
		PAWH211T	World History (HI)	4
4	Minor Course 4	PAPP310T	Public Policy in India (PP)	4
5	Minor Course 5	PAIC407T	Institutions & complexities in Public Policy Process (PP)	4
6	Minor Course 6	PAFP307T	Foreign Policy of India (PP)	4
7	Minor Course 7	PAPA104T	Environmental Policy and Administration (PP)	4
8	Minor Course 8	PARM405T	Research Methodology (PP)	3

MINOR COURSES IN PUBLIC POLICY (PP)

Semes-ter	Category	Course Code	Course Name	Credits
1	Minor Course 1	PASP105T	Policy Making – Structures and Processes (PP)	4
2	Minor Course 2	PAIC208T	Public Policy Implementation (PP)	4
3	Minor Course 3	PAIE308T	Policy Education, Impact and Evaluation (PP)	4
4	Minor Course 4	PAPP310T	Public Policy in India (PP)	4
5	Minor Course 5	PAIC407T	Institutions & complexities in Public Policy Process (PP)	4
6	Minor Course 6	PAFP307T	Foreign Policy of India (PP)	4
7	Minor Course 7	PAPA104T	Environmental Policy and Administration (PP)	4
8	Minor Course 8	PARM405T	Research Methodology (PP)	3

MINOR COURSES IN HISTORY (HI)

Semes-ter	Category	Course Code	Course Name	Credits

1	Minor Course 1	PAHI108T	Historiography, Early Civilizations, Ancient to Medieval Indian History (HI)	4
2	Minor Course 2	PAMH210T	Modern Indian History (HI)	4
3	Minor Course 3	PAWH211T	World History (HI)	4

MINOR COURSES IN PUBLIC POLICY (PP)

PASP105T: POLICY MAKING – STRUCTURES AND PROCESSES
(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students would be able to:

CO1: Recall the basic concepts of Public Policy. (Remembering)

CO2: Explain the role of different institutions involved in policy-making in India. (Understanding)

CO3: Identify various techniques and approaches of policy formulation. (Applying)

CO4: Examine the impact of globalization on policy making. (Analyzing)

Module I: Introduction to Public Policy (15 Hours)

Meaning, Nature, Scope and Significance; Public Policy and Public Administration, Policy Cycle

Module II: Policy Making Structures (15 Hours)

Inter-Governmental Relations; Role of Legislature; Role of Executive; Role of Judiciary; Role of Bureaucracy; Challenges in Policy Making

Module III: Policy Making Strategies (15 Hours)

Techniques of Policy Formulation; Approaches/ Models of Policy Making; Agencies involved in Policy Making; Informal Channels of Policy Making.

Module IV: Public Policy and Globalization: (15 Hours)

Impact of Globalization on Public Policy Making Process; Public Policy and LPG, International Organizations influencing Policy Making; Role of Private Sector in Public Policy Making

Suggested Readings

1. Ramesh Kumar Tiwari and AashaKapur Mehta, Public Policy and Administration, Gyan Publishing House 2012.
2. Christoph Knill and JaleTosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.
3. Maniram sharma, Public Policy in India, Mahaveer Publications, 2023.
4. Haridwar Shukla, Public Policy and Administration in India, Mahaveer Publications, 2021
5. Michael Howlett, Designing Public Policies: Principles and Instruments, Routledge, 2019.
6. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
7. Michael Howlett and JaleTosun (Eds.), Policy Styles and Policy Making: Exploring the Linkages, Routledge, 2018.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		

CO 3			H	
CO 4				H

PAIC208T: PUBLIC POLICY IMPLEMENTATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, the students are able to:

CO1: Explain the Concept and processes of policy implementation. (Understanding)

CO2: Identify the role played by different agencies in implementing policies. (Applying)

CO3: Examine the role played by stakeholders in policy implementation. (Analyzing)

CO4: Appraise Policy Implementation through case studies. (Evaluating)

Module I: Policy Implementation System (15 Hours)

The Concept of Policy Implementation; Approaches/ Models of Policy Implementation; Constraints of Policy Implementation

Module II: Agencies in Policy Implementation (15 Hours)

Policy Implementors; Political Executives in Policy Implementation; Permanent Executives in Policy Implementation; Relationship between Political and Permanent Executives in Policy Implementation Process

Module III: Stakeholders of Policy Implementation (15 Hours)

Role of Citizens; Role of Civil Societies; Role of Media and other relevant interest groups and actors

Module IV: Case Studies in Policy Implementation (15 Hours)

Suggested areas- Education, Health, Tribal Development, Weaker Sections. Evaluation and Feedback: Monitoring and Social Audit

Suggested Readings

1. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
2. Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015.
3. Christoph Knill and Jale Tosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.
4. Paul Cairney, Understanding Public Policy: Theories and Issues, Red Globe Press, London, 2020
5. Jaideep Singh, Case Studies in Public Administration, Indian Institute of Public Administration, 1983.
6. Darlington Mgbeke, Public Policy Implementation in Democratic Governance Society: A Roadmap to Empower Citizen Participation: An Empirical Study, Author House, 2009.
7. R.K Sapru, Public Policy: A Contemporary Perspective, Sage Publications India Pvt Ltd, 2017.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4				H

PAIE308T: POLICY EDUCATION, IMPACT AND EVALUATION

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall the basics of policy education. (Remembering)

CO2: Explain the use of the tools and techniques of policy monitoring and evaluation. (Understanding)

CO3: Identify the role of different institutions in policy evaluation. (Applying)

CO4: Examine the policy impact through case studies. (Analyzing)

Module I: Introduction to Policy Education (15 Hours)

Policy Education as an emerging discipline; Importance of Policy Education; Policy Education for Policy Implementation; Public Policy and Experiential Learning.

Module II: Monitoring, Evaluation and Review (15 Hours)

Methods and Approaches of Evaluation; Evaluation standards and Ethics; Approaches to Policy Monitoring; Policy Monitoring and Policy Outcomes; Importance of Policy Review, Strategies for Policy Review.

Module III: Policy Evaluation Institutions (15 Hours)

NITI Aayog, DMEO, Comptroller and Auditor General of India, Social Audit

Module IV: Policy Impact: Case Studies (15 Hours)

Poverty reduction, empowerment of women, environmental protection, educational development, Tribal Development

Suggested Readings

1. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
2. Christoph Knill and Jale Tosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.
3. Paul Cairney, Understanding Public Policy: Theories and Issues, Red Globe Press, London, 2020.
4. DN Khurana, Public Policy: Contemporary Issues, Excel Books, 2010.
5. Vishal Narain, Public Policy: A View From the South, Cambridge University Press, 2018.
6. Rachel Meltzer and Alex Schwartz, Policy Analysis as Problem Solving: A Flexible and Evidence-Based Framework, Routledge, 2018.
7. Jaideep Singh, Case Studies in Public Administration, Indian Institute of Public Administration, 1983.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3			M	
CO 4				H

PAPP310T: PUBLIC POLICY IN INDIA

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

CO1: To develop the understanding of public policy through its meaning, nature and significance. (Understanding)

CO2: To gain knowledge about various approaches of public policy. (Remembering)

CO3: To analyze the role of various policies for protecting women and children. (Analysing)

CO4: To evaluate the role of social policy and planning through various institutions in India. (Evaluating)

Module I: Introduction to Public Policy (15 Hours)

Meaning, Nature and Scope of Public Policy; Significance of Public Policy; Types of Policy; Public Policy and Public Administration; Policy Cycle

Module II: Approaches to Public Policy (15 Hours)

The Process Approach; The Logical Positivist Approach; The Phenomenological Approach; The Participatory Approach; The Normative Approach.

Module III: Social Policies in India (15 Hours)

Children's Policy in India for juvenile justice, child labour restraint and child marriage prevention; Critical Review of Governmental & Non-Governmental Efforts, Social Legislations and Women's Rights in India: Marriage Acts; Divorce Acts; Prevention of Domestic Violence; Prevention of Sexual Harassment at Workplace.

Module IV: Social Policy and Planning (15 Hours)

Role of Media Advocacy, Accountable Governance, Corporate Social Responsibility in India; Role of Important Institutional Machineries -NITI Aayog, National Commissions for Women, SCs, STs, Backward Classes, Evaluation of Social Policy in India.

Suggested Readings

1. Rajesh Chakrabarti and Kaushiki Sanyal, Public Policy in India, Oxford University Press, 2016.
2. Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
3. Maniram Sharma, Public Policy in India, Mahaveer Publications, 2023.
4. Haridwar Shukla, Public Policy and Administration in India, Mahaveer Publications, 2021
5. Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015
6. Veerendra Mishra, Transgenders in India: An Introduction, Taylor and Francis Group, Routledge Publications, 2023.
7. John Baldock et. al., Social Policy, London: Oxford University Press, 2011.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		M		
CO 3		M	H	
CO 4				H

PAIC407T: INSTITUTIONS & COMPLEXITIES IN PUBLIC POLICY PROCESS

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Explain the role of different institutions in policy-making process. (Understanding)

CO2: Identify the issues involved in policy design. (Applying)

CO3: Examine the factors behind complexities in policy implementation. (Analysing)

CO4: Appraise the impact of conditions in policy evaluation and analysis. (Evaluating)

Module I: Institutions in Public Policy Process (15 hours)

Inter-governmental relations; The role of the legislature; The role of political and permanent executives; the role of the judiciary; planning machinery at the central, state, and local levels.

Module II: Complexities in policy formulation (15 hours)

Identifying issues in agenda-setting; Faulty policy design- reasons and effects; inadequate collaborative policymaking

Module III: Complexities in policy implementation (15 hours)

Key factors behind policy failure; Policy failure and the policy-implementation gap; local contextual realities

Module IV: Complexities in Policy evaluation and analysis (15 hours)

Changing conditions and needs; Issues of cost-benefit analysis; Complexities in the analysis of outcomes of public policy

Suggested Readings

1. Sapru, R. (2019). *Public Policy: A Contemporary Perspective*. SAGE Publications Pvt. Limited.
2. Chakrabarty, B., & Chand, P. (2019a). *Public Policy: Concept, Theory and Practice*. SAGE Publications Pvt. Limited.
3. Chakrabarti, R., & Sanyal, K. (2017). *Public Policy in India*. Oxford India Short Introduction.
4. Knill, C., & Tosun, J. (2020). *Public Policy: A New Introduction*. Bloomsbury Publishing
5. Cairney, P. (2019). *Understanding Public Policy: Theories and Issues*. Bloomsbury Publishing.
6. Mathur, K. (2016). *Public Policy and Politics in India: How Institutions Matter*. Oxford India Paperbacks.
7. Singh, J. (1983), Case Studies in Public Administration. Indian Institute of Public Administration.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3		M	H	
CO 4				H

PAFP307T: FOREIGN POLICY OF INDIA

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Recall the principles and Phases of Indian Foreign Policy. (Remembering)

CO2: Explain India's engagement with Super Powers and International Institutions. (Understanding)

CO3: Identify the various determinants of India's Policy towards its Neighbours. (Applying)

CO4: Examine the role of India in relation to Major International Issues. (Analyzing)

Module I: Foreign policy of India: An Overview (15 hours)

Legacies- Strategic Thinkers- Determinants- Principles- Structure and Process- Phases of Indian Foreign Policy

Module II: India's engagement with Superpowers and International Institutions (15 hours)

USA- Russia- China- EU- UN- SAARC- ASEAN- G-77- G-20- BRICS- BIMSTEC

Module III: India and its Neighbours (15 hours)

Policy towards Immediate and Extended Neighbours- Defence- Energy Security- Trade; Cyber Security

Module IV: India and major International Issues (15 hours)

UNSC Reform- Terrorism- Maritime Security- International Migration- Palestine Problem-Environmental Governance- Military Intervention- Nuclear Issue

Suggested Readings

1. Mazumdar, A. (2014). Indian Foreign Policy in Transition: Relations with South Asia. United Kingdom: Taylor & Francis.
2. Menon, S. (2018). Choices: Inside the Making of India's Foreign Policy. India: Penguin Random House India Private Limited.
3. Jaishankar, S. (2020). The India Way: Strategies for an Uncertain World. India: HarperCollins India.
4. Pant, H. (2016). Indian Foreign Policy: An Overview. United Kingdom: Manchester University Press.
5. Mitra, S. K., Pauli, M. (2022). INDIA: Statecraft and Foreign Policy. Germany: Nomos.
6. Hall, I. (2019). Modi and the Reinvention of Indian Foreign Policy. United Kingdom: Bristol University Press.
7. Sikri, R. (2009). Challenge and Strategy: Rethinking India's Foreign Policy. India: SAGE Publications.
8. Alam A., Mohammad (2015). *Contours of India's Foreign Policy*. Oxford University Press.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H		
CO 3			H	M
CO 4				H

PAPA104T: ENVIRONMENTAL POLICY AND ADMINISTRATION

(4 Credits - 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, students would be able to:

CO1: Recall major Environmental Policy and legislations in India (Remembering)

CO2: Show the environmental issues in India (Understanding)

CO3: Identify the Impact of urbanization on the Environment (Applying)

CO4: Appraise the level of Environmental Protection in India (Evaluating)

Module I: Environmental issues in India (15 hours)

Nature of Environmental Problems in India; Environmental Policy and Legislation in India; Implementation of Laws relating to Environmental Protection

Module II: Development and Environment (15 hours)

Development – Environment Discourse; Global Environmental Governance

Module III: Urbanization (15 hours)

Urban Environmental administration and politics in India; Impact of urbanization on Environment and Public Health

Module IV: Urban Environmental Administration (15 hours)

Environmental Protection and People's rights and duties; Steps taken by the government for environmental protection in recent years; case studies on environmental degradation

Suggested Readings

1. Bruckmeier, Karl. "Global Environmental Governance: Social-Ecological Perspectives." (2018). Arild Vatn-Environmental Governance: Institutions, Policies and Actions
2. Divan, Shyam, and Armin Rosencranz. Environmental Law and Policy in India: Cases and Materials. Oxford University Press, 2022.
3. Evans, James P. Environmental governance. Routledge, 2012.
4. Portney, Kent E. Taking sustainable cities seriously: Economic development, the environment, and quality of life in American cities. MIT Press, 2013.

5. Spence, Michael, Patricia Clarke Annez, and Robert M. Buckley, eds. Urbanization and growth. World Bank Publications, 2008.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PARM405T: RESEARCH METHODOLOGY
(3 Credits – 45 Hours) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, students are able to:

CO1: Explain the key concepts in research methods, Research Process and Research Design. (Understanding)

CO2: Identification and mastery of the necessary skills to use research tools to undertake research study (Applying)

CO3: Evaluate governmental policy or programme/projects on the basis of primary and secondary data (Evaluating)

Module I: Foundations of Public Administration Research (15 Hours)

Key concepts in research methods; Meaning and types of research; Research process – Defining research problem, steps of research and application of research methods in Public Administration; Hypothesis; Research Design: Concept and importance; Types of research designs

Module II: Scientific Method, Measurement and Sampling Techniques (30 Hours)

Concept of scientific method; Basics of sampling and types of sampling, Data Collection, Processing and Analysis, Data analysis and Report writing

Suggested Readings

1. Kothari, C R and Garg, G (2018) Research Methodology: Methods and Techniques. New Age International Publishers: New Delhi
2. Kumar, Ranjit (2011) Research Methodology: A Step by Step Guide for Beginner. Sage Publications: London
3. McNabb, David E (2017) Research Methods in Public Administration and Non-profit Management (4th Edition). Routledge: UK
4. Miller, G J and Yang, K (Eds.) (2007) Handbook of Research Methods in Public Administration. CRC Press: New York

Mapping of COs to Syllabus

	Module 1	Module 2
CO 1	M	
CO 2		H
CO 3		H

MINOR COURSES IN HISTORY (HI)

PAHI108T: HISTORIOGRAPHY, EARLY CIVILIZATIONS, ANCIENT TO MEDIEVAL INDIAN HISTORY
(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

CO1: Recall the various Sources for understanding pre-history, proto history and megalithic Cultures (Remembering)

CO2: Show the economic conditions of society, contribution of Educational institutions, art and literature and major political thinkers in Post Mauryan Period. (Understanding)

CO3: Identify the major Political Developments in North India, Agriculture and Urban Economy, religious movement and Philosophies in Late 8th – 13th Century (Applying)

CO4: Identify the emergence of regional kingdoms in the late 17th and 18th centuries. (Applying)

Module I: An Overview of Sources and Pre-history up to Impact of Iranian and Macedonian invasions (15 Hours)

a) Archaeological Sources, Literary Sources, Indigenous sources and Foreign Accounts

b) Pre-history and Proto-history, Megalithic Cultures, Expansion of Aryans in India, Period of Mahajanapadas and Iranian and Macedonian invasions and their impact

Module II: Post Mauryan Period, Vakatakas and Vardhanas and Regional states (15 hours)

a) Early State and Society in Eastern India, Deccan and South India, Polity and administration, Economic conditions, Contribution of educational institutions, Literature, scientific literature, art and architecture, Growth of Vaishnava and Saiva religions.

b) Institutions of temple and temple architecture; Arab conquest of Sind; Alberuni, Local Government; Growth of art and architecture, religious sects, Institution of temple and Mathas, Agraharas, education and literature, economy and society.

c) Themes in Early Indian Cultural History: Languages and texts, major stages in the evolution of art and architecture, major philosophical thinkers and schools, ideas in Science and Mathematics.

Module III: India from Late 8th – 13th Century (15 hours)

a) Major political developments in Northern India and the Peninsula and Cultural Traditions in India, 750-1200: Village economy and society, Agriculture and urban economy, the status of the Brahman and the new social order, Condition of women, Indian science and technology, Shankaracharya and Vedanta, Ramanuja and Vishishtadvaita, Madhva and Brahma-Mimamsa, Literature in Sanskrit and in the newly developing languages, Kalhan's Rajtarangini, Alberuni's India and Khalji Revolution.

b) Political Developments and Economy in 15th & 16th Century: Rise of Provincial Dynasties: Bengal, Kashmir (Zainul Abedin), Gujarat, Malwa, Bahmanids, The Vijayanagara Empire, Lodis, The Sur Empire: Sher Shah's administration, Portuguese Colonial enterprise, Bhakti and Sufi Movements.

c) The Fifteenth to early seventeenth Century – Society and Culture: Regional cultural specificities, Literary traditions, Provincial architecture, Society, culture, literature and the arts in Vijayanagara Empire; Establishment of Jagir and Mansab systems under Akbar, Rajput Policy, Evolution of religious and social outlook, theory of Sulh-i-kul and religious policy, Religious policies of Jahangir, Shahjahan and Aurangzeb

Module IV: Late 17th Century Crisis and Revolts to 18th Century (15 Hours)

Late 17th Century Crisis and Revolts, The Ahom Kingdom, Shivaji and the early Maratha Kingdom, Factors for the decline of the Mughal Empire, The regional principalities: Nizam's Deccan, Bengal, Awadh, Maratha ascendancy under the Peshwas, Emergence of Afghan Power, Battle of Panipat 1761, State of politics, culture and economy on the eve of the British conquest

Suggested Readings

1. India- An Archaeological History: Paleolithic Beginnings to Early History, Dilip K. Chakrabarti, Oxford University Press (2009)
2. A History of Ancient and Early Medieval India: From the Stone Age to the 12th Century, Upinder Singh, Pearson Publisher (2009)

3. A History of India, Romila Thapar, Penguin Books Limited (1990)
4. India Through the Ages, Jadunath Sarkar, Life Span Publishers and Distributors (2020)
5. India's Ancient Past, R. S. Sharma, Oxford University Press (2006)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PAMH210T: MODERN INDIAN HISTORY
(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

- CO1: Recall the important events leading establishment of British Colonial Rule. (Remembering)
 CO2: Show the Economic, Social, religious and Cultural impact of British Colonial Rule. (Understanding)
 CO3: Identify the various responses to the British Rule in India. (Applying)
 CO4: Identify the impact of Politics of Separatism, Consolidation as a Nation and Economic & Political Changes. (Applying)

Module I: European Penetration into India (15 Hours)

- a) The Early European Settlements; The Portuguese and the Dutch; The English and the French East India Companies; Their struggle for supremacy; Carnatic Wars; Bengal - The conflict between the English and the Nawabs of Bengal; Siraj and the English; The Battle of Plassey; Significance of Plassey.
- b) British Expansion in India: Bengal – Mir Jafar and Mir Kasim; The Battle of Buxar; Mysore; The Marathas; The three Anglo-Maratha Wars; The Punjab, Annexation & Consolidation of the Lushai Hills.
- c) Early Structure of the British Raj: The early administrative structure; From diarchy to direct control; The Regulating Act (1773); The Pitt's India Act (1784); The Charter Act (1833); The voice of free trade and the changing character of British colonial rule; The English utilitarian and India.

Module II: Impact of British Colonial Rule (15 Hours)

- a) Economic Impact of British Colonial Rule: (a) Land revenue settlements in British India; The Permanent Settlement; Ryotwari Settlement; Mahalwari Settlement; Economic impact of the revenue arrangements; Commercialization of agriculture; Rise of landless agrarian labourers; Impoverishment of the rural society. (b) Dislocation of traditional trade and commerce; De-industrialisation; Decline of traditional crafts; Drain of wealth; Economic transformation of India; Railroad and communication network including telegraph and postal services; Famine and poverty in the rural interior; European business enterprise and its limitations.
- b) Social and Cultural Developments: The state of indigenous education, its dislocation; Orientalist-Anglicist controversy, The introduction of western education in India; The rise of press, literature and public opinion; The rise of modern vernacular literature; Progress of science; Christian missionary activities in India.
- c) Social and Religious Reform movements in Bengal and Other Areas: Ram Mohan Roy, The Brahmo Movement; Devendranath Tagore; Iswarchandra Vidyasagar; The Young Bengal Movement; Dayanada Saraswati; The social reform movements in India including Sati, widow remarriage, child marriage etc.; The contribution of Indian renaissance to the growth of modern India; Islamic revivalism – the Feraizi and Wahabi Movements.

Module III: Indian Response to British Rule (15 Hours)

- a) Various Peasant Movements and Tribal Uprisings leading to the birth of Indian nationalism: Peasant movements and tribal uprisings in the 18th and 19th centuries including the Rangpur Dying (1783), the Kol Rebellion (1832), the Mopla Rebellion in Malabar (1841-1920), the Santal Hul (1855), Indigo Rebellion (1859-60), Deccan Uprising (1875) and the Munda Ulgulan (1899-1900); The Great Revolt of 1857 - Origin, character, causes of failure, the consequences; The shift in the character of peasant uprisings in the post-1857 period; the peasant movements of the 1920s and 1930s.
- b) Factors leading to the birth of Indian Nationalism; Politics of Association; The Foundation of the Indian National Congress; The Safety-valve thesis relating to the birth of the Congress; Programme and objectives of Early Congress; the social composition of early Congress leadership; the Moderates and Extremists; The Partition of Bengal (1905); The Swadeshi Movement in Bengal; the economic and political aspects of Swadeshi Movement; The beginning of revolutionary extremism in India.
- c) Rise of Gandhi; Character of Gandhian nationalism; Gandhi's popular appeal; Rowlatt Satyagraha; the Khilafat Movement; the Non-cooperation Movement; National politics from the end of the Non-cooperation movement to the beginning of the Civil Disobedience movement; the two phases of the Civil Disobedience Movement; Simon Commission; The Nehru Report; the Round Table Conferences; Nationalism and the Peasant Movements; Nationalism and Working class movements; Women and Indian youth and students in Indian politics (1885-1947); the election of 1937 and the formation of ministries; Cripps Mission; the Quit India Movement; the Wavell Plan; The Cabinet Mission.
- d) Constitutional Developments in the Colonial India between 1858 and 1935 and Other strands in the National Movement
 - i. The Revolutionaries: Bengal, the Punjab, Maharashtra, U.P, the Madras Presidency, Outside India.
 - ii. The Left; The Left within the Congress: Jawaharlal Nehru, Subhas Chandra Bose, the Congress Socialist Party; the Communist Party of India, other left parties.

Module IV: Politics of Separatism, Consolidation as a Nation and Economic Development & Political Change (15 Hours)

- a) Politics of Separatism; the Muslim League; the Hindu Mahasabha; Communalism and the politics of partition; Transfer of power; Independence.
- b) Consolidation as a Nation; Nehru's Foreign Policy; India and her neighbours (1947-1964); The linguistic reorganisation of States (1935-1947); Regionalism and regional inequality; Integration of Princely States; Princes in electoral politics; the Question of National Language.
- c) Caste and Ethnicity after 1947; Backward castes and tribes in post-colonial electoral politics; Dalit movements.
- d) Economic development and political change; Land reforms; the politics of planning and rural reconstruction; Ecology and environmental policy in post - colonial India; Progress of science.

Suggested Readings

1. History of Modern India, Bipan Chandra, Orient Blackswan Private Limited (2020)
2. Modern Indian History, V.D. Mahajan, S. Chand Publishing (2020)
3. From Plassey to Partition and After, Sekhar Bandopadhyay, Orient Blackswan Private Limited (2014)
4. Modern India: 1885-1947, Sumit Sarkar, Pearson Education India (2014)
5. India: What can it Teach Us? (A Course of Lectures Delivered Before the University of Cambridge), F. Max Muller, General Press (2022)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	

CO 4				H

PAWH211T: WORLD HISTORY

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes

CO1: Recall the important ideas and events brought about enlightenment, modern Politics and Industrialisation (Remembering)

CO2: Show the rise of Nationalism, Imperialism, colonialism, Revolution and Counter Revolution (Understanding)

CO3: Identify the various causes and consequences of World Wars, Power Blocs, Non-alignment and End of Colonial Rule (Applying)

CO4: Identify the factors constraining Development, unification of Europe, disintegration of Soviet Union and rise of unipolar world. (Applying)

Module I: Enlightenment, Origins of Modern Politics and Industrialization (15 Hours)

- Enlightenment and Modern ideas: Major ideas of Enlightenment: Kant, Rousseau; Spread of Enlightenment in the colonies; Rise of socialist ideas (up to Marx); spread of Marxian Socialism.
- Origins of Modern Politics: European States System; American Revolution and the Constitution; French revolution and aftermath, 1789-1815; American Civil War with reference to Abraham Lincoln and the abolition of slavery; British Democratic Politics, 1815-1850; Parliamentary Reformers, Free Traders, Chartists.
- Industrialization: English Industrial Revolution: Causes and Impact on Society; Industrialization in other countries: USA, Germany, Russia, Japan; Industrialization and Globalization.

Module II: Nation-State System, Imperialism and Colonialism and Revolution & Counter-Revolution (15 Hours)

- Nation-State System: Rise of Nationalism in 19th century; Nationalism: state-building in Germany and Italy; Disintegration of Empires in the face of the emergence of nationalities across the world.
- Imperialism and Colonialism: South and South-East Asia; Latin America and South Africa; Australia; Imperialism and free trade; Rise of neo-imperialism.
- Revolution and Counter-Revolution: 19th Century European revolutions; The Russian Revolution of 1917-1921; Fascist Counter-Revolution, Italy and Germany; The Chinese Revolution of 1949

Module III: World Wars; Post World War II & Liberation from Colonial Rule (15 Hours)

- World Wars: 1st and 2nd World Wars as Total Wars: Societal implications; World War I: Causes and consequences; World War II: Causes and consequence
- The World after World War II: Emergence of two power blocs; Emergence of Third World and non-alignment; UNO and the global disputes.
- Liberation from Colonial Rule: Latin America-Bolivar; Arab World-Egypt; Africa-Apartheid to Democracy; South-East Asia-Vietnam

Module IV: Factors Constraining Development, Unification of Europe, Disintegration of Soviet Union and Rise of Unipolar World (15 Hours)

- Factors constraining development: Latin America, Africa
- Unification of Europe: Post War Foundations: NATO and European Community; Consolidation and Expansion of European Community; European Union.
- Disintegration of Soviet Union and the Rise of the Unipolar World: Factors leading to the collapse of Soviet communism and the Soviet Union, 1985-1991; Political Changes in Eastern Europe 1989-2001; End of the cold war and US ascendancy in the World as the lone superpower.

Suggested Readings

1. A Short History of the World, H.G. Wells, Fingerprint Publishing, 2015
2. Mastering Modern World History, Norman Lowe, Palgrave Master Series (2013)
3. History of the World, Arjun Dev and Indira Arjun Dev, Orient Blackswan (2009)
4. History of the Modern World, Dr. Hukam Chand Jain, Jain Prakashan Mandir (2022)
5. A History of the Modern World: An Outline, Ranjan Chakrabarti, Primus Books (2013)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

SKILL ENHANCEMENT COURSES

Semes-ter	Category	Course Code	Course Name	Credits
1	S E Course 1	PAOH106L	Office, Home Management and Secretarial practice	3
2	S E Course 2	PACO107L	Corporate Communication	3
3	S E Course 3	PAES209L	Ethics & Self Awareness	3

PAOH106L: OFFICE, HOME MANAGEMENT AND SECRETARIAL PRACTICE

(3 Credits – 15+30 Hours) (L-T-P: 1-0-2)

Course Outcomes

At the end of the Course, students will be able:

CO1: To demonstrate the functioning of the office management, filing and indexing systems, secretarial practices, and meeting procedures. (Understanding)

CO2: To acquire Proficiency in using tools and techniques in office management, filing, and indexing systems and secretarial practices. (Applying)

Module I: Theory (15 Hours)

Modern managerial tools for office management; Modern office record management; Modern filing and indexing systems; Modern Secretarial practices and meeting procedures.

Module II: Practical (30 hours)

The practice of modern managerial tools for office management; The practice of modern office record management; The Practice of modern filing and indexing systems; Practicing Data Entry Operations and Typing; Organising mock organisational meetings: preparation of notices and correspondences, agendas, Resolutions, Minutes, and confirmation of the Minutes and holding meetings.

Suggested Readings

1. Hislop, Donald, Rachele Bosua, and Remko Helms. *Knowledge management in organizations: A critical introduction*. Oxford University Press, 2018.
2. Shark, Alan R. *Technology and public management*. Taylor & Francis, 2022.
3. Read, Judith, and Mary Lea Ginn. *Records management*. Cengage Learning, 2015.

4. Smith, Kelvin. *Public sector records management: A practical guide*. Ashgate Publishing, Ltd., 2007.
5. Chowdhury, Gobinda G. *Introduction to modern information retrieval*. Facet Publishing, 2010.
6. Price, Leah. *Literary secretaries/secretarial culture*. Routledge, 2017.

Mapping of COs to Syllabus

	Module 1	Module 2
CO 1	H	M
CO 2	M	H

PACO107L: CORPORATE COMMUNICATION

(3 Credits – 15+30 Hours) (L-T-P: 1-0-2)

Course Outcomes

At the end of the Course, students will be able:

CO1: To demonstrate skills in modern corporate communication. (Understanding)

CO2: To acquire Proficiency in using modern tools and techniques in corporate communication (Applying)

Module I: Modern corporate Communication tools: (15 Hours)

Social intranet, all-in-one employee communication tools, Task/ project management software and tools, Instant messaging, Newsletters, Voice & video conferencing tools (like Cisco Webex Meetings, Go To Meeting, ZOOM; SKYPE, Google Meet, and Microsoft Teams), Document collaboration tools (like Google Workspace), ERP, Knowledge centre tools, File sharing tools, Employee directory software, Internal blogs, videos & updates, Analytics, Discussion forums, Email management tools, Communication tools for the social media content (like Buffer or Hootsuite).

Module II: Practical (30 Hours)

Practising Modern Corporate Communication tools

Suggested Readings

1. Wrench, Jason S., ed. *Workplace communication for the 21st century: Tools and strategies that impact the bottom line*. ABC-CLIO, 2013.
2. Patterson, Kerry, et al. *Crucial conversations tools for talking when stakes are high*. McGraw-Hill Education, 2012.
3. Sullivan, Jay. *Simply said: Communicating better at work and beyond*. John Wiley & Sons, 2016.
4. Fine, Debra. *The Fine Art of Small Talk: How to Start a Conversation, Keep It Going, Build Networking Skills--and Leave a Positive Impression!*. Hachette UK, 2023.

Mapping of COs to Syllabus

	Module 1	Module 2
CO 1	H	M
CO 2	M	H

PAES209L: ETHICS AND SELF AWARENESS

(3 Credits – 15+30 Hours) (L-T-P: 1-0-2)

Course Outcomes:

At the end of the Course, students will be able:

CO1: To demonstrate knowledge of Ethics and Self Awareness. (Understanding)

CO2: To Make Use of Skills and values in the practice of Ethics and self-awareness. (Applying)

Module I: Introduction - Ethics and Self-Awareness (15 Hours)

Ethical theories; Moral principles and strategies for weighing competing values and interests; Essence, determinants, and consequences of ethics in-human actions; Self-awareness – techniques

Module II: Practical (30 Hours)

Ethics Tournaments; Signing Honour Codes; Self-awareness – activities

Suggested Readings

1. Singer, Peter. *Practical ethics*. Cambridge University Press, 2011.
2. Thompson, Mel. *Understand Ethics: Teach Yourself: Making Sense of the Morals of Everyday Living*. Hachette UK, 2010.
3. Rachels, James, and Stuart Rachels. *The Elements of Moral Philosophy 7e*. McGraw-Hill, 2012.
4. Tugaleva, Vironika. *The art of talking to yourself: Self-awareness meets the inner conversation*. Soulux Press, 2017.
5. Holiday, Ryan. *Ego is the Enemy*. Elex media komputindo, 2019.
6. Williams, Ron. *Learning to lead: The journey to leading yourself, leading others, and leading an organization*. Greenleaf Book Group, 2019.

Mapping of COs to Syllabus

	Module 1	Module 2
CO 1	H	M
CO 2	M	H

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	PAIN109I	Internship	4
4	Internship	PAIN212I	Internship	4
5	Internship	PAIN311I	Internship	2

PAIN109I/PAIN212I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits: 120 Hours)

The student will carry out a field Internship as per the need of the Organization with a specific Objective since he or she will exit after 1st year or 2nd Year of UG Programme. The Internship will be of 1 month duration with follow up of the supervisors allotted as per as specialization. The student will need to sort out the Organisation with due permissions of the Department/University authorities and submit a preliminary plan for approval. The plan of activities undertaken during the Internships would be areas related to Public Administration, Public Policies, Rural Development, Urban Development etc with specific objectives and Mission and Vision of the Organisation. The student will submit a final report of the Internships with supportive documents and signature of the Organization where he/she has undertaken the Internships within 10 days after the Internship is over.

Time duration: 1 Month/30 days

Final Report: Within 10 days after the Internship is over (Hard Copy in Hard/Spiral Bound), 30-40

Pages

Marks: 100

PAIN311I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)
(2 Credits-60 Hours)

The student will carry out a field Internship as per the need of the Organization with a specific Objective at the end of the 4th Semester and Evaluated in the 5th Semester of UG Programme. The Internship will be of 1 month duration with follow up of the supervisors allotted as per as specialization. The student will need to sort out the Organization with due permissions of the Department/University authorities and submit a preliminary plan for approval. The plan of activities undertaken during the Internships would be areas related to Public Administration, Public Policies, Rural Development, Urban Development etc with specific objectives and Mission and Vision of the Organisation. The student will submit a final report of the Internships with supportive documents and signature of the Organization where he/she has undertaken the Internships within 10 days after the Internship is over.

Time duration: 1 Month/30 days

Final Report: Within 10 days after the Internship is over (Hard Copy in Hard/Spiral Bound), 30-40 Pages

Marks: 100

RESEARCH PROJECT /DISSERTATION

BA PUBLIC ADMINISTRATION (Honours)				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	PCDI409P	Research Project Phase I	6
8	Research Project/Dissertation	PCDI410P	Research Project Phase II	6
BA PUBLIC ADMINISTRATION (Honours) with Research				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	PCDI411P	Dissertation I	18
8	Research Project/Dissertation	PCDI412P	Dissertation II	20

BA PUBLIC ADMINISTRATION (Honours)

PADI408P: Research Project Phase I
(6 credits – 180 hours) (L-T-P: 0-0-12)

The Research project is divided into two phases, taking place during Semester VII and Semester VIII, known as Research Project Phase-I and Research Project Phase-II, respectively. The primary objective of this course is to enhance students' independent critical thinking abilities and improve their oral and written communication skills by incorporating a research project alongside a strong academic foundation. The research project aims to achieve valuable learning outcomes with long-term impacts, preparing undergraduates for their future professional endeavours.

During the first phase of the research project, students are required to select a suitable study topic within their area of specialization. They must effectively articulate and formulate a research question related to their chosen topic. Additionally, students need to gather relevant literature pertaining to their research topic and,

if applicable, develop research hypotheses. Proper planning of the research design is essential, including considerations for sampling, observational, statistical, and operational designs.

PADI409P: Research Project Phase II
(6 credits – 180 hours) (L-T-P: 0-0-12)

The Research project spans across two semesters, Semester VII and Semester VIII, referred to as Research Project Phase-I and Research Project Phase-II, respectively. In Phase-I, students select a research topic and begin their work. Phase-II serves as a continuation of Phase-I, where students refine their research project and prepare it for presentation.

During Phase-II, students are required to compile relevant data, analyze and interpret it, and, if applicable, test any hypotheses. By analyzing and interpreting the collected data, the student (researcher) will draw logical conclusions and propose appropriate recommendations for the research problem. The final outcome should be a well-structured project report that the students will defend in front of a panel of examiners.

BA PUBLIC ADMINISTRATION (Honours) with Research

PADI410P: DISSERTATION I
(18 Credits -540 Hours) (L-T-P: 0-0-36)

The students will have to submit a dissertation, which will be assessed by External Examiners appointed by the University. The dissertation work will be spread over two semesters, namely Semester VII and Semester VIII, referred to as Dissertation Phase-I and Dissertation Phase-II, respectively. The total dissertation carries 38 credits, with 18 credits assigned to Semester VII and 20 credits to Semester VIII.

The main objectives of the course are to enhance students' presentation skills and develop their academic writing abilities. Additionally, the course aims to enable students to apply the statistical research training they have received during the taught portion of the program. This application will involve designing an appropriate research strategy and methodology to conduct their research.

During Dissertation Phase-I, students are expected to come up with a research idea independently. By the end of Semester VII, they must defend a research proposal based on this idea, presenting it as a Synopsis.

Structure of Dissertation Phase-I

Sl. No.	Tentative Stages to be completed
1.	Research idea or concept note, i.e., Statement of the Problem
2.	Review of Literature
3.	Research Methodology Sampling, Sample size determination, Selection of sample, Analytical tools to be used, Questionnaire preparation, Preliminary exploration of data, i.e. Pilot Survey
4.	Synopsis Presentation Submission of Modified Synopsis to the Department
5.	Students have to collect all the required data during the semester

PADI411P: DISSERTATION II
(20 Credits -600 Hours) (L-T-P: 0-0-40)

The students need to submit a dissertation, which will be evaluated by External Examiners chosen by the University. The dissertation work will be divided into two phases: Dissertation Phase-I in Semester VII and

Dissertation Phase-II in Semester VIII. These phases account for a total of 38 credits, with 18 credits in Semester VII and 20 credits in Semester VIII.

The primary objective of the course is to refine the students' dissertations during Phase-I, while also teaching them how to apply statistical and scientific tools to their research. They will also learn research ethics. In Dissertation Phase-II, the students will conduct data analysis, write the dissertation, and defend it before the end of the semester.

The dissertation must encompass original research questions (if any), a critical review of relevant literature, use of analytical tools to address the research questions, data analysis, and interpretation. Following all guidelines provided by the University, the students must submit the completed dissertation. Throughout this process, the students will receive guidance from a designated supervisor from the department.

Structure of Dissertation Phase-II

Sl. No.	Tentative Stages to be completed
1.	Validation of data, data entry and preliminary analysis of data (drawing graphs, trend lines, making tables, etc.)
2.	Main data analysis and interpretation
3.	Dissertation writing, Proof reading, and Plagiarism checking
4.	Submission and Viva Voce

VALUE ADDED COURSES

DEPARTMENT OF PUBLIC ADMINISTRATION

PACS0022: CIVIL SERVICE IN INDIA

Credits: 3 (45 lectures) (45 Hours)

Course Outcomes

At the end of this course, students are able to:

1. Understand the Concept, Significance and Evolution of Civil Services (Remembering & Understanding)
2. Understand the Concept of Bureaucracy and its historical evolution (Understanding)
3. Analyze the Changing Nature of Public Services (Analyzing)
4. Evaluate the Civil Services in the context of Globalisation (Applying)

Module I (10 hours) Civil Services:

Concept, Significance and Evolution of Civil Services; Classification of Civil Services (All India Services, Central Services, State Services and Local Services); Union Public Service Commission and Other Service Commissions

Module II (10 hours) Bureaucracy:

Concept of Bureaucracy – Historical Evolution; Civil Service: Neutrality and Commitment; Relationship between Politicians and Civil Servants

Module III (10 hours) Public Personnel Administration:

Recruitment; Methods and Significance; Training of Public Servants in India- Promotion System in India; Disciplinary Procedure for Civil Servants

Module IV (10 hours) Civil Services-Citizenry Interface:

Civil Society and Administration; Technology and Changing Nature of Public Services; Ethics and Accountability

Module V (05 hours) Indian Civil Services:

Major Issues - Generalists and Specialists Controversy, Civil Services in the context of Globalisation, Civil Service Reforms- IInd ARC Recommendation

Suggested Readings

1. P. N. Parashar- History and Problems of Civil Services in India
2. Yogendra Narain- Civil Services: Challenges And Resolutions
3. Abhay Prasad Singh & Krishna Murari - Constitutional Government and Democracy in India
4. S.K. Das - The Civil Services in India
5. Lohit Matani, Vishal - An Introduction to Civil Services
6. S.N. Singh - Politician Civil Servant Relationship and Public Administration in India
7. Sandeep Sharma- Indian Civil Service and Public Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
1	H	L	L	L
2	L	H	L	L
3	L	L	H	L
4	L	L	L	H

PAIG0023: INNOVATION IN GOVERNANCE

Credits: 3 (45 lectures) (45 Hours)

Course Outcomes

At the end of this course, students are able to:

1. Understand the Institutional Framework for Promoting Innovations (Remembering & Understanding)
2. Understand the Methodological Approach for studying best Practices (Understanding)
3. Analyze the Innovations in Public Services (Analyzing)
4. Evaluate the role of Citizen Participation in Government Innovations. (Applying)

Module – I (10 hours) Innovations in Governance:

Meaning of innovation in governance; Perspectives and Challenges; Characteristics and Patterns of Innovations; Institutional Framework for Promoting Innovations; Public Governance and Innovations: Administrative Reform to Innovation Discourse

Module – II (10 hours) Understanding Innovations:

Innovation for Achieving a Quality of Life, Methodological Approach for Studying Best Practices, Capacities for Innovation and Best Practices

Module – III (10 hours) Innovations in Public Services:

Recent trends; Innovation Capacity in Organizations; Leadership and Innovation; Innovations in different sectors: General Administration, Urban Administration, Health Administration, Private Sector, Agriculture, etc

Module – IV (10 hours) Transferability of Best Practices and Innovations:

The Ombudsman against Corruption, Technology and Changing Nature of Organizations, Best Practices of Knowledge Management Framework, Diffusion of Innovation in a Development Context

Module – V (05 hours) Issue Areas:

Originality and Replication of Innovations; Innovation with or Without Improvement; Citizen Participation in Government Innovations; Research in Innovative Governance

Suggested Readings

1. Anttiroiko et.al. (Eds.) (2011), Innovations in Public Governance, IOS Press.
2. Bevir, Mark, ed. (2010) The Sage Handbook of Governance. Thousand Oaks, CA: Sage Publications.
3. Borins, S. (2001), The Challenge of Innovating in Government (PricewaterhouseCoopers Endowment for the Business of Government,) Governance Innovators Network, <http://www.innovations.harvard.edu/>
4. Innovations in Governance and Public Administration: Replicating what works, (2006) Department of Economic and Social Affairs, United Nations, New York
5. Jean Hartley (January 2005), Innovation in Governance and Public Services: Past and Present, Public Money & Management, pp.27-36.
6. Newman, J., Raine, J. and Skelcher, C. (2000), Innovation in Local Government: A Good Practice Guide (DETR, London).
7. Peters, B. Guy (1996) The Future of Governance: Four Emerging Models, pp. 1-20.
8. Pollitt, C. and Bouckaert, G. (2000), Public Management Reform: A Comparative Analysis (Oxford University Press, Oxford).
9. Sanford Borins, ed., (2008), Innovations in Government Research, Recognition, and Replication, Brookings Institution Press.
10. Stephen P. Osborne, Ed.,(2001), The New Public Governance? Emerging Perspectives on the Theory and Practice of Public Governance. London: Routledge
11. Walker, R., Jeanes, E. and Rowlands, R. (2002), Measuring innovation: Applying the literature based innovation output indicator to public services. Public Administration, 80, pp. 201–214.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
1	H	L	L	L
2	L	H	L	L
3	L	L	H	L
4	L	L	L	H

DEPARTMENT OF PHILOSOPHY

PROGRAMME: BACHELOR OF ARTS in PHILOSOPHY (BA) Degree: BA PHILOSOPHY (HONOURS) MINORS IN ENGLISH AND PSYCHOLOGY

VISION:

To be a centre of excellence in teaching, learning, and research that is committed to moulding ethically and socially responsible graduates with deeper knowledge about God, the world, and the human person in his or her social setting, which is religiously, culturally, economically, linguistically, and ethnically diverse.

MISSION:

The Department of Philosophy seeks to:

Promote critical thinking by training students to analyse, evaluate, and interpret societal events, which aims at the integral development of students.

Search for and find true values and meanings with a coherent and cogent exposition of one's philosophical convictions.

Provide the students with a worldview that ensures a holistic vision of reality by engaging them with the multi-cultural and multi-linguistic traditions of northeast India and its people.

Inculcate among the students true human values that promote and appreciate each other's differences.

PROGRAMME OUTCOMES (PO)

- PO 1: **Critical Thinking:** Choose informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organisational, and personal) from different perspectives.
- PO 2: **Effective Communication:** Speak, read, write, and listen clearly in English and one Indian language, and make meaning of the world by connecting people, ideas, books, media, and technology.
- PO 3: **Social Interaction:** Discuss the views of others, mediate disagreements, and help reach conclusions in group settings.
- PO 4: **Effective Citizenship:** Demonstrate empathetic social concern and equity-centred national development, as well as the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO 5: **Ethics:** Analyse different value systems, including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO 6: **Environment and Sustainability:** Assess the issues of environmental context and sustainable development. PO 7: **Self-directed and Life-long Learning:** Develop the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.
- PO 7: **Enhancing Abilities and Skills:** To acquire hands-on competence in skills and abilities that will enhance the learning process.

PROGRAMME SPECIFIC OUTCOMES (PSO)

- PSO 1: **Demonstrating Comprehensive Acquaintance with the Subjects:** To explain and analyse with alacrity the various issues in philosophy, English, and psychology.
- PSO 2: **Developing Philosophical Thinking:** To assess the thoughts and writings of different philosophers, psychologists, and literary writers, both Western and Indian, analytically.
- PSO 3: **Building a Multi-disciplinary Worldview:** To develop familiarity with knowledge of concepts and notions regarding disciplines other than philosophy, English, and psychology.
- PSO 4: **Creating Social and Cultural Sensibilities:** To appraise and estimate the complexities of the social and cultural sensibilities of people by engaging in a variety of philosophical discourses.

Mapping of Courses to PO/PSO

SL.	Name of Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
1.1	Ancient & Medieval Western Philosophy	H				H		H		H	H		H
1.2	General English I	M	H			H		M	M	H	H		M
1.3	Basics in Mathematics	H			M			H	H			H	
1.4	Communicative English I		H			M		M	M	H	H		
1.5	Basics in Motor Mechanics/ Tailoring and Plumbing				H	M	M	H	H			H	
1.6	Environmental Education	M		M	H	H	H	H				H	M
1.7	Understanding India		M	M	H	H	M	H				H	M
1.8	Service Learning: Theory		H	H	H	H	M	M				H	M
2.1	Vedic & Upanishadic Philosophy	H				H				H	H		H
2.2	General Psychology	H	M	H				H	M	H			
2.3	Basics in Accounting				H	M	M	H	H			H	
2.4	Communicative English II		H			M		M	M	H	H		
2.5	Basics in Office Automation		M		H	M		H	H	H		H	
2.6	Digital and Technological Solutions		M		H	M	M	H	H	H		H	
2.7	Health & Wellness, Yoga Education, Sports & Fitness			M	H	M	H	H	H	H		H	
2.8	Service Learning: Practice		H	H	H	M	M	M	M	M		M	
3.1	Systems in Indian Philosophy	H				H				H	H		H
3.2	Modern Western Philosophy	H				H				H	H		H
3.3	General English II	M	H			H		M	M	H	H		M
3.4	Introduction to General Science	H			M			H	H			H	
3.5	MIL I (Communicative Hindi I / Communicative Assamese I)		H	H	M			H	M	H	H		
3.6	Basics in Electrical and Electronics				H	M	M	H	H			H	
4.1	Classical and Symbolic Logic	H		H	M	H	M	M		H	H		H
4.2	Contemporary Western Philosophy	H		H	M	H	M	M		H	H		H
4.3	Philosophy of Being	H		H	M	H	M	M		H	H		H
4.4	Developmental Psychology	H	M	H				H	M	H			
4.5	MIL II (Communicative Hindi II / Communicative Assamese II)		H	H	M			H	M	H	H		
5.1	Philosophy of Knowledge	H		H	M	H		M		H	H		H
5.2	Philosophy of God and Religion	H		H	M	H	M	M		H	H		H
5.3	Postmodernism	H		H	M	H	M	M		H	H		H
5.4	Alternative English I	M	H			M		M		H	H		
5.5	Internship: Teaching in Schools		H	H			M	M	M				M
6.1	Philosophy of the Human Person and Mind	H		H	M	H	M	M		H	H		H
6.2	Philosophy of Science and Nature	H		H	M	H	M	M		H	H		H

6.3	Heterodox Systems of India	H		H	M	H	M	M		H	H		H
6.4	Project Work based on Field Research	M	H	H	H	M	M	H	M	H		M	M
6.5	Theories of Personality and Positive Psychology	H	M	H				H	M	H			
7.1	Ethics	H		H	M	H	H	M		H	H		H
7.2	Vedanta Philosophy	H		H	M	H	M	M		H	H		H
7.3	Alternative English II	M	H			M		M		H	H		
7.4	Research Methodology		H	M		M		M					M
7.5	Dissertation based on Themes in Philosophy or Psychology	H	H	H	H	M	M	H	M	H	H	M	H
8.1	Contemporary Indian Philosophy	H		H	M	H	M	M		H	H		H
8.2	The Philosophy of the Bhagavad Gita	H		H	M	H	M	M		H	H		H
8.3	Social Psychology	H	M	H				H	M	H			
8.4	Comprehensive Evaluation on Dissertation and Philosophy (Viva Voce)	H	H	H	M	M	M	H	M	H	H	M	H

DETAILED SYLLABUS MAJOR COURSES

Semester	Category	Course Code		Credits
1	Major Course 1	PYAM100T	Ancient & Medieval Philosophy	4
2	Major Course 2	PYVU103T	Vedic & Upanishadic Philosophy	4
3	Major Course 3	PYSI200T	Systems of Indian Philosophy	4
3	Major Course 4	PYMW201T	Modern Western Philosophy	4
4	Major Course 5	PYCS202T	Classical and Symbolic Logic	5
4	Major Course 6	PYWP203T	Contemporary Western Philosophy	5
4	Major Course 7	PYPB204T	Philosophy of Being	4
5	Major Course 8	PYPK300T	Philosophy of Knowledge	5
5	Major Course 9	PYGR301T	Philosophy of God and Religion	5
5	Major Course 10	PYPM302T	Postmodernism	4
6	Major Course 11	PYHP304T	Philosophy of the Human Person and Mind	4
6	Major Course 12	PYSN305T	Philosophy of Science and Nature	4
6	Major Course 13	PYHS306T	Heterodox Systems of India	4
6	Major Course 14	PYFR307P	Project work based on Field Research	4
7	Major Course 15	PYET400T	Ethics	5
7	Major Course 16	PYVP401T	Vedantic Philosophy	5
8	Major Course 17	PYCI404T	Contemporary Indian Philosophy	5
8	Major Course 18	PYPB405T	The Philosophy of the Bhagavad Gita	5

PYAM100T: ANCIENT AND MEDIEVAL WESTERN PHILOSOPHY

(4 Credits – 60 Hours)

Course Objectives

The course intends to expand the discursive and reasoning skills of the students. It assists the students in their development of problem-solving experience in at least one of the main areas of philosophy. Ancient Greek Philosophy arose in the 6th century BCE and its influence is noticed in the later part of continental

philosophy. Alfred North Whitehead would say that the philosophy after Plato is only a footnote to Plato's philosophy. Ancient thinkers have dealt with philosophy, ethics, metaphysics, ontology, biology, logic, rhetoric and aesthetics. Medieval Christian thinkers made use of Greek philosophy to interpret Christian theology and arrive at a coherent Christian philosophy.

Course Outcomes

CO 1: Outlines the basic philosophies of different schools of Greek and Medieval Philosophy (understanding)

CO 2: Analyses the various issues that the Ancient Greek and Medieval thinkers were grappling with (analysing)

CO 3: Develops the techniques for solving problems in at least one of the main areas of philosophy (applying) CO 4: Improves critical thinking and analytical skills (creating)

Module 1: The Origin and Development of Early Greek Thought (10 hours)

The problem of substance: Thales, Anaximander, Anaximenes, Pythagoras

The Problem of Change: permanence and change – Heraclitus and Eleatic School

The Theory of Atomism: Democritus - metaphysics and cosmology, psychology, theory of knowledge, theology and ethics

Module 2: Problems of Knowledge and Conduct (8 hours)

The Age of the Sophists, Socrates, and Socratic School

Module 3: The Age of Greek Systems (15 hours)

Plato: dialectic and theory of knowledge, the doctrine of Ideas, philosophy of nature, the doctrine of immortality, ethics and politics

Aristotle: philosophy and sciences, logic, metaphysics, the four causes, theology, psychology, ethics and politics

Module 4: The Ethical Period (12 hours)

Epicureanism, stoicism, scepticism, Neoplatonism

Module 5: The Rise of Medieval Philosophy (15 hours)

The Patristic Period: Early Fathers of the Church, St Augustine

Scholasticism: meaning, characteristics, faith and reason, John Scotus Erigena, St Anselm, Peter Abelard, The Golden Age of

Scholasticism: St Thomas Aquinas and John Duns Scotus; Nominalism: William of Ockham and Roger Bacon

Suggested Readings

Frederick Copleston, A History of Philosophy, vol. I, New York: Image Books, 1985.

History of Philosophy without any Gaps, <https://historyofphilosophy.net/series/classical-greek-philosophy>.

T.Z. Lavine, From Socrates to Sartre: The Philosophic Quest, New York: Bantam Books, 1989.

Krishna P. Bahadur, The Geeks: Their Philosophy, History and Culture, New Delhi: Ess Ess Publications, 1989.

Frank Thilly, A History of Philosophy, Allahabad: Central Book Depot, 1981.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	H	H	H	H	H
CO3		M	H	M	H
CO4	M	M	H	M	H

PYVU103T: VEDIC AND UPANISHADIC PHILOSOPHY

(4 Credits – 60 Hours)

Course Objectives

The course intends to offer the students basic knowledge of the culture, religion, and philosophy of ancient India so that they can have a genuine appreciation of India's rich heritage and be legitimately proud of being Indians. Hence, the course makes a survey of the origin and development of Indian culture, religion, and philosophy from the Indus Valley civilization to the Upanishadic period. The earliest available texts of religion

and philosophy in India are the Vedas. These texts are studied from such different angles as religion, philosophy, scripture and religious experience. A short survey of the principal characteristics of the Brahmanas and Aranyakas introduces an integrated approach to the Upanishads.

Course Outcomes

CO 1: Explains in detail the ancient Indian Scriptures particularly the Vedas and the Upanishads (understanding)

CO 2: Builds a brief survey of the developments of the religion and philosophy of Ancient India (applying)

CO 3: Outlines the Indian traditions, value systems, social life and belief systems (understanding)

CO4: Appraises the philosophy impeded in the Sruti literature (evaluating)

Module 1: Fundamental Beliefs of Hinduism (10 hours)

Cosmic Order (Rta), The Theory of Dharma, The Theory of Karma

The Theory of Rebirth (Punarjanma), The Theory of Liberation (Mukti)

Module 2: Purusharthas, Varnasramas, Asramadharma (10 hours)

Purusharthas: artha, kama, dharma and moksha Varnasramas: Brahmins, Kshatriyas, Vaisyas and Sudras Asramadharma: brahmacarya, grahastha, vanaprastha and sanyasa

Module 3: The Historical Development of the Hindu Philosophy (10 hours)

The Indus Valley civilization The Vedic Age: the Four Vedas

The Brahmanic period, the Aranyaka period and the Upanishadic period

Module 4: Philosophy and Religion of Vedas (10 hours)

The origin and development of the idea of the divine in the Vedas and Upanishads: nature worship, polytheism, henotheism/kathanotheism, monotheism, monism and absolutism

The creation theories in Vedas: Purushasukta (Rig Veda 10. 90), Nasadiyasukta (Rig Veda 10.129), Hiranyagarbhasukta (Rig

Veda 10. 121) and Visvakarmasukta (Rig Veda

10.82) The Theory of Law and Sacrifice (yajna)

Module 5: The Philosophy of the Upanishads (20 hours)

The Principal Upanishads Sreyas and Preyas

The Atman Brahman Identity

Mahavakyas: Tattvamasi, Ahambrahamasmi, Ayamattmabrahma, Sarvamkhalvidam Brahma, The Pancikarana/Trivrittkarana

The Concept of the Human Person

The Concept of Transmigration and Liberation

Four Levels of the Existence of Atman (jagrat, svapana, sushupti and turiya)

Suggested Readings

K.P. Bahadur, The Wisdom of the Upanishads, New Delhi: Sterling Publishers, 1989.

H.D. Griswold, The Religion of the Rigveda, Delhi: Motilal Banarsidas, 1971.

Hiriyanna, Outlines of Indian Philosophy, Delhi: Motilal Banarsidas Publishers, 1993.

Robert Ernest Hume, The Thirteen Principal Upanishads, Delhi: Oxford University Press, 1983.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	M	M	H	H	H
CO2	H	H	H	H	H
CO3	H	H	H	H	H
CO4	M	M	H	H	H

PYSI200T: SYSTEMS OF INDIAN PHILOSOPHY

(4 Credits – 60 Hours)

Course Objectives

This paper aims at an in-depth study of the orthodox systems in Indian philosophy, which, on the one hand, provided a philosophical and scientific foundation to the Vedic teachings, and, on the other, developed into independent schools of philosophy. They began to philosophize using human reason as well as revelation to address the perennial questions that confronted them. This was a departure from the traditional exegetical type of doing philosophy.

Course Objectives

CO 1: Outlines the salient features of Indian Classical Philosophy (understanding)

CO 2: Illustrates the philosophies of Nyaya, Vaiseshika, Samkhya, Yoga and Purva Mimamsa (understanding) CO 3: Appraises the contributions of Classical Indian Philosophy to later thinking in India (evaluating)

CO 4: Develops a genuine appreciation for the various philosophical issues Indian Schools (creating)

Module 1: General Characteristics of Indian Philosophy (10 hours)

The unity of moral and spiritual outlook among the systems

Philosophy springs from Spiritual disquiet at the existing order of things Belief in an eternal moral order in the universe The universe as a moral stage

Ignorance as the reason for bondage and knowledge as means to liberation Sadhanas for liberation

Module 2: The Philosophy of Vaiseshika System (10 hours)

Vaiseshika as a system of pluralism, atomism and realism

The Padarthas: substance, quality, action, universal, particular, inherence and negation The theory of atomism The creation and destruction of the universe

Module 3: The Philosophy of Nyaya System (10 hours)

The Theory of Perception: definition of perception, modes of perception, types of perception, types of contact (sannikarsha)

The Theory of Reasoning: terms of inference, limbs of syllogism, types of inference, fallacies Comparison

Verbal Testimony: types of verbal testimony, conditions of meaningful sentence The theory of causality (Asatkaryavada) Proofs for the existence of God

Module 4: The Philosophy of Samkhya (10 hours)

The Theory of Causality (Satkaryavada), The Concept of Prakriti

The Concept of Purusha, The Concept of Gunas, The Evolution of Prakriti, The Concept of Liberation

Module 5: The Yoga Philosophy (10 hours)

Definition and Importance of Yoga, The Levels of the Mind (cittabhumi), The Eight Limbs of Yoga; The Yoga Categories

Module 6: The Philosophy of Early Mimamsa (10 hours)

The Purva Mimamsa: a way of interpreting scriptural texts

The Philosophy of Kumarila Bhatta: theory of cognizedness, theory of anuaplabdhi, theories of svathapramana and partathahaparamana, theory of vivaritakhyati

The Philosophy of Prabhakara: theory of triputi, theory of svathapramana and svatahapramana, theory of akhyati

Suggested Readings

S. Dasgupta, History of Indian Philosophy, vol.1, New Delhi: Motilal Banarsidas, 1992.

Erich Frauwallner, History of Indian Philosophy, Delhi: Motilal Banarsidas, 1984.

Raju Puligandla, Fundamentals of Indian Philosophy, New York: Abingdon Press, 1975.

A.K. Warder, Outline of Indian Philosophy, Delhi: Motilal Banarsidas, 1986.

Heinrich Zimmer, Philosophies in India, Delhi: Motilal Banarsidas, 1990.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2	H	H	H	H	H	H
CO3	M	M	M	M	M	M

CO4	H	H	H	H	H	H

PYMW201T: MODERN WESTERN PHILOSOPHY

(4 Credits – 60 Hours)

Course Objectives

The main objective of this course is to acquaint the students with knowledge about modern Western philosophy, which is marked by the revolt against authority, love for humanism, emphasis on the awakening of the reflective spirit, and demand for freedom of thought, feeling, and action. The students will study the thinkers of this period who refused to accept blindly the dictates of religion and tradition but searched for certain foundations of life and realities. Philosophy is thus based on human reasoning rather than on faith.

Course Outcomes

CO 1: Outlines the salient features of Modern Western Philosophy (understanding)

CO 2: Illustrates the philosophies of Descartes, Spinoza, Leibniz, Locke, Berkeley, Hume, Kant, and Hegel (understanding)

CO 3: Appraises the contributions of Modern Western Philosophy to Contemporary Western Thought (evaluating)

CO 4: Develops a genuine appreciation for the various philosophical issues raised in the modern period (creating)

Module 1: Beginnings of Modern Philosophy (5 hours)

Francis Bacon: reform of science, inductive method, the programme of philosophy, philosophy of man, metaphysics, theology; Salient Features of Modern Philosophy

Module 2: Continental Rationalism (15 hours)

Rene Descartes: Cartesian method, classification of sciences, the criterion of knowledge, proofs for the existence of God, the existence of the external world, body-mind relation and the theory of innate ideas

Benedict Spinoza: rationalism, method, the universal substance, attributes of god, the doctrine of modes, the human mind, ethics and politics; Blaise Pascal: wager argument

Module 3: The British Empiricism (10 hours)

John Locke: origin of knowledge, nature and validity of knowledge, limits of knowledge, metaphysics, ethics, free will and political philosophy

George Berkeley: the rejection of abstract ideas, *esse est percipi*, the world of spirits, knowledge of ideas, spirits, and relations, refutation of dualism, atheism and scepticism

David Hume: the origin of human knowledge, the relation of cause and effect, the validity of knowledge, knowledge of the external world, denial of soul-substance

Module 4: Rationalism in Germany (5 hours)

G W. Leibniz: the doctrine of force, the doctrine of monads, theology, ethics, logic and theory of knowledge
Christian Wolff: Mysticism and Romanticism

Module 5: Critical Philosophy of Immanuel Kant (15 hours)

Kant's problem, the problem of knowledge, the transcendental method, the theory of sense perception, the theory of understanding, the validity of the judgement, unity of self-consciousness, knowledge of thing-in-itself, the impossibility of metaphysics, practical reason, moral theology and ethics

Module 6: German Idealism (10 hours)

Johann Gottlieb Fichte Friedrich Wilhelm Schelling

Georg Wilhelm Hegel: the problem of philosophy, dialectical method, thought and being, logic and metaphysics, philosophy of nature, philosophy of mind, religion and philosophy

Suggested Readings

Frederick Copleston, A History of Philosophy. Vol. I. New York: Image Books, 1985.

Will Durant, The Story of Philosophy. New York: Pocket Books, 1976.

T.Z. Lavine, From Socrates to Sartre: The Philosophic Quest. New York: Bantam Books, 1989.

Archana Roy, Western Philosophy from Descartes to Kant. New Delhi: Gitanjali Publications, 1994.

Bertrand Russell, A History of Western Philosophy. London: Unwin, 1984.

Frank Thilly, A History of Philosophy. Allahabad: Central Book Depot, 1981.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	M	M	M	M	M
CO2	H	H	H	H	H	H
CO3		M	M	M	M	M
CO4	H	H	H	H	H	H

PYCS202T: CLASSICAL AND SYMBOLIC LOGIC

(Credits: 5 – 75 Hours)

Course Objectives

This course introduces students to the fundamentals of deductive, inductive, and symbolic logic. Students will learn basic logical concepts and common argumentative forms, which help them to know the merits of good arguments, recognise their presence or absence in argumentative discourse, and exhibit them in their writing and speech.

Course Outcomes

CO 1: Shows the various modes of arguments both deductive and inductive (remembering)

CO 2: Contrasts the valid and the invalid reasoning in Indian and Western Logic (understanding)

CO 3: Constructs truth tables using symbols (applying)

CO 4: Changes the ordinary language into symbolic language by using the quantification theory (creating)

Module 1: Logic and Language (5 hours)

Introduction – the subject matter of Logic - deduction and induction, function and uses of language - language makes things possible - various functions of language

Module 2: Propositions and Terms (10 hours)

Terms: types of terms, distribution of terms, denotation and connotation of terms, contradictory terms Propositions: traditional

classification of propositions and modern classification of propositions Aristotelian Square of Opposition Immediate Inference: Conversion, Obversion, Contraposition and Inversion

Module 3: Syllogisms (10 hours)

The Three Laws of Thought

Structure of Syllogism - Figures and Moods of Syllogism General Rules of Syllogism - Deductive Fallacy Types of Syllogisms Determination of Valid Moods.

Module 4: Nyāya Logic (5 hours)

Elements of Indian Inference – Terms – Fallacy - Conclusion

Module 5: Methods of Induction (10 hours)

Analogical reasoning, causal reasoning, science and hypothesis, probability, types of induction

Module 6: Introducing Symbolic Logic (10 hours) What is Symbolic Logic?

Truth Functions: negation, conjunction, alternation (or disjunction), conditional (or material implication), bi-conditional (or material equivalence), Sheffer's Stroke function. Interdefinability of different truth functions.

Module 7: Truth Tables (10 hours)

Truth trees method. Alternation (or disjunctive) and conjunctive normal forms as decision procedures. Use of these methods for (a) deciding consistency (contingency), inconsistency (contradiction), and validity (tautology) of propositions. (b) showing implication and equivalence between propositions and (c) showing validity/invalidity of truth-functional argument.

Module 8: Quantification Theory (5 hours)

Syllogistic and the method of antilogism.

Translating Ordinary Language into the Language of Quantification.

Suggested Readings

- Basson & O'Connor, An Introduction to Symbolic Logic, Oxford: University Tutorial Press, 1962.
- Bergmann, Merrie, Moor James and Jack Nelson, The Logic Book, 4th edition, New York: McGraw Hill, 2004.
- Chhanda Chakraborty, Logic: Informal, Symbolic and Inductive, 2nd edition, New Delhi: Prentice Hall of India Private Limited, 2007.
- Irving Copi, Introduction to Logic, 5th edition, New York: Macmillan, 1982.
- Irving M. Copi and Carl Cohen, Introduction to Logic, 13th edition, Delhi: Dorling Kindersley (India) Pvt Ltd. 2009.
- Irving Copi, Carl Cohen, et.al., Introduction to Logic, 13th edition, New Delhi: Prentice Hall, 2010.
- Anton Dumitriu, History of Logic, New Delhi: Heritage Publishers, 1991.
- Brian Garrett, Elementary Logic, Bristol: Acumen Publishing Limited, 2012.
- Gilbert Harman, Thought, Princeton, New Jersey: Princeton University Press, 1973.
- Krishna Jain, A Textbook of Logic, 4th revised edition, New Delhi: D.K. Print World (p) Ltd. 1998.
- R. Jeffery, Formal Logic: Its Scope and Limits, New York: McGraw Hill Book Company.
- W.V. Quine, Methods of Logic, 4th edition, Cambridge, Mass: Harvard University Press. 1982.
- Jno J. Tigert, Handbook of Logic, New Delhi: Cosmo Publications, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7	Module 8
CO1	H	H	H	H	H	H	H	
CO2		H	H	H	H	H	H	H
CO3							H	H
CO4	M							H

PYWP203T: CONTEMPORARY WESTERN PHILOSOPHY

(Credits: 5 – 75 Hours)

Course Objectives

The course provides the students with basic knowledge in the main areas of contemporary philosophy, which were developed in the 19th and 20th centuries in the West. Several traditions of philosophizing sprang up during this period. Without entering into postmodernism, this course familiarizes the students with the thoughts of contemporary Western thinkers.

Course Outcomes

CO 1: Explains the main areas of contemporary philosophy (understanding)

CO 2: Summarizes the life and thought of different philosophers of this period (Understanding)

CO 3: Appraises the human situations of freedom, anxiety, dread and death in the quest for authenticity (evaluating).

CO 4: Improves students' critical thinking and analytical skills (creating)

Module 1: Introduction (10 hours)

Contemporary Western Philosophy

Anglo-American Traditions and Continental Traditions Characteristics of Existentialism

Module 2: Analytic Tradition (10 hours)

Gottlob Frege, Bertrand Russell, Ludwig Wittgenstein

Logical Positivism: Moritz Schlick, A. J. Ayer

Module 3: Phenomenology (10 hours)

Edmund Husserl, Merleau-Ponty

Process Philosophy: Alfred Whitehead

Module 4: Existentialism (15 hours)

Søren Kierkegaard, Martin Heidegger Jean-Paul Sartre

Module 5: Pragmatic Tradition (10 hours)

C. S. Peirce William James, John Dewey W. V. O. Quine

Module 6: Hermeneutic Tradition (10 hours)

Hans-Georg Gadamer, Paul Ricoeur

Module 7: Structuralism and Post-structuralism (10 hours)

Ferdinand de Saussure Levi Strauss

Suggested Readings

- James Collins, *The Mind of Kierkegaard*, Chicago: Regnery, 1935.
- Danske, J. *Being, Man and Death: A Key to Heidegger*, Kentucky: The University of Kentucky Press, 1970.
- M.A.E. Dummett, *The Origins of Analytical Philosophy*, London: Duckworth, 1993.
- G. Frege, "On Sense and Reference," *Translations from the Philosophical Writings of Gottlob Frege*, eds. M. Black and P. Geach, Blackwell: Oxford, 1952.
- H. Glock, *A Wittgenstein Dictionary*, Oxford: Blackwell Publishers, 1996.
- Michael Hammond, *Understanding Phenomenology*, Oxford: Blackwell, 1991.
- Martin Heidegger, *Being and Time*, trans., John Macquarrie, London: SCM, 1962.
- Edmund Husserl, *Ideas, General Introduction to Pure Phenomenology*, London: George Allen & Unwin, 1958.
- William James, *Pragmatism and Other Essays*, New York: Washington Square Press, 1963.
- Walter. Kaufmann, ed., *Existentialism from Dostoevsky to Sartre*, Cleveland: World Publishing Company, 1968.
- Soren Kierkegaard, *Either Or*, trans., David Swenson, London: Oxford University Press, 1946.
- Michael Luntley, *Contemporary Philosophy of Thought*, Oxford: Blackwell, 1999.
- Brian Masters, *A Student's Guide to Sartre*, London: Heinemann, 1970.
- Maurice Merleau-Ponty, *Phenomenology of Perception*, London: Routledge & Kegan Paul, 1962.
- R.M. Rorty, *The Linguistic Turn*, Chicago, IL: University of Chicago Press, 1967.
- B. Russell, *The Principles of Mathematics*, London: Allen & Unwin, 1903.
- Jean-Paul Sartre, *Being and Nothingness*, trans., Hazel Barnes, New York: Washington Square Press, 1966.
- Jean-Paul Sartre, *Existentialism and Humanism*, trans., Bernard Frechtman, New York: The Philosophical Library, 1957.
- Herbert Spiegelberg, *Doing Phenomenology*, The Hague: Martinus Nijhoff, 1975.
- A.N. Whitehead, *Process and Reality*, New York: The Free Press, 1979.
- L. Wittgenstein, *Philosophical Investigations*, trans., G.E.M. Anscombe, Oxford: Blackwell, 1953.

Mapping of COs to Syllabus

Course comes	Out-	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO1		H	H	H	H	H	H	H
CO2		H	H	H	H	H	H	H
CO3					H			
CO4		H	H	H	H	H	H	H

PYPB204T: PHILOSOPHY OF BEING

(Credits: 4 – 60 Hours)

Course Objectives

Among the different branches of philosophy, metaphysics helps students discover the core of philosophical knowledge that influences all other branches. Metaphysics, as the summit of human knowledge in the natural order, plays the role of guiding human knowledge and activity in the light of its basic principles, and the knowledge of the natural order paves the way for the knowledge of the supernatural order. It is the most general and fundamental of all the disciplines. It aims to identify the nature and structure of all there is. Central to this discipline is the explanation of the relationship between Being and beings, of one and many.

Course Outcomes

CO 1: Defines the basic concepts in metaphysics (remembering)

CO 2: Demonstrates the first principles of being and knowing (understanding)

CO 3: Develops the notion of being (applying)

CO 4: Compares the concept of being at various levels of existence (evaluating)

Module 1: Introducing Metaphysics (10 hours)

Etymology, definition and nature of metaphysics; a brief history of metaphysics: Indian and Western; the starting point of metaphysics (10 hours)

Module 2: Notions, Principles, Methods and Categories (10 hours)

Fundamental notions and principles in metaphysics; methods of metaphysics; basic categories: Indian and Western

Module 3: Metaphysical Structure of Finite Being (16 hours)

Being and essence; substance and accidents, matter and form, act and potency

Module 4: Metaphysical Nature of Finite Being (8 hours)

Supposit and person; spirituality and immortality of the person

Module 5: Metaphysical Properties (8 hours)

Modes of Being: analogy of being; transcendentals: oneness, truth, goodness and beauty

Module 6: Metaphysical Problems (8 hours)

The problem of one and many; the problem of evil

Suggested Readings

Ando Takatura, Metaphysics: A Critical Survey of its Meaning, The Hague: Martinus Nijhoff, 1963.

Henry J. Koren, An Introduction to the Science of Metaphysics, London: Herder Book Co. 1960.

M. Hiriyanna. The Essentials of Indian Philosophy, Bombay: Blackie and Son, 1973.

Henry Renard, The Philosophy of Being, Milwaukee: The Bruce Publishing Company, 1953.

T.M.P. Mahadevan, Invitation to Indian Philosophy, New Delhi: Arnold Heinemann Publishers, 1979.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	H	H	H	H	H
CO2	M	H	M	M	H	M
CO3		M	H	H	H	M
CO4		M	M	M	H	H

PYPK300T: PHILOSOPHY OF KNOWLEDGE

(Credits: 5 – 75 Hours)

Course Objectives

The philosophy of knowledge investigates the grounds of human knowledge. It deals with the nature, sources, and limits of human knowledge. This course has the objective of initiating students of philosophy into various theories of knowledge. There are four components of a knowledge situation: the knower, the known, the means of knowledge, and the knowledge itself. The knowledge of an object is produced in the subject by a certain medium. Hence, the students need to study in detail the source or how one tries to know the object and then evaluate whether the knowledge obtained is valid or invalid. Such an approach warrants one to look into the various conditions of knowledge on the one hand, and on the other, we need to evaluate whether knowledge is possible.

Course Outcomes

CO1: Explains the history of Indian and Western epistemological traditions (understanding)

CO2: Identifies the various sources of knowledge, theories of truth, possibilities of knowledge and justification of knowledge (applying)

CO3: Develops the mental faculties to steer clear of opinions and beliefs from true knowledge (creating)

CO4: Discusses contemporary issues in the philosophy of knowledge such as relativism, foundationalism, coherentism, reliabilism, contextualism, etc. (creating)

Module 1: Definition and Nature of Epistemology (10 hours)

Concepts and definitions: knowledge, knower, means of knowledge, the object of knowledge, scepticism, foundationalism, certainty; A brief history of epistemology: Indian and Western

Module 2: Knowledge and Belief (10 hours)

Theories of belief: belief as a mental act, belief as a mental state, belief as a behavioural disposition
Four conditions of knowledge: truth condition, belief condition, justification condition, MM Gettier's counter-example and the condition of justification without falsity

Module 3: Sources of Knowledge (15 hours)

Perception, Inference, Comparison, Verbal testimony, Postulation
Non-cognition

Module 4: Theories of Truth (15 hours)

The correspondence theory of truth: theories of evidence - external and internal
The coherence theory of truth
The pragmatic theory of truth - Dewey, William James and Charles Pierce
Deflationary theory of truth, redundancy theory, performative theory and pro-sentential theory of truth

Module 5: Epistemic Justification (10)

Foundationalism, Coherentism, Reliabilism, Contextualism
The notion of certitude: logical certitude, ontological certitude, physical certitude, moral certitude hermeneutics

Module 6: Theory of Knowledge in Indian Thought (15 hours)

The Vedic period
The doctrine of atman in the Upanishadic period
Systematic speculations (the absolute vs. the synthetic view of knowledge)

Suggested Readings

- B. Carr and D.J. O'Connor, Introduction to the Theory of Knowledge, Sussex, 1982.
D.M. Datta, Six Ways of Knowing, The University of Calcutta, 1998
Everson Stephen, ed., Epistemology, Cambridge, 1989.
Keith Lehrer, Theory of knowledge, London, 1990.
Paul K. Moser, The theory of knowledge: A Thematic Introduction, Oxford: Oxford University Press, 1998.
John L. Pollock, Contemporary Theories of Knowledge, New Jersey: Rowman and Littlefield Publishers, 1986.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	H	H	H	H	H
CO2	M		H	H	H	H
CO3	M	H	M	M	M	M
CO4					H	

PYGR301T: PHILOSOPHY OF GOD AND RELIGION

(Credits: 5 – 75 Hours)

Course Objectives

The course aims to describe, analyse, and evaluate the role of religion in the lives of humans since the earliest times and to discover, through rational interpretation of religion, the truth of religious beliefs (especially in God) and the value of religious attitudes and practices in the human quest for growth and fulfilment.

Course Outcomes

- CO1: Outlines a rational interpretation of religious truths (understanding)
- CO2: Develops a series of arguments for the existence of God (applying)
- CO3: Examines the possibility of meaningful religious discourse (evaluating)
- CO4: Evaluates the role of religion in the life of humans since the earliest times (evaluating)

Module 1: Introduction (10 hours)

Shift from Theodicy to Philosophy of God Objects of Philosophy of God and Religion Philosophy of God and Theology

Module 2: Methods in the Study of Religions (10 hours)

Towards a definition of religion

Nature, necessity and Scope of comparative religions

Possibility of and the need for the study of comparative religions Commonality and differences among religions

Module 3: Knowing God (10 hours)

Meanings of meaning - Meaning vis à vis reference - Indirect and direct reference - negative way, positive way, and way of eminence

Faith and reason as two modes of God-talk - trust in the ability of reason - critique of reason as capable of reaching God - between rigorous proofs and complete non-rationality 'Both-And': modal language and model language.

Module 4: Rationality for God's Existence (10 hours)

Pre-philosophical arguments: phenomenological approach, the argument from common human consent, natural desire for perfect happiness.

Philosophical Arguments: the ontological arguments (St Anselm, Descartes, Leibniz), the cosmological arguments (St Thomas, Samuel Clarke), the teleological arguments (St Thomas, William Paley).

Module 5: Challenges to the Existence of God (10 hours)

God and Problem of Evil - faith solutions, philosophical motifs, process solution. God and Atheism Auguste Comte: the religion of humanity Friedrich Nietzsche: Prophet of atheistic humanism Albert Camus: God as surety for suffering Jean-Paul Sartre: God as self-contradiction.

Module 6: Issues in Religions (10 hours)

Incarnation, prophet hood, death, re-birth, after-life, eschatology, liberation

Module 7: Religious Hermeneutics (10 hours)

Religion and moral value Religion and social values Religion and science Possibility of universal religion

Suggested Readings

- Edgar Brightman, A Philosophy of Religion, New York: Greenwood Press, 1969.
- William Lane Craig, Philosophy of Religion: A Reader and Guide, Edinburgh: Edinburgh University Press, 2002.
- Brian Davies, The Philosophy of Religion, Oxford: Oxford University Press, 2000.
- Stephen T. Davis, ed., Encountering Evil: Live Options in Theodicy, Atlanta: John Knox Press, 1981.
- John Hick, Arguments for the Existence of God, New York: Herder and Herder, 1971.
- John Hick, Philosophy of Religion, New York: Prentice-Hall, 1973.
- William James, The Varieties of Religious Experience, New York: Dolphin Books, 1902.
- Kurian Kachappilly, God-Talk Reconstructed: An Introduction to Philosophy of God, Bangalore: Dharmaram Publications, 2006.
- J. L. Mackie, Miracle of Theism: Arguments for and against the Existence of God, Oxford: Clarendon Press, 1982.

John Macquarie, Twentieth Century Religious Thought: The Frontiers of Philosophy, London: SCM Press, 1971.

Alfred N. Whitehead, Religion in the Making, New York: Macmillan, 1926.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO1	H	H	H	H	H	H	H
CO2	M	M	H	H	H	M	M
CO3	M	M	M	M	M	H	H
CO4	H	H	M	M	H	M	M

PYPM302T: POST MODERNISM

(Credits: 4 – 60 Hours)

Course Objectives

As postmodern philosophy questions the importance of power relationships, personalization, and discourse in the construction of truth and worldviews, the students are provided with ample opportunities for critical thinking. The origin of postmodernism can be placed in the closing decades of the twentieth century, when it was first apparently conceived in the visual arts, and then spread to other areas, including philosophy and theology. The term is at once fashionable and elusive but has become a catchword in art, architecture, philosophy, literature, film and music. It has become a powerful concept that can no longer be ignored. It implies a shattering of innocent confidence in the capacity of the self to control destiny. It shatters all trust in global strategies of social planning and undertakes a radical critique of the philosophical systematization of grand theories or metanarratives paving the way for a celebration of pluralism in all spheres of life.

Course Outcomes

CO1: Explains the origin, growth and development of the postmodern philosophy (understanding)

CO2: Develops the philosophies of prominent postmodern thinkers (applying)

CO3: Evaluates postmodern philosophy about postmodern literature, films, music and culture (evaluating)

CO4: Compiles the influences that postmodernism on contemporary thought (creating)

Module 1: Introduction (10 hours)

Preliminary clarification of postmodernism Origin of postmodernism

Characteristics of the modern age

General nature and traits of postmodernism

The transition from modernism to postmodernism Postmodernism as a break with the past Philosophical characteristics of postmodernism

Module 2: Heralds of Postmodernism (15 hours)

Friedrich Nietzsche, Martin Heidegger, Emmanuel Levinas

Module 3: Postmodern Activists (15 hours)

Michael Foucault, Jean Francois Lyotard, Jacques Derrida

Module 4: Postmodern Feminists (10 hours)

Luce Irigaray, Julia Kristeva, Judith Williamson

Module 5: Postmodern Thinkers of India (10 hours)

Homi K. Bhabha, Gayatri Spivak, Jayanta Mahapatra

Suggested Readings

Christopher Butler, Postmodernism: A Very Short Introduction, Oxford: Oxford University Press, 2002.

Paul Heelas, ed., Religion, Modernity and Postmodernity, Oxford: Blackwells, 1998.

Linda Hutcheon, The Politics of Postmodernism, London: Routledge, 2002.

Charles Lemart, *Postmodernism is Not What You Think*, Oxford: Blackwell, 1997.

Johnson J. Puthenpurackal, ed., *The Postmodern: A Siege of the Citadel of Reason*, New Delhi: Media House, 2002.

Madan Sarup, *An Introductory Guide to Post-Structuralism and Postmodernism*, Hertfordshire: Harvester Wheatsheaf, 1993.

Glenn Ward, *Teach Yourself Postmodernism*, London: Hodder & Stoughton, 2003.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	M	M	M	M
CO2	M	H	H	H	H
CO3	M	H	H	H	H
CO4	H	H	H	M	M

PYHP304T: PHILOSOPHY OF THE HUMAN PERSON AND MIND

(Credits: 4 – 60 Hours)

Course Objectives

The course aims to challenge and stimulate students philosophically to raise the fundamental question, “Who am I?” and to have clarity about human existence and nature by critically and creatively investigating meta-physical and epistemological questions regarding human subjectivity. Human existence is fundamentally co-existence and pro-existence. We are rooted in nature, formed by nurture, and sustained by God; we act upon the world, build up the community, and move towards God.

Course Outcomes

CO1: Explains the metaphysical and epistemological questions regarding human subjectivity (understanding)

CO2: Outlines the role of gender issues in understanding the human person (understanding)

CO3: Examines the fundamental questions about Human Person (analysing)

CO4: Elaborates the various human faculties that distinguish humans from other beings (creating)

Module 1: Introducing the Philosophy of the Human Person and Mind (10 hours)

After defining what the philosophy of the human person and mind is, the module deals with its distinguishing characteristics vis-à-vis other branches of anthropology and psychology and investigates the scope and methods of enquiry. the module also examines briefly the development of the topic in the historical context. both the Eastern and Western course of development is examined for a synthesis of the concept of the human person.

Module 2: Evolution of Life and Human Person (10 hours)

The origin and evolution of life and the human person are studied from scientific, philosophical and religious perspectives. Directed evolution as proposed by Teilhard de Chardin is given importance as a synthesis of scientific, philosophical and religious views.

Module 3: Intellect and Will (15 hours)

Although there are several functions that human bodies perform and are common to all animals, human beings are uniquely endowed with intellect and will. The intellect is an immaterial cognitive faculty that strives actively towards intelligibility and the will is the capacity to choose between the good and the evil that is known by the intellect. The nature of human knowledge with special reference to sense knowledge and intellectual knowledge, the relationship between intellect and will, acts of will, and freedom of will are explored in this unit. These two faculties reside in a spiritual coordinating substance: the soul. The origin, nature and immortality of the human soul are studied especially from a scholastic point of view.

Module 4: Human Person as Inter-Subjective (15 hours)

Human nature is inter-subjective and social and we belong to a community. This aspect of the human person is fundamental because all the species-specific characteristics such as language, culture, work and play have

a social dimension. *Homo sapiens* are also *homo loquens*, *homo fabiens*, and *homo ludens* and they are constitutive of being human.

Module 5: Gender Issues and Human Person (10 hours)

It studies gender relations, gender issues, and gender as a structuring principle in human societies. Feminist points of view are presented to foster co-responsibility, mutual respect and partnership of women and men for building up a gender-just society.

Suggested Readings

- Martin Buber, *I and Thou*, Edinburgh: T & T Clark, 1937.
 Teilhard De Chardin, *The Phenomenon of Man*, Chicago: Harper Books, 1976.
 Gareth Evans, *Varieties of Reference*, London: Oxford University Press, 1982.
 G. Graham, *The Philosophy of Mind*, 2nd ed., Oxford: Blackwell, 1998.
 S. Guttenplan, *A Companion to the Philosophy of Mind*, Oxford: Blackwell, 1994.
 D. Hume, *A Treatise of Human Nature*, 2nd edn, eds, L. A. Sell Bigge and P. H. Nidditch, Oxford: Clarendon Press, 1978.
 John McDowell, *Mind and World*, Cambridge: Harvard University Press, 1994.
 Battista Mondin, *Philosophical Anthropology*, Bangalore: Theological Publications of India, 1998.
 S. Radhakrishnan, *Indian Philosophy*, vols., 1 & 2, London: George Allen & Unwin, 1966.
 Gilbert Ryle, *Concept of Mind*, London: Penguin Books, 1949.
 Wilfrid Sellars, *Empiricism and the Philosophy of Mind*, Cambridge: Harvard University Press, 1997.
 Amartya Sen, *The Argumentative Indian: Writings on Indian Culture, History and Identity*, London: Penguin Books, 2005.
 Claude Sumner, *The Philosophy of Man*, Addis Ababa: Central Printing Press, 1989.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	M	M	M	H	M
CO2	M	M	M	M	H
CO3	M	H	H	H	H
CO4		M	H	H	M

PYSN305T: PHILOSOPHY OF SCIENCE AND NATURE

(Credits: 4 – 60 Hours)

Course Objectives

Philosophy of Science and Nature intends to initiate students into bridging between philosophy, nature, and scientific developments. Apart from introducing students to various scientific paradigms, they are given opportunities to approach those theories from a critical philosophical angle to understand the basic vision of reality that is unveiled and also approach science from a holistic and integral angle. Philosophy began with wonder at the reality that was obvious to human eyes, yet its origin, makeup and growing up during the times gone by have surprised most thinkers. It is different from science as well as myth. The goal of all three is to explain reality, but the methods and courses that they hold on to are quite different. There is a slow development from myth to philosophy and then to science. Myths are not existentially true and meaningful; philosophy tries to be factually true and meaningful by rational investigation. Science attempts to be factually true and does not directly influence existential meaning. Myths provide us with intuitive and existential meaning. Philosophy gives us rational meaning. Science shows us empirical facts.

Course Outcomes

- CO1: Shows the role philosophy plays in understanding nature and scientific developments (remembering)
 CO2: Outlines the various scientific paradigms in understanding the universe (understanding)
 CO3: Identifies the various philosophical and scientific theories that explain matter (applying)
 CO4: Proposes the prospects of the philosophy of science and nature (creating)

Module 1 Introduction to Philosophy of Science and Nature (8 hours)

Introduction; Pre-Socratic and Socratic Understanding of Nature Pre-Copernican Philosophy of Science and Nature Philosophy of Science and Nature in the Middle Ages

Module 2 Philosophy of Science and Nature During the Renaissance (15 hours)

Revolution and its Philosophical Implications Mechanical Philosophy of Nature Contributions made by Copernicus and others Isaac Newton and Classical Mechanics: the concept of force Other schools and their implications.

Module 3 Philosophy of Science and Nature in the Modern Period (15 hours)

Contemporary Philosophy of Science

Logical Positivism: basic ideas, clarifying of terms, implications and critique. Historicism: basic ideas, persons, implications and critique

Historical Realism: basic ideas, persons, implications and critique

Module 4 Philosophy of Science and Nature in the Contemporary Period (15 hours)

Contemporary Philosophy of Nature

Relativistic Revolution: scientific-philosophical implications Quantum Mechanics and its philosophical implications Finite / Infinite Nature of the universe

Scientific theories on the origin and end of the universe

Module 5 The Future of Philosophy of Science and Cosmology (7 hours)

A virtual journey - our journey in science and nature The novel challenges: ecological crisis vs human greed Mechanization of the human mind and thinking patterns

Suggested Readings

I.B. Cohen, The Birth of a New Physics, London: Penguin Books, 1992.

John Earman, World Enough and Space-Time: Absolute versus Relational Theories of Space and Time, Cambridge, Mass.: MIT Press, 1989.

Brian Green, The Fabric of the Universe, London: Penguin Books, 2004.

Brian Greene, The Fabric of the Universe, London: Penguin Books, 2004.

Stephan Hawking, A Brief History of Time, New York: Bantam Press, 1988.

Stephen Hawking, The Universe in a Nutshell, New York: Bantam Books, 2001.

Carl Hempel, Aspects of Scientific Explanations, New York: Free Press, 1965.

Michio Kaku, Hyperspace – A Scientific Odyssey Through the Parallel Universes, Time Warps, and the 10th Dimension, New York: Anchor Books, 1994.

Job Kozhamthadam, "The Changing Face of Science- Christianity Dialogue," Science, Technology and Values, ed., Job Kozhamthadam, Pune: ASSR Publications, 2003.

E. Nagel, The Structure of Science, London: Routledge, 1982.

Kar Popper, The Logic of Scientific Discovery, New York: Basic Books, 1959.

J.J. Sakurai, Modern Quantum Mechanics, New York: Addison- Wesley, 2000.

S. Sambursky, The Physical World of the Greeks, London: Routledge and Kegan Paul, 1960 14. C. Singer, A Short History of Scientific Ideas to 1900, London: Oxford University Press, 1959.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	M	M	M	H	H
CO3	H	M	M	H	M
CO4	H	H	H	H	H

PYHS306T: HETERODOX SYSTEMS IN INDIA

(Credits: 4 – 60 Hours)

Course Objectives

The study of heterodox systems in India helps the students foster an understanding of Indian schools that oppose the authority of the Vedas. It enables the students to interpret diverse atheistic and theistic beliefs and practices and to foster an understanding of diverse systems of thought. Due to their universal outlook and philosophical relevance, Buddhism and Jainism have received increasing attention, even in the Western world. This course offers students an alternative thinking pattern, different from the main line of Hindu thought.

Course Objectives

CO1: Explains the Materialistic Philosophy of India (understanding)

CO2: Examines the origin and development of the Heterodox Systems of India (analysing)

CO3: Compares the Buddhist and Jaina Philosophies in understanding human beings, the world and God (evaluating) CO4: Assess the contributions of the Buddhist and the Jain thought to the Indian Society (evaluating)

Module 1: The Carvaka Philosophy (10 hours)

The origin and scope

The Carvaka epistemology, The Carvaka metaphysics, The Carvaka ethics

Module 2: The Jaina Philosophy of Knowledge (10 hours)

Introduction - origin and history

The Jaina theory of knowledge: nature and kinds of knowledge The Jain theory of judgement: syadvada, saptabhanganaya

Module 3: Jaina Metaphysics (10 hours)

The Jaina conception of substance Classification of substance

The concept of the soul

The inanimate substances: matter, space, time, dharma and adharma

Module 4: Jaina Ethics and Religion (5 hours)

Bondage of the soul Liberation

Jainism as a religion without a God

Module 5: The Ethical Teachings of Buddhism (10 hours)

Origin and history of Buddhism – Buddha, Hinayana, Mahayana

The teachings of Buddhism: the four noble truths, the eightfold path to liberation

The philosophical implications of Buddha's teachings: theory of dependent origination, theory of karma, theory of universal change, theory of the non-existence of the soul

Module 6: The Buddhist Schools of Philosophy (15 hours)

The Madhyamika School of Philosophy, The Yogacara School of Buddhism

The Sarvastivada school of Buddhism - sautrantika and vaibhashika schools

Suggested Readings

- Ashok Kumar Chatterjee, *Yogacara Idealism*, Delhi: Motilal Banarsidass, 1999.
 Dakshinaraman Shastri, *A Short History of Indian Materialism*, Calcutta: Book Company, 1930.
 E. J. Thomas, *History of Buddhist Thought*, London: Kegan Paul, 1953.
 J. L. Jaini, *Outlines of Jainism*, Cambridge: Cambridge University Press, 1916.
 Mohanlal Mehta, *Outlines of Jaina Philosophy*, Bangalore: Jaina Mission Society, 1954.
 Radhakrishnan and Charles A. Moore, *A Sourcebook in Indian Philosophy*, Princeton: Princeton University Press, 1957.
 S. Radhakrishnan, *Indian Philosophy*, London: George Allen and Unwin Ltd., 1923.
 T. R. V. Murti, *The Central Philosophy of Buddhism*, London: George Allen and Unwin, 1955.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2	H	H	H	H	H	H
CO3		H	H	H	H	H
CO4		H	H	H	H	H

PYFR307P: PROJECT WORK BASED ON FIELD STUDY:

(Credits: 4 – 60 Hours)

Course Objectives

Project-based learning, especially field study, helps students to assess and to deepen the quality of acquired knowledge. It offers the students the possibility of learning beyond the classroom setting.

Course Outcomes

CO1: Identifies the subjects and helps draw correlations between subjects and surroundings, and how the surroundings may influence the behaviour (applying).

CO2: Outlines in-depth information on subjects because they are observed and analysed for a long period (understanding).

CO3: Influences the researcher to fill the gaps in data which can be understood by conducting in-depth primary research (evaluating).

CO4: Combines theory and practical research study by qualitatively analysing the data (creating)

The students are expected to carry out field research during the semester break after 6th semester on themes about the relevance, usefulness, popularity and application of philosophy, Psychology or English Literature in seminaries, colleges or universities under the guidance of a faculty using research tools such as interviews, focus groups, surveys and observation.

The following steps are to be followed while conducting the field study:

Identify and acquire researchers in the field: It is essential to acquire researchers who are specialized in the field of research. Moreover, their experience in the field will help them undergo further steps of conducting field research.

Identify the topic of research: The researcher works on identifying the topic of research. The researchers are responsible for deciding what topic of research to focus on based on the gaps observed in the existing research literature.

Identify the right method of research: After fine-tuning the research topic, researchers define the right method to approach the aim and objectives of the research.

Visit the site of the study and collect data: Based on the objectives, the observations begin. The researcher goes on the field and starts collecting data either by visual observation, interviews or staying along with the subjects and experiencing their surroundings to get an in-depth understanding.

Analyze the data acquired: The researcher undergoes the process of data analysis once the data is collected. **Communicate the results:** The researchers document a detailed field study report, explaining the data and its outcome. Giving the field study a suitable conclusion.

The field research should be for a minimum duration of 60 hours which can be extended depending upon the convenience and requirement of the student and the organisation respectively. The rest of the hours are allotted for completing the Project Report. However, the entire duration of the course should not exceed 120 hours.

The Project Report must be in a spiral bind. It should be accompanied by a recommendation letter from the department and a certificate of authentication from a competent authority from where the research was carried out. The Contents of the Report must include:

- Introduction.
- Need of the study
- Objectives of the study
- Significance of the study
- The methodology which was undertaken for the study
- Description of the work done
- Learning Outcomes
- Feedback from the target audience/community members
- Geotagged photographs

The assessment will be done as follows:

There would be a presentation (PPT) and Viva-Voce Examination during the 7th semester. The Assessment for the project work based on field study will have the following components: a) Report: 40 marks

b) Seminar Presentation: 30 marks

c) Viva-Voce Examination: 30 marks

Mapping of COs to Syllabus

Course Outcomes	
CO1	H
CO2	H
CO3	H
CO4	H

PYET400T: ETHICS

(Credits: 5 – 75 Hours)

Course Objectives

This course aims at introducing the students to the philosophical need for Ethics starting with a brief discussion of Moral law and how the human person in his or her process of growth intuitively ethical principles. Discussions about the dynamics of morality are undertaken to show how on the one hand new situations call for new responses from a moral point of view and on the other hand certain fundamentals of ethics remain the same in so far as there is something of a common human nature adequately understood. It seeks to respond to some of the important challenges to ethics as a philosophical discipline. Thus, we attempt to look at Indian as well as Western traditions. We, then, shall explore the chief ideas of virtue ethics in various philosophical thoughts and religious traditions. It also aims to understand the important aspects of human rights and the moral importance of duties then proceed with a discussion on current ethical questions. Living in social groups is an essential characteristic of humans. Sociality and individuality are not opposite poles but are related to each other. Therefore, the right knowledge of society with its institutions is essential. We also make a critical look at the political philosophy and moral questions arising out of it. By the end of the course, the students are oriented to gain a detailed understanding of the philosophical issues involved in many contemporary debates in the public sphere as well as developing moral reasoning skills and application of those skills to contemporary social and political issues.

Course Outcomes

- CO1: Explains the nature and principles of human behaviour (understanding)
CO2: Summarises the history of Indian and Western traditions on ethics (understanding)
CO3: Develops the foundations of human behaviour (applying)
CO4: Discusses the various ethical issues in contemporary times and the challenges that legislations of liberal nations pose. (creating)

Module 1: Introduction to Ethics (10 hours)

Nature, scope and subject matter of Ethics Challenges and importance of ethics

Ethics in the History of Indian Philosophy Ethics in the History of Western Philosophy Kinds of ethics
Relation with other disciplines

Module 2: Human Conduct and Responsibility (10 hours)

Human acts Emotions, moods and desires Knowledge
Freedom and determinism Levels of willing and not willing
Modifiers of Responsibility: Ignorance, Strong Emotions, Fear, Force, habit The indirect
voluntary Principle of doubt effect

Module 3: Criteria for Morality (10 hours)

The objective criterion of morality: eternal law, natural law, divine positive law The subjective criterion of
morality: conscience

Module 4: Virtue (10 hours)

Definition, Moral virtues, Cardinal virtues

Module 5: The Objective Good in Moral Life (10 hours)

Good, pleasure, convention, consequences Intuition, reason, law, free-
dom Situation ethics; Love, habit, happiness

Module 6: Ethical Issues Related to Human Life (10 hours)

Bio-Ethics: body care, abortion, suicide, mutilation, euthanasia, artificial birth control and sterilization.
Sexual Ethics: rape, masturbation, pre-marital sex, homosexuality, lesbianism, sodomy, bestiality, fornication,
adultery and incest
Medical Ethics: what is medical ethics; duties of physicians, duties of nurses, patient and doctor relationship,
cloning, stem cell; Hippocratic oath

Module 7: Social Ethics (15 hours)

Personal Ethics: relation to self; relation to the world; relation to others; relation to God; situation ethics
Societal Ethics: liberation ethics, human rights; rights of workers, strikes, social justice, alcoholism, substance
abuse, punishments and capital punishment
Business Ethics: what is business ethics; patent rights, consumer protection and bribe War and Peace: self-
defence, just war theory, nuclear war, peace and non-violence Global Issues: HIV/AIDS, poverty, corruption,
child labour and militancy

Suggested Readings

- Simon Blackburn, Being Good: A Short Introduction to Ethics, Oxford: Oxford University Press, 2002.
John Finnis, Fundamentals of Ethics, Oxford: Clarendon Press, 1983.
E. Hargrove, The Foundations of Environmental Ethics, New Jersey: Prentice-Hall 1989.
Alasdair MacIntyre, "The Nature of the Virtues," After Virtue: A Study in Moral Theory, Notre Dame: Uni-
versity of Notre Dame Press, 1984.
Mark R. Amstutz, International Ethics: Concepts, Theories, and Cases in Global Politics, 2nd ed., Row-
man& Littlefield, 2005
J. Passmore, Man's Responsibility for Nature, London: Duckworth 1974.
Shyam Ranganathan, Ethics and the History of Indian Philosophy, Delhi: Motilal Banarsidass, 2007.

Richard Scott, *Institutions and Organisations*, London: Sage, 2001.

S. P. Sharma, *Nature and Scope of Ethics*, New Delhi: Mohit Publications, 2003.

Henry J. Steiner and Philip Alston, *International Human Rights in Context: Law, Politics, Morals*, New York: Oxford University Press, 2000.

Wilbur Marshall Urban, *Fundamentals of Ethics: An Introduction to Moral Philosophy*. Highland: Holt, 1993.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO1	M	H	H	H	H	H	H
CO2	H	M	H	M	H	M	M
CO3	M	H	H	H	H	H	H
CO4	M	M	H	M	H	H	H

PYVP401T: VEDANTA PHILOSOPHY

(Credits: 5 – 75 Hours)

Course Objectives

This course makes the students familiar with the philosophy and spirituality of the Vedanta Schools of Philosophy. It is an introduction to various schools of Vedanta highlighting the history, the context of their origin, the authors and the main teaching of these schools. The focus is on interactive learning where the students will engage themselves in a rigorous and analytical examination of the key ideas present in these schools of Philosophy. The Vedanta Philosophy is an interpretation and exposition of the *Jnanakhanda* section of the Upanishads. The primary thrust of the systems is to delve into the Nature of the self, and its relation to the Ultimate Reality. The systems also speak about the nature of the world in which we live. In the process, the systems deal with how a seeker having lived in this mundane world, attains his liberation (*Moksha*) Vedanta philosophy, though, is an exposition of the *Brahmasutrabhashyas*, *Upanishads* and *Bhagavad Gita*, each one of them is different in their viewpoints.

Course Outcomes

CO1: Outlines the richness of the philosophy and spirituality embedded in the Vedantic texts (understanding).

CO2: Evaluates the Metaphysics, Epistemology, Ethics, and Means of Liberation proposed in Vedantic thought(evaluating)

CO3: Discuss the contributions of great thinkers like Shankara and Ramanuja for the resurgence of Hinduism (creating)

CO4: Assesses the subtle nuances that differentiate diverse schools of Vedanta (evaluating)

Module 1: Introduction (10 hours)

Origin, Meaning and Purpose of Vedanta Philosophy

Module 2: Advaita Philosophy of Shankara (20 hours)

Life, Works, Influences, Brahman and Atman, Knowledge, Maya, World, Liberation

Module 3: Visishtadvaita Philosophy of Ramanuja (15 hours)

Life, Works, Influences, Brahman and Atman, Knowledge, Maya, World, Way of Devotion

Module 4: Dvaita Philosophy of Madhava (10 hours)

Life, Works, Influences, Brahman and Atman, Maya

Module 5: Other Schools of Vedanta Philosophy (10 hours)

Dvaita Advaita of Nimbarka Suddha Advaita of Vallabha Achintya Bhedabheda of Chaitanya

Module 6: The Vaishnavite Philosophy of Srimat Shankerdev (10 hours)

Life, Works, Influences, Understanding of God, Way of Devotion

Suggested Readings

- S. Dasgupta, History of Indian Philosophy, 5 vols., Delhi: Motilal Banarsidas, 1975.
 Subodh Kapoor, The Systems of Indian Philosophy, New Delhi: Cosmo Publications, 1987.
 Max F. Muller, The Six Systems of Indian Philosophy, Varanasi: Chronicle Books, 2004.
 Matthew Narimattam, The Valley in Blossom, Dimapur: Don Bosco Publications.
 S. Radhakrishnan, Indian Philosophy, vols 1 & 2, New York: George Allen and Unwin Ltd., 1977.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	H	H	H	H	H
CO2	M	H	H	H	H	H
CO3	M	H	H	M	M	M
CO4	H	H	H	H	H	H

PYCI404T: CONTEMPORARY INDIAN PHILOSOPHY

(Credits: 5 – 75Hours)

Course Objectives

This course aims at allowing the students to absorb the new spirit of philosophising that emerged due to the mushrooming of different philosophical movements in contemporary India. It allows them to get a feel for the new religious and social outlook that has emerged over time in India. The students would imbibe the spirit of openness and determination shared by contemporary philosophers in India. The main philosophical movements were the Bhakti, Sufi, and Reform movements. The Bhakti movement brought about revolutionary changes in the moral, social, and political perspectives of the people of India. It underscored the need to stand for unity among the religions. The Sufi movement emphasises man's role in enhancing social unity, cultural synthesis, and communal harmony. Reform movements impel us to look at religion critically and scientifically. In the 19th century, after the reform movements, India produced some eminent thinkers who, through their ideas, philosophical and political, shaped the minds of millions and contributed to the nation-building process.

Course Outcomes

CO1: Explains in-depth the philosophical ramifications of events like the Bhakti, Sufi and Reform Movements (understanding)

CO2: Analyses the political, social and philosophical movements of India from the 19th century (analysing)

CO3: Assesses the philosophical thoughts of contemporary Indian thinkers like Gandhi, Vivekananda, K.C. Bhattacharya, Radhakrishnan, Aurobindo, Tagore, and others (evaluating)

CO4: Estimates the influences of ancient philosophy on contemporary Indian thought (creating)

Module 1: Bhakti Movement (15 hours)

Introduction

History of the Bhakti Movement

Nature and Characteristics of the Bhakti Movement

Leaders of Bhakti Movements: Ramanuja, Ramananda, Kabir, Namdeva, Gurunanak, Chaitanya, Tulsi Das, Guru Ramdas, Tukaram

Bhakti movement in South India: Nayanmars, Alvars, Basava Women leaders: Akkamahadevi, Janabai, Mirabai, Bahinabai

Implications of the Bhakti Movement: ethical and Philosophical

Module 2: Sufi Movement in India (15 hours)

Roots of Sufism

History and Development of Sufism in India

Interaction between Hindu and Muslim saints

Module 3: Reform Movement in India (15 hours)

Modern reform movement: the historical context Brahma Samaj: the universalistic reform movement Arya Samaj: the nationalistic reform movement

19th Century Hindu universalism: Ramakrishna Paramahansa, Ramkrishna Mission (Vivekananda), ISKCON Movement

The Guru movements: Osho, Satya Sai Baba,

Module 4: The Philosophy of Contemporary Thinkers (30 hours)

Vivekananda: the concept of God, the concept of the world, the concept of Maya, the concept of the human person, freedom and karma, liberation and the means of liberation, his idea of religion

Aurobindo: His idea of integral yoga, Involution and evolution, levels of reality, the destiny of human being Mahatma Gandhi: life, political ideas - Satyagraha, ahimsa, Sarvodaya, religion, the concept of God

B.R. Ambedkar: social philosophy, political ideas and socio-political criticism, economic ideals and social development, religious criticism and social transformation

S. Radhakrishnan: metaphysics, epistemology, religion and ethics, social and political philosophy

Suggested Readings

D.R. Bali, Modern Thought, New Delhi: Sterling Publishers, 1988.

Basant Kumar Lal, Contemporary Indian Philosophy, New Delhi: Sterling Publishers, 1983.

T.M. Mahadevan, and V. Saroja. Contemporary Indian Philosophy, New Delhi: Sterling Publishers, 1983.

Glyn Richards, ed., A source-Book of Modern Hinduism, London: Curzon Press, 1985.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2	M	M	H	H
CO3	M	M	H	H
CO4	H	H	H	H

PYPB405T: THE PHILOSOPHY OF THE BHAGAVAD GITA

(Credits: 5 – 75 Hours)

Course Objectives

The objective of this course is to make the students familiar with the philosophy and spirituality of the Bhagavad Gita. This course is an introduction to the Bhagavad Gita, highlighting the history, the context of the text, the author, and the main teaching of the text. The focus is on interactive learning, where the students will engage themselves in a rigorous and analytical examination of the key ideas present in the Bhagavad Gita. It gives answers to many existing philosophical dilemmas. The text highlights some important issues, like the nature of the self and the nature of the non-self, the different paths to liberation, the purpose of incarnation, the true nature of God, and the different qualities of a good person as well as a bad person. Hence, this text helps a student further reflect on Indian philosophy. The Bhagavad Gita is a spiritual classic. Though it is not a sruti text, it is highly regarded by devout Hindus and accepted by many other seekers of truth. This text helps the students delve deep into Indian spirituality. A text-based study of the Gita enables the students to understand and appreciate its rich spiritual and philosophical wealth.

Course Outcomes

CO1: Outlines the richness of the philosophy and spirituality embedded in the Gita (understanding)

CO2: Develops an appreciation for the Metaphysics of the Bhagavad Gita, particularly the Nature of God, the Nature of the true self, different paths to liberation, and the status of liberation (applying)

CO3: Evaluates the ethical values present in the Gita (evaluating)

CO4: Examines the leadership and management qualities Krishna and make them relevant in the present context(analysing)

Module 1: Introduction to the Bhagavad Gita (15 hours)

History, general context and author of the text The immediate context of the Bhagavad Gita The dilemma of Arjuna Arjuna is a representative of every human person in crisis

Module 2: Main Philosophical Ideas in the Bhagavad Gita (15 hours)

The true nature of self

The true nature of the world Different Paths to Liberation The purpose of the incarnation

Module 3: Krishna as a Model of Leadership (10 hours)

Krishna's type of leadership and management Educative transformative leadership The distinction between normal work and nishkama karma

Module 4: The Qualities of Persons with Sattva Guna and Tamas Guna (10 hours)

Qualities of people with demonic nature

Result of entertaining demonic qualities and living in delusion How to guard oneself against taking the road of demonic nature:

Qualities of people with divine qualities, and final success for them

Module 5: Text-based Study (25 hours)

The text of the Bhagavad Gita will be critically explained for an in-depth understanding of its philosophy.

Suggested Readings

Keya Maitra, Philosophy of the Bhagavad Gita: A Contemporary Introduction.

M.K. Gandhi, The Gospel of Selfless Action.

Shri Aurobindo, Bhagavad Gita and its Message.

Swamy Krishnananda, The Philosophy of Bhagavad Gita.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	H	H	H	H	H
CO3	M	H	H	H	H
CO4		M	H	M	

MINOR COURSES (IN ENGLISH AND PSYCHOLOGY)

Semester	Category	Course Code		Cred-its
1	Minor Course 1	EGGE106T	General English I	4
2	Minor Course 2	PCGP100T	General Psychology	4
3	Minor Course 3	EGGE207T	General English II	4
4	Minor Course 4	PCDP200T	Developmental Psychology	4
5	Minor Course 5	EGAE307T	Alternative English I	4
6	Minor Course 6	PCPP300T	Theories of Personality and Positive Psychology	4
7	Minor Course 7	EGAE407T	Alternative English II	3
7	Minor Course 8	PYRM402T	Research Methodology	2
8	Minor Course 9	PCPS400T	Social Psychology	3

EGGE106T: GENERAL ENGLISH I

(Credits: 4 - 60 Hours)

Course Objectives

The objective of this course is to acquaint the students with language and literature and to whet their appetite for the same. The students are led to a gradual discovery of the three genres: fiction drama and poetry. They are expected to undertake an in-depth analysis of the texts. They are also encouraged to closely examine the various themes and motifs and to have a contextualized reading of the texts. If this exercise is taken seriously the students will acquire the skill to communicate effectively. The outcome will be the ability to critically evaluate and appreciate a particular work.

Course Outcomes

CO 1: Shows familiarity with vocabulary and phraseology (remembering)

CO 2: Illustrates the use of the language effectively in reading, writing and speaking (understanding)

CO 3: Develops the ability to the ability to critically evaluate and appreciate a particular piece of writing (applying) CO 4: Tests the knowledge of English grammar (creating)

Module 1: Selected Novels (15 hours)

Anita Desai - Fasting Feasting

Jane Austen - Sense and Sensibility

Module 2: Selected Dramas (15 hours)

Oscar Wilde - The Importance of Being Earnest. Henrik Ibsen - A Doll's

House Harold Pinter - The Birthday Party

Module 3: Selected Poems (18 hours)

Kamala Das - My Mother at Sixty Six John Donne - Death Be Not Proud

William Wordsworth - The World is Too Much with Us Dante Gabriel Rossetti - The Blessed Damozel

Module 4: Basic English Grammar (12 hours)

Grammar I Grammar II

Suggested Readings

Anita Desai, Fasting Feasting.

D.G. Rossetti, The Blessed Damozel.

Das & Mohanty, Literary Criticism: A Reading, Oxford University Press.

Edward Albert, A History of English Literature, Oxford University Press.

Harold Pinter, The Birthday Party.

Henrik Ibsen, A Doll's House.

Jane Austin, Sense and Sensibility.

John Donne, Death Be Not Proud.

Kamala Das, My Mother at Sixty Six.

M.H. Abrahams, A Glossary of English Terms, Bangalore: Macmillan Publishers India.

Oscar Wilde, The Importance of Being Earnest.

William Wordsworth, The World is Too Much With Us.

Wren & Martin, English Grammar.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	H
CO2	H	H	H	M
CO3	H	H	H	M
CO4	M	M	M	H

PCGP100T: GENERAL PSYCHOLOGY

(Credits: 4 – 60 Hours)

Course Objectives

This introductory course in psychology gives a brief historical sketch of the science of psychology and a glimpse into the methods used in psychology. It also provides knowledge about the various psychological processes that every human being experiences. The paper also has several practicals.

Course Outcomes

- CO 1: Explains the developments and methods in psychology (understanding)
CO 2: Outlines the biological foundations of behaviour, and processes underlying sensation, perception, cognition, memory and motivation (understanding)
CO 3: Evaluates the different psychological processes and behaviours (evaluating)
CO 4: Proposes practicals based on the processes discussed theoretically thus offering the students a hands-on experience (creating)

Module 1: Introduction to Psychology (10 hours)

Definition and Goals of Psychology, Role of a Psychologist in Society
Modern Perspectives: Biological, Psychodynamic, Behaviouristic, Gestalt, Cognitive, Cross-Cultural, Humanistic and Evolutionary Methods: Experimental, Observation, Questionnaire and Inventories, Interview, Clinical Case Study

Module 2: Biology and Behaviour (10 hours)

Neurons: structure of neurons, neural impulses, synapses and neurotransmitters nervous system: central and peripheral nervous systems

Cerebral Cortex: structure and psychological importance in thought and language, the significance of left and right brain, split brain.

Effects of Hormones on Behaviour

Module 3: Sensory-Perceptual Processes (10 hours)

Sensation: basic concepts and processes in sensation

Types of Senses (An Overview): visual, auditory, gustatory, olfactory, tactile, vestibular, kinaesthetic and organic senses Sensory Adaptation: advantages and disadvantages, integration of senses, sensory thresholds

Perception: understanding perception, gestalt laws of organization Different Process of Perception

Correlates of Perception: awareness, set, motives, needs, learning and attention Illusion: subliminal perception, extra-sensory perception

Module 4: Memory and Forgetting (10 hours)

Basic Processes: encoding, storage, retrieval Sensory Storage: iconic memory and echoic memory

STM-working memory, serial position curve, rehearsal, chunking

LTM-Units of Memory: declarative, procedural, semantic, episodic memory

Associative Models: explicit and implicit memory, retrieval cues, state-dependent and context-dependent memory, tip-of-the tongue phenomena, flashbulb memory levels of processing, constructive processes in memory, schemas Forgetting: decay theory, interference theory, prospective memory, absence of retrieval cues, memory dysfunctions Improving Memory: mnemonic strategies

Module 5: Learning and Cognitive Processes (10 hours)

Attention: definition, characteristics, selective attention and divided attention process of thinking, Types: Reasoning-types, problem-solving, decision making, creative thinking, concept formation

Classical Conditioning: basics of conditioning, operant conditioning Language and thinking, imagery and thinking

Cognitive Learning: latent learning, observational learning, insight learning

Module 6: Motivation and Emotion (10 hours)

Motivation: meaning, approaches-instinct, drive reduction, arousal, incentive, cognitive, humanistic Maslow's Need Hierarchy: types, physiological motivation (hunger, thirst, sex, maternal drive), psychological motivation (achievement, affiliation, power, parenting)

Emotion: meaning, the physiological basis of emotions

Theories-James Lange Theory, Cannon-Bard Theory, Cognitive Theory Emotional Expression

Suggested Readings

R.S. Feldman, Understanding Psychology, 4th ed., New Delhi: McGraw Hill, 2006.

Atkinson Hilgard, Introduction to Psychology, Oxford: IBH Publishing, 1975.

King Morgan, Weiss and Schopler, Introduction to Psychology, 7th ed., New Delhi: McGraw Hill, 1989.

Robert A. Baron, Psychology, 3rd ed., New Delhi: Prentice Hall, 2001.

Swarnalatha Iyer, Introduction to Psychology, New Delhi: Premier Publishing Company, 2006.

Wayne Weiten, Psychology: Themes and Variations. 4th ed., New York: Brooks & Cole Publishing, 2001.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	M	M			
CO2		H	H	H	H	H
CO3		H	M	M	M	M
CO4		M	M	M	M	H

EGGE207T: GENERAL ENGLISH II

(Credits: 4 – 60 Hours)

Course Objectives

The course intends to broaden the mental horizons of the students by unfolding before them the philosophy, wit, and wisdom that is contained in the selected literary works. It helps in the correction of taste, that is, the ability to distinguish between the excellent and the mediocre. The course assists the students in bringing the necessary literary gravitas to their academic pursuits.

Course Outcomes

CO 1: Shows familiarity with vocabulary and phraseology in written English (Remembering).

CO 2: Illustrates the use of the language effectively in selected short stories and essays (understanding).

CO 3: Develops the ability to articulate thoughts and ideas meaningfully coherently and cogently with certain lexical elegance (applying).

CO 4: Tests the knowledge of the English language and composition (creating).

Module 1: Selected Short Stories (20 hours)

The Happy Prince - Oscar Wilde, The Necklace - Guy de Maupassant

The Open Window - Hector Hugh Munro, The Last Leaf - O. Henry

Module 2: Selected Essays (20 hours)

The Origin of Species - Charles Darwin of Studies - Francis Bacon

Module 3: Language and Composition (20 hours)

Suggested Readings

Charles Darwin, The Origin of Species.

Das & Mohanty, Literary Criticism: A Reading. Oxford University Press.

Edward Albert, A History of English Literature, Oxford University Press.

Francis Bacon, Of Studies.

Guy de Maupassant, The Necklace.

Hector Hugh Munro, The Open Window.

M.H. Abrahams, A Glossary of English Terms, Bangalore: Macmillan Publishers India.

O. Henry, The Last Leaf.

Oscar Wilde, The Happy Prince.

Wren & Martin, English Grammar and Composition.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H	H	H
CO3	H	H	H
CO4	M	M	H

PCDP200T: DEVELOPMENTAL PSYCHOLOGY

(Credits: 4 – 60 Hours)

Course Objectives

Developmental psychology is a branch of psychology that seeks to provide a general introduction to various developmental concepts across the different stages of life, with the nature versus nurture debate as a concurrent theme. It focuses on advancing knowledge of the processes of change for individuals across the lifespan. Topics of research interest include developmental theories, methods of investigating life-span change, as well as such processes as cognition, memory, theories of mind, identity, risk-taking, social relationships, and problem behaviour.

Course Outcomes

CO 1: Explains human development from conception till adulthood (understanding)

CO 2: Develops topics such as biological beginnings, development and change across infancy, childhood, adolescence and adulthood (applying)

CO 3: Compares the psychological ramifications at the various stages of human development (analysing)

CO 4: Proposes healthy psychological growth of a human person (creating)

Module 1: Introduction (10 hours)

Concept of Human Development: introduction, meaning, stages of lifespan development

Aspects of human development: physical, social, cognitive, moral principles of human Development (Balte)

Factors influencing human development: ecological factors, hereditary factors

Theories of human development: Erickson, Piaget, Vygotsky (Dialectical), Kohlberg Biological Beginnings of Development

Genetic Foundations: genetic processes and genetic principles; chromosomal and gene-linked abnormalities

Module 2: Pre-natal Development and Infancy (10 hours)

Prenatal development: course of prenatal development; teratogens and prenatal environment, heredity, environment and individual differences

Infancy: characteristics of Infancy

Physical, motor development, emotional development, language development new-born reflexes and their adaptive value: (optical, Palmer, Babinsky, Moro, sucking, rooting, swimming, walking, placing), the importance of assessing new-born reflexes

Module 3: Childhood (10 hours)

Subdivisions of childhood, characteristics of each period

Aspects of development: physical development, cognitive development, language development, emotional development, psychosocial development

Module 4: Puberty and Adolescence (10 hours)

Puberty: meaning, biological changes (sexual maturation, growth spurt, secondary sexual characteristics) Reactions to physical changes

Adolescence: characteristics of adolescence Marcia's stages of development of personal identity

Development of a career stage in vocational planning influences vocational planning Adolescent relationships: family, peers, adult society

Module 5: Adulthood (20 hours)

Subdivisions, characteristics of each stage Early adulthood

Vocational Adjustment: choosing an occupation, stability of vocational selection foundations of intimate relationships:

friendship, love, sexuality

Marriage: marital adjustment and conditions influencing it Parenthood: adjustment to parenthood

Middle adulthood occupational adjustment: stable and unstable patterns, preparation for retirement Psychosocial changes: coping with midlife crisis

Changes in relationships: marriage, relationship with maturing children, ageing parents, siblings, grandparenthood, friendships; late adulthood

Primary and secondary ageing, theories of ageing

Psychosocial aspects: models of coping, models of successful ageing, lifestyle and social issues (work retirement and leisure) Personal relationships: relationship with adult children, siblings, great-grandparenthood

Aspects of death: biological, sociocultural aspects, psychological aspects, patterns of grieving

Suggested Readings

Hetherington and Parke, Developmental Psychology, 5th ed., New York: McGraw Hill Publication, 1999.
 Hurlock, E. B., Developmental Psychology, 6th ed., New Delhi: Tata McGraw Hill, 1999.
 Laura C. Berk, Child Development, 3rd ed., New Delhi: Prentice Hall of India, 1996.
 D. E. Papalia, Human Development, 9th ed., New Delhi: Tata McGraw Hill, 2004.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	M	H	H	H	H
CO3	H	H	H	H	H
CO4	H	H	H	H	H

EGAE309T: ALTERNATIVE ENGLISH I

(Credits: 4 – 60 Hours)

Course Objectives

The study of literature has to be discursive. This course presupposes a movement on the part of the students to engage in more serious literature to be able to identify the technique and craft of different authors. It intends to take the students to a higher level of appreciation for the work. It will also set in motion a preparedness for serious research.

Course Outcomes

CO1: Shows familiarity with vocabulary and phraseology in written English (Remembering).
 CO2: Illustrates the use of the language effectively in selected poems, dramas and novels (understanding).
 CO3: Develops the ability to articulate thoughts and ideas meaningfully coherently and cogently with certain lexical elegance (applying).
 CO4: Tests the knowledge of the English language and composition (creating).

Module I Introduction to Poetry (20 hours)

Key terms, concepts and literary devices Selected Poems:

P.B Shelley- Ode to the West Wind Nissim Ezekiel - The Professor

William Butler Yeats - The Second Coming Matthew Arnold – The Dover Beach

Module 2: Introduction to Drama (20 hours)

Key Terms and Concepts

Selected Dramas: George Bernard Shaw- Candida and Oliver Goldsmith - She Stoops to Conquer

Module 3: Introduction to Novel (20 hours)

Key terms

Selected Novels: George Orwell, The Animal Farm Earnest Hemingway, The Old Man the Sea

Suggested Readings

Das & Mohant, Literary Criticism: A Reading. Oxford University Press.

Earnest Hemingway, The Old Man and the Sea.

Edward Albert, A History of English Literature, Oxford University Press.

George Bernard Shaw, Candida.

George Orwell, The Animal Farm.

M.H. Abrahams, A Glossary of English Terms, Bangalore: Macmillan Publishers India.

Matthew Arnold, The Dover Beach.

Ezekiel Nissim, The Professor.

Oliver Gold Smith, She Stoops to Conquer.

P. B. Shelley, Ode to the West Wind.
William Butler Yeats, The Second Coming.
Wren & Martin, English Grammar.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H	H	H
CO3	H	H	H
CO4	H	H	H

PCPP300T: THEORIES OF PERSONALITY AND POSITIVE PSYCHOLOGY

(Credits: 4 – 60 Hours)

Course Objectives

Understanding the theories of personality helps understand the behaviour patterns of individuals. It is important for the wellbalanced psychological growth of an individual. Positive psychology, on the other hand, is the scientific study of what makes life worth living, focusing on individual and societal well-being. It acquaints the students with positive subjective experiences, positive individual traits, and positive institutions. It aims to improve the quality of life.

Course Outcomes

CO1: Explains the inner dynamics of human nature (understanding)

CO2: Demonstrates the uniqueness and the immense value of every person (understanding)

CO3: Identifies the various forces – both environmental and hereditary – that shape human personality (applying)

CO4: Examines the various theories of personality (analysing)

Module 1: Freud's Classical Psychoanalytical Theory (15 hours)

The structure of personality: The Id, the Ego and the Superego The dynamics of personality: psychic energy and instincts The stages of development: oral, anal, genital, phallic, latency period, etc.

Contemporary Psychoanalytical Theory: Erikson's concept of the life cycle and eight stages of human development

Module 2: Jung's Analytical Theory (10 hours)

Analytical psychology versus psychoanalysis

The structure of personality: the ego, the personal unconscious and complexes, the collective unconscious

The Archetypes: persona, anima and animus, shadow, self

Module 3: Social Psychological Theories (10 hours)

Adler's five major contributions to personality theory; the five major sources of his thought: inferiority feelings and compensation, striving for superiority, family, order of birth and personality, style of life

Fromm's analysis of human loneliness and isolation the basic conditions of human existence and the specific needs; the five character types; the problem of human beings' relations to society; humanistic communitarian socialism as the perfect society Horney's strategies for coping with basic anxiety; the ten 'neurotic' needs; moving towards people, moving away from people, and moving against people

Module 4: Organismic Theory (10 hours)

The principal features of the organismic theory

Kurt Goldstein: the structure of an organism; the dynamics of the organism; the development of the organism

Andras Angyal: the structure of the biosphere; the dynamics of the biosphere; the development of personality

Maslow's humanistic psychology as the "third force," the human potential movement, the hierarchy of motives, characteristics of self-actualized persons and peak experiences

Module 5: Rogers' Person-Centred Theory (10 hours)

The structure of personality: organism and self; congruence and incongruence the dynamics of personality the development of personality

Module 6: Constitutional Psychology (10 hours)

Spranger's six types of personalities: theoretical, economic, aesthetic, social and power-politics types
Kretschmer's three types of physiques and the corresponding personality types
Sheldon's Atlas of men and Atlas of women

Module 7: Eastern Psychology (15 hours)

Eastern psychologies and Western personality theories

Abhidhamma theory: unhealthy and healthy factors; personality types, means to healthy personality; concentration and altered states of consciousness

Suggested Readings

- Alfred Adler, *Practice and Theory of Individual Psychology*, New York: Harcourt, Brace & World, 1927.
Erik Erikson, *Identity: Youth and Crisis*, New York: Norton, 1968.
Sigmund Freud, *Introductory Lectures on Psychoanalysis*, London: Hogarth Press, 1963.
Erich Fromm, *The Sane Society*, New York: Rinehart, 1955.
Calvin S. Hall and Gardner Lindzey, *Theories of Personality*, New York: Wiley, 1998.
Karen Horney, *Neurotic Personality of our Times*, New York: Norton, 1937.
Carl G. Jung, *Memories, Dreams and Reflections*, New York: Random House, 1961.
Abraham Maslow, *Motivation and Personality*, New York: Harper, 1954.
M. A. Narada, *Manual of Abhidhamma*, Kandy, Sri Lanka: Buddhist Publication Society, 1968.
L. A. Pervin, *The Science of Personality*, New York: Wiley, 1996.
C. Peterson, *Personality*, New York: Harcourt Brace Jovanovich, 1992.
Rabin, J Arnoff, et al, eds., *Further Explorations in Personality*, New York: Wiley, 1981.
William H. Sheldon, *Atlas of Men: A Guide for Somatotyping the Adult Male at All Ages*, New York: Harper, 1954.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO1	H	H	H	H	H	H	H
CO2	H	H	H	H	H	H	H
CO3	H	H	H	H	H	H	H
CO4	H	H	H	H	H	H	H

EGAE407T: ALTERNATIVE ENGLISH II

(Credits: 3– 45 Hours)

Course Objectives

The study of literature has to be discursive. This course presupposes a movement on the part of the students to engage in more serious literature to be able to identify the technique and craft of different authors. It will take the students to a higher level of appreciation for the work. It will also set in motion a preparedness for serious research.

Course Outcomes

- CO1: Shows familiarity with vocabulary and phraseology in written English (Remembering).
CO2: Illustrates the use of the language effectively in selected essays and plays (understanding).
CO3: Develops the ability to articulate thoughts and ideas meaningfully coherently and cogently with certain lexical elegance (applying).
CO4: Tests the knowledge of the English language and composition (creating).

Module 1: Essays (25 hours)

A Room of One's Own - Virginia Woolf
 The Purloined Letter - Edgar Allan Poe
 The Praise of Chimney Sweepers - Charles Lamb
 The Rocking Horse Winner - D. H. Lawrence
 The Homecoming - Rabindranath Tagore
 The Doll's House - Katherine Mansfield

Module 2: Language & Linguistics (15 hours)**Module 3: Plays (20 hours)** Theatre of the Absurd – Martin Esslin**Suggested Readings**

Catherine Mansfield, The Doll's House.
 Charles Lamb, The Praise of the Chimney Sweepers.
 D. H. Lawrence, The Rocking Horse Winner.
 Das & Mohanty, Literary Criticism: A Reading, Oxford University Press.
 Edgar Allan Poe, The Purloined Letter.
 Edward Albert, A History of English Literature, Oxford University Press.
 M. H. Abrahams, A Glossary of English Terms, Bangalore: Macmillan Publishers India.
 Rabindranath Tagore, The Home Coming.
 The Complete Works of Shakespeare.
 Virginia Woolf, A Room of One's Own.
 Wren & Martin, English Grammar and Composition.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H	M	H
CO3	H	H	H
CO4	M	H	M

PYRM402T: RESEARCH METHODOLOGY

(Credits: 2– 30 Hours)

Course Objectives

The objectives of the course in Research Methodology include an understanding of the research process and acquiring the attitudes and skills essential for research, developing skills for interpretation, documentation and presentation of results of the research, the process of report writing and publication, and basic statistics.

Course Outcomes

CO1: Identifies the various components involved in research (applying).
 CO2: Outlines the basics in Statistics (understanding).
 CO3: Illustrates the different steps involved in the research process (understanding).

Module 1: Introduction to Research (5 hours)

Philosophical Foundations of Research; Natural and social science research- characteristics and scientific attitude.; Scope of social science research

Module 2: Research designs, approaches and types (8 hours)

Research designs: Descriptive, Exploratory and Experimental: meaning, scope, characteristics, application in a social work setting.

Research Approaches: Qualitative and Quantitative Research: meanings, scope, methods, steps, sampling, data collection, analysis, interpretation and reporting. Strengths and weaknesses.

Evaluative research: Programme and project evaluation: concept, types, steps, reports.

Module 3: Steps in Research Process (12 hours)

Problem Formulation: Identifying the research issue, formulating the research topic and problem, reviewing the literature (library work), theoretical framework, formulating objectives, clarifying concepts, and variables- conceptual and operational, and formulating hypothesis.

Population and Sampling: Inclusion and exclusion criteria of population, the logic of sampling size and techniques: probability and non-probability sampling.

Tools for data collection: Levels, Types of measurements, reliability and validity of tools. Constructing tools for data collection: questionnaire, interview schedule, scales. Quantification of qualitative data.

Sources, Collection and Analysis of Data: Secondary and primary sources. Data collection data editing, coding, master sheet, analysis, report writing. Using a computer for data analysis: coding, analysis- graphs and results. Professional report writing

Module 4: Introduction to Statistics for Research (5 hours)

Statistics: Definition, Uses and Limitations. Classification and tabulation of data, univariate and bivariate, diagrammatic and graphic presentations. Measures of central tendencies, Mean, Median and Mode and their uses. Measures of variability range, variance and standard deviation.

Suggested Readings

Ram Ahuja, Research Methods, Rawat, Jaipur, 2001.

Alston M. Bocolos, Research in Social Workers: An Introduction to the Methods, Rawat, Jaipur, Indian edition, 2003.

T.L. Baker, Doing Social Research, McGraw Hill, Singapore, 1994.

W.J. Goode and P.K. Hatt, Methods in Social Research, McGraw Hill Singapore, 1981.

R. M. Grinnell (Jr.), Social Work Research and Evaluation, F.E. Peacock Pub. Inc., Illinois, 1988.

C.B. Gupta, Introduction to Statistical Methods, Vikas Publishing House, 1995.

S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, Delhi, 1997.

S.P. Gupta, Statistical Methods, Sultan Chand and Sons, New Delhi 1997.

K.K. Jacob, Methods and Fields of Social Work in India, Asia Publishing, Bombay, 1996.

C.R. Kothari, Research Methodology: Methods and Techniques, 2nd edition reprint, New Age International New Delhi, 2004.

O.R. Krishnaswamy, Methodology for Research in Social Science, Himalaya, Bombay, 1993.

D.K. Laldas, Practice of Social Research, Rawat, Jaipur, 2000.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1		H	H	
CO2				H
CO3			H	

PCSP400T: SOCIAL PSYCHOLOGY

(Credits: 3– 45 Hours)

Course Objectives

The course seeks to give comprehensive knowledge about the psychological ramifications that follow from the fact that a human being is a social animal. Social psychology is the study of how individual or group behaviour is influenced by the presence and behaviour of others. The major question social psychologists ponder is this: How and why are people's perceptions and actions influenced by environmental factors, such as social interaction?

Course Outcomes

CO1: Explains the psychological ramifications of human beings considered social beings (understanding)

CO2: Demonstrates the processes such as social relationships and problem behaviour (understanding) CO3: Evaluates the role of society in the growth of a human person (evaluating)

CO4: Discusses concepts such as motivation, self-concept, attitude and conflict (creating)

Module 1: Introduction (15 hours)

Definition and History of social psychology

Theories: motivational, learning, cognitive, decision-making, interdependence, socio-cultural, evolutionary, and mid-range theories

Module 2: Social Perception (15 hours)

Self-concept: beginning, formation; self: schemas and multicultural perspectives self-presentation: false modesty, selfhandicapping, impression management self-esteem: development and consequences perceiving persons: attribution logic, integration, confirmation bias

Module 3: Positive Social Relations (10 hours)

Pro-Social behaviour: origin, helping, influences (personal, interpersonal and situational), receiving help interpersonal attraction and affiliation: characteristics of the individual, others and situational influences

Module 4: Negative Social Relations (10 hours)

Perceiving Groups: stereotypes, prejudices (individual differences and reducing prejudice) Aggression: origin, influences (social and situational), forms, prevention and control

Module 5: Social Influences (10 hours)

Attitudes: formation, attitude and behaviour, attitude change

Group: formation, function (roles, status, norms and cohesiveness), productivity, groupthink, conflict and conflict resolution

Suggested Readings

Robert A. Baron and D. Byrne, Social Psychology, 8th ed., New Delhi: Prentice-Hall of India, 2001.

S. S. Brehm, and S. N. Kassin, Social Psychology, 3rd ed., Boston: Houghton Mifflin Company, 1996.

R. J. Crisp and R. N. Turner, Essential Social Psychology, New Delhi: Sage Publications, 2007.

D. G. Myers, Social Psychology, 7th ed., New York: McGraw Hill Companies, 2002.

S. E. Taylor, L. A. Peplau and D. O. Sears, Social Psychology, 12th ed., New Delhi: Pearson Prentice-Hall of India, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	H	H
CO2	M	H	H	H	H
CO3	H	H	H	H	H
CO4	H	M	M	M	H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code		Credits
1	S E Course 1	PYMT102L	Basics in Motor Mechanics/Tailoring and Plumbing	3
2	S E Course 2	PYOA104L	Basics in Office Automation	3
3	S E Course 3	PYBE205L	Basics in Electrical and Electronics	3

PYMT102L: BASICS IN MOTOR MECHANICS/TAILORING AND PLUMBING

(Credits: 3 - 90 Hours)

Course Objectives

The course intends to offer hands-on training to the students in skills. In this skill enhancement course, the students are acquainted with two skills, namely, motor mechanics (for boys) and tailoring (for girls) and plumbing (for both boys and girls). The students will have 45 hours of theory classes and 45 hours of practicum.

Course Outcomes

CO 1: Demonstrates basic skills in motor mechanics, tailoring and plumbing (understanding)

CO 2: Shows the basic safety practices in motor mechanics, tailoring and plumbing (understanding)

CO 3: Identifies the basic errors in motor mechanics, tailoring and plumbing (applying)

CO 4: Analyses the basic operations in motor mechanics, tailoring and plumbing (analysing)

Module 1: Basics in Motor Mechanics/Tailoring (25 hours of theory and 25 hours of practicum)

Motor Mechanics: aggregates and components of a vehicle, hand tools and special tools, workshop calculations, terms and terminologies, components of a vehicle.

Tailoring: machine classification, needle anatomy, industrial sewing machine, cleaning of the sewing machine, sewing machine motors, threads, safety tips, sewing fundamentals, exercise, stitch and seam classification, sewing and fabric defects, recognising garment parts, sewing methods and garment construction.

Module 2: Basics in Plumbing (20 hours of theory and 20 hours of practicum)

Plumbing tools, piping materials and fittings, plumbing fixtures, designing plumbing systems, preparing for plumbing system installation, installing water supply piping, installing fixtures, faucets, and appliances.

Suggested Readings

Automobile Repair, New Delhi: Don Bosco Tech Society.

Modern Plumbing (Seventh Edition), ISBN 9781605252360.

Sewing Machine Operator, New Delhi: Don Bosco Tech Society.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H

PYOA104L: BASICS IN OFFICE AUTOMATION

(Credits: 3 – 90 Hours)

Course Objectives

This skill enhancement course in office automation is aimed at teaching the students digital concepts as well as various other skills that they will need to succeed in the modern workplace. The course offers an added advantage to students while applying for jobs in various sectors, be they governmental or non-governmental. The students will have 45 hours of theory classes and 45 hours of practicum.

Course Outcomes

CO 1: Defines the various computer programmes that are employed for office management (remembering)

CO 2: Explains the various uses of computers in office management (understanding)

CO 3: Develops typing skills, designing and publishing using computer software (applying)

CO 4: Discusses office procedures and the various devices used in a modern office (creating)

Module 1: Computer Science and Operating System (10 hours of theory and 10 hours of practicum) Typing Skills, Basics of Computer, Programming, Windows**Module 2: Personal Computer Software Tools (10 hours of theory and 10 hours of practicum)**

MS Word, MS Excel, MS PowerPoint

Module 3: Designing and Publishing software (15 hours of theory and 15 hours of practicum) PageMaker, Photoshop and Corel Draw

Module 4: Office Procedures and the Devices Engaged in Modern Office (10 hours of theory and 10 hours of practicum) Photocopier, Risograph, Scanners, Laminating Machine, etc.

Suggested Readings

1. Course on Computer Concepts. Kolkata: BPB Publication.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	H
CO2	H	H	H	H
CO3	H	M	H	
CO4	M			H

PYBE205L: BASICS IN ELECTRICAL AND ELECTRONICS

(Credits: 3 – 90 Hours)

Course Objectives

The course intends to offer hands-on training to the students in skills. In this skill enhancement course, the students are acquainted with two skills, namely, electrical and electronics. The students will have 45 hours of theory classes and 45 hours of practicum.

Course Outcomes

CO 1: Demonstrates basic skills in electrical and electronics (understanding)

CO 2: Shows the basic safety practices in electrical and electronics (understanding)

CO 3: Identifies the basic errors in electrical and electronics (applying)

CO 4: Analyses the basic operations in electrical and electronics (analysing)

Module 1: Basics in Electricals (25 hours of theory and 25 hours of practicum)

Basic tools & safety: introduction to electricity, safety precautions, elementary first aid, identification of different hand tools with their specifications-care and maintenance of hand tools, ohms law, resistance electric signs & symbols

Electrical Wires: identification of various types of wires used for house wiring, motor winding in electrical appliances, their uses and sizes

Electric Accessories & Meters: common electric accessories and fixtures with their specifications installation of different types of electric meters and instruments (portable type panel/board type)function and uses of ampere meter, voltmeter, energy meter, wattmeter, megger

Protective Devices: Understanding of fuses and circuit breakers (Kit-Kat Type, H.R.C. Fuse, Cartridge Fuse, M.C.B. ELCB) earthing: the purpose of earthing, methods of earthing (plate & pipe earthing)

Complete house-wiring layout, Splitting load wire by NEC I.E.E. rules, multi-storeyed system, fault finding and troubleshooting.

Module 2: Basics in Electronics (20 hours of theory and 20 hours of practicum)

Basic technical know-how in fitting, assembling, repairing and maintaining electronic equipment such as computers, televisions, solar panels, UPS, inverters and mobiles.

Domestic Appliances: working principles and circuits of common domestic equipment and appliances: calling bell, buzzer, alarms, electric iron, heater, light. electric kettle, heater/immersion heater, hot plate, oven, geyser, cooking range, mixer, washing machine, motor pump set, etc.

Suggested Readings

Charles K. Alexander, Matthew N.O. Saidiku, Fundamentals of Electrical Circuits, Tata McGraw Hill company.

R.L. Boylestad and Louis Nashelsky, Electronic Devices and Circuits, 9th edition, PEI/PHI 2006.

R.S. Sedha, Applied Electronics, S. Chand & Co., 2006.

Surinder Pal Bali, Electrical Technology, Pearson Publications.

V.N. Mittle, Basic Electrical Engineering, Tata McGraw Hill edition, New Delhi, 1990.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H

INTERNSHIPS (Conducted after 4th Semester and evaluated in 5th Semester)

Semester	Category	Course Code	Course Name	Credits
5	Internship	PYIN303L	Teaching in Schools	2

PYIN303L: TEACHING IN SCHOOLS**Course Objectives**

This course is intended to acquire practical know-how in teaching and the art of accompanying children. It provides a compelling reason to learn, teaches the skills of civic participation and develops an ethic of service and civic responsibility. It increases motivation and retention of academic skills as specific learning goals are tied to community needs. The students are expected to spend some days in schools that are assigned to them. They will be engaged in teaching and in other co-curricular activities that are beneficial to the children.

Course Outcomes

CO1: Develops familiarity with the social and economic situation of the localities where the internships are carried out (applying).

CO2: Extends the facilities of learning and teaching techniques to lesser privileged children (understanding)

CO3: Evaluates the teaching abilities or social sensibilities of students (evaluating)

CO4: Improves the intellectual and psychological well-being of the children as well as the beneficiaries of social work (creating)

The students have to undergo the internship during the semester break after the 4th semester. They are expected to keep a daily report of the activities that they carry out and the learning outcomes during the entire period of the internship. The faculty members will supervise them during this period. After completing their internship, they need to produce a certificate of completion from the headmasters or principals of the concerned schools.

The internship should be for a minimum duration of 30 hours which can be extended depending upon the convenience and requirements of the student and the school respectively. The rest of the hours are allotted for completing the Report. However, the entire duration of the course should not exceed 60 hours.

The Report must be in a spiral bind. It must be accompanied by a certificate of authentication from the headmaster/principal of the school in which the candidate underwent the internship. The Report must contain a detailed description of the activities performed, learning outcomes, feedback from the target group and Geo-tagged photographs.

The assessment will be based on the presentation (PPT) and Viva-Voce Examination after the completion of the internship.

The Assessment for the internship will have the following components: a) Report: 40 marks

b) PPT Presentation: 30 marks

c) Viva-Voce Examination: 30 marks

Mapping of COs to Syllabus

Course Outcomes	Teaching	Social Work
CO1	M	H
CO2	H	
CO3	H	
CO4	H	H

RESEARCH PROJECT/DISSERTATION

BA Philosophy (Honours)				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	PYDI403P	Dissertation Based on Themes in Philosophy or Psychology	6
8	Research Project/Dissertation	PYDI406P	Comprehensive Evaluation of Dissertation and Philosophy (Viva-Voce)	6

PYDI403P: DISSERTATION BASED ON THEMES IN PHILOSOPHY OR PSYCHOLOGY

Credits: 6

Course Objectives

Dissertations are an important method of demonstrating that the students can identify a topic of concern to the field, and read, understand and incorporate the relevant literature into a new research question to be investigated. It involves active research, coming up with a question, following a defined methodology and engaging with the work of other researchers. It is a rite of passage within education and shows that the students can 'do' what they have been studying.

Course Outcomes

CO1: Develops descriptive, analytic and synthetic skills in writing (remembering).

CO2: Demonstrate a sense of originality, self-discipline and hard work (understanding)

CO3: Assumes a thorough knowledge of the subject matter under research (analysing)

CO4: Shows that the researcher can undertake independent work and, depending on the final result, move to a high standard in terms of quality (understanding)

One thesis, not exceeding 18,000 words, on a specialised subject during the seventh semester. Registration for the thesis will be done during the sixth semester.

The student selects the theme and a guide (promoter) among the faculty members in consultation with the HoD, Department of Philosophy.

The scheme of the thesis (with a minimum of 300 words) has to be submitted for approval before the completion of the sixth semester.

The scheme shall include the relevance of the theme, methodology, titles, an outline of the chapters, and a working bibliography.

The departmental meeting shall approve the schemes of the theses in the sixth semester itself.

The students will be allotted 180 class hours during the seventh semester for the completion of the thesis.

The thesis shall be submitted at least one month before the end of the seventh semester.

The thesis should be typewritten in the format prescribed by the Department of Philosophy.

Three bound copies of the thesis are to be submitted to the office.

The thesis will be evaluated by the respective guide (promoter). There will also be a public defence of the thesis for 30 minutes in the eighth semester.

The Assessment for the dissertation will have the following components:

- a) Evaluation of the guide (promoter): 60 marks
- b) Viva-Voce Examination: 40 marks

Mapping of COs to Syllabus

Course Outcomes	
CO1	H
CO2	H
CO3	H
CO4	H

PYDI406P: COMPREHENSIVE EVALUATION OF DISSERTATION AND PHILOSOPHY (VIVA-VOCE)

Credits: 6

Course Objectives

The purpose of the comprehensive evaluation is for students to demonstrate mastery of knowledge in philosophy, the subject in which they are majoring. It also gives the students opportunities to exhibit their familiarity with research. The comprehensive evaluation of dissertations and philosophical subjects consists of a viva voce examination.

Course Outcomes

CO1: Develops systematic and critical philosophical thinking (applying)

CO2: Examines the extent of philosophical knowledge acquired during the course of study (analysing) CO3: Evaluates the capacity of a candidate for a comprehensive understanding of things (evaluating). CO4: Assesses the internalising capacity of the intellectual inputs (evaluating).

The students shall have a comprehensive viva voce examination at the end of the eighth semester. The students will be allotted 180 class hours for the examination. The duration of the viva voce examination will be an hour before two panels (2x2) of four examiners, which can be held in two different phases. In the first phase, the candidates will appear before the first panel, and they will be asked to present in brief the findings of the dissertation prepared in the seventh semester, and questions based on them will be asked. In the second phase, before the two- member panel, the candidates will be examined for 30 minutes on the principal courses in philosophy. This will also last for 30 minutes. Both panels will evaluate the performance of the candidates out of 100, and the average is taken for the final reckoning. The comprehensive viva voce examinations will carry a weightage of 6 credits.

Mapping of COs to Syllabus

Course Outcomes	
CO1	H
CO2	H
CO3	H
CO4	H

DEPARTMENT OF HOSPITALITY AND HOTEL ADMINISTRATION

PROGRAMME: BACHELOR OF SCIENCE in HOSPITALITY AND HOTEL ADMINISTRATION (BSC)

DEGREE: BSC HHA (HONOURS)/ BSC HHA (HONOURS) WITH RESEARCH

VISION

To develop design and deliver research-based personalized education that equips students to become global hospitality professionals. Our aim is to impart knowledge, skills and abilities to the students through the holistic approach for nurturing them as dependable human leaders. We do develop our students to interface with stakeholders and to deliver hospitality Professionals that add to the financial, intellectual, environmental, ethical, cultural and social growth of the nation

MISSION

The mission of this department is to be a leading hospitality institution imparting quality education of global excellence leading to hospitality ready professionals carrying ethical and social values.

PROGRAMME OUTCOMES (PO)

- PO 1: Critical Thinking: Demonstrate professional aptitude, critical thinking, problem solving skills, and leadership skills needed for all sectors in the hospitality industry.
- PO 2: Effective Communication: Speak, read, write and listen clearly in person and through electronic media in English and in one more foreign language.
- PO 3: Social Interaction: Elicit views of others, mediate disagreements and help reach conclusions in the organizational and operational structure of hospitality industry.
- PO 4: Effective Citizenship: Demonstrate awareness and understanding necessary for social concern and equity towards national development.
- PO 5: Ethics: Apply ethical standards in the professional field and accept responsibility for them.
- PO 6: Environment and Sustainability: Understand the issues of environmental contexts and sustainable development.
- PO 7: Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the field of hospitality management.

PROGRAMME SPECIFIC OUTCOMES (PSO)

- PSO 1: Conceptual skills: Proficient in the core functional and support areas of hospitality sectors to plan and coordinate business related events.
- PSO 2: Management skills: Manage structures and finance of the industry, as well as disaster management.
- PSO 3: Problem solving skills: Develop legal awareness for handling real-life challenges of hospitality industry.
- PSO 4: Entrepreneurial skills: Achieve necessary skills to become a hospitality entrepreneur.

LIST OF COURSES

- 1.1: Introduction to Food & Beverage service
- 1.2: Introduction to gastronomy & hygiene practices
- 1.3: **Multidisciplinary**
- 1.4: **Ability Enhancement**
- 1.5: Introduction to room division
- 1.6: **Common value added**
- 1.7: **Common value added**
- 1.8: **Community Engagement**
- 1.9: Introduction to Food & Beverage service Practical
- 1.10: Introduction to gastronomy & hygiene practices Practical
- 2.1: Restaurant Ethics & Menu planning

- 2.2: Culinary & Baking skills
- 2.3: **Multidisciplinary**
- 2.4: **Ability Enhancement**
- 2.5: Functional areas & cleaning agents
- 2.6: **Common value added**
- 2.7: **Common value added**
- 2.8: **Community Engagement**
- 2.9: Restaurant Ethics & Menu planning Practical
- 2.10: Culinary & Baking skills Practical
- 2.11: Vocational Training **
- 3.1: In room dining & beverages
- 3.2: Indian Gastronomy
- 3.3: Room reports & surface cleaning
- 3.4: **Multidisciplinary**
- 3.5: **Ability Enhancement**
- 3.6: Introduction to Marketing
- 3.7: In room dining & beverages Practical
- 3.8: Indian Gastronomy Practical
- 3.9: Room reports & surface cleaning Practical
- 4.1: Bar operation & Outlet Management
- 4.2: Quantity Food Production
- 4.3: Front Office Management
- 4.4: Housekeeping supervision and Budgeting
- 4.5: **Ability Enhancement**
- 4.6: Bar operation & Outlet Management Practical
- 4.7: Quantity Food Production Practical
- 4.8: Front Office Management Practical
- 4.9: Housekeeping supervision and Budgeting Practical
- 4.10: Vocational Training **
- 5.1: Restaurant Planning & Management
- 5.2: Garde Manger & Confectionary
- 5.3: Revenue Management & Budgeting
- 5.4: Advance Housekeeping Management
- 5.5: Field Project/ Apprenticeship
- 5.6: Restaurant Planning & Management Practical
- 5.7: Garde Manger & Confectionary Practical
- 5.8: Revenue Management & Budgeting Practical
- 5.9: Advance Housekeeping Management Practical
- 6.1: Training & Development – Food & Beverage service
- 6.2: Training & Development – Gastronomy
- 6.3: Training & Development – Front Office
- 6.4: Training & Development – Housekeeping
- 6.5: Training report presentation

4 YEAR UG Degree (Honours)

- 7.1: Modern Trends in Gastronomy – I / Modern Trends in Front Office –I
- 7.2: Modern Trends in Food & Beverage service –I / Modern Trends in Housekeeping – I
- 7.3: Basics of Tourism
- 7.4: Research Methodology
- 7.5: Project Phase –I / Dissertation Phase – I
- 7.6: Modern Trends in Gastronomy – I Practical / Modern Trends in Front Office –I Practical
- 7.7: Modern Trends in Food & Beverage service –I Practical / Modern Trends in Housekeeping – I Practical

8.1: Modern Trends in Gastronomy – II / Modern Trends in Front Office –II

8.2: Modern Trends in Food & Beverage service –II / Modern Trends in Housekeeping – II

8.3: Organizational Behaviour

8.4: Project Phase –II / Dissertation Phase – II

8.5: Modern Trends in Gastronomy – II Practical / Modern Trends in Front Office –II Practical

8.6: Modern Trends in Food & Beverage service –II Practical / Modern Trends in Housekeeping – II Practical

4 YEAR UG Degree (Research)

7.1: Research Methodology

7.2: Dissertation Phase – I

8.1: Dissertation Phase – II

Note: ** These courses are only applicable if the student opts out from the program after 1st or 2nd year.**MAPPING of COURSES to PO/PSOs**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3	PSO 4
1.1	L						M		M		
1.2	L			M				M			
1.3											
1.4											
1.5			M		L			M			
1.6											
1.7											
1.8											
1.9							M		L	M	
1.10				M						M	
2.1		L			M				M		
2.2	M							M			
2.3											
2.4											
2.5			L		M				M		
2.6											
2.7											
2.8											
2.9	M								M		
2.10	M										M
2.11**				L			M				M
3.1	M		L							M	
3.2	L				M			M			
3.3			M					M			
3.4											
3.5											
3.6			M					M			
3.7		L		M					M		
3.8					M				M		
3.9			M				L		M		
4.1	L				M					M	
4.2							M				M

4.3		L	M					M			
4.4						M	L		M		
4.5											
4.6		L					M				M
4.7							M				M
4.8		M				L					M
4.9			L				M				M
4.10**				L			M				M
5.1	L		M							M	
5.2	L						M	M			
5.3	L				M					M	
5.4			L				M		M		
5.5	L					M	H	L		M	
5.6	M							L	M		
5.7							M	L		M	
5.8				L	M				M	L	
5.9			L		M				M		
6.1	L		M				H	L		M	H
6.2	L		M				H	L		M	H
6.3	L		M				H	L	M		H
6.4	L				M		H	M			
6.5			L	M				M			

4 YEAR UG Degree (Honours)

7.1	L					M	H		L		M
	L				M	M	H		L		M
7.2			M			M	H		M		
					L	M	H			M	
7.3			L		M			M			
7.4	L				M			L		M	
7.5	L				M		H		M		
7.6	L						M	M			H
			L				M		M		H
7.7	L						M		M		H
			L			M					H
8.1	L					M	H		L		M
	L				M		H		L		M
8.2			M			M	H			M	
					L	M	H			M	
8.3	L		M				M		M		
8.4	L				M		H		M		
8.5	L				M		H		M		
			L				M		M		H
8.6	L						M		M		H
			L			M	H				H

4 YEAR UG Degree (Research)

7.1	L				M				M	
7.2	L		M				H	L	M	
8.1	L		M				H	L	M	H

DETAILED SYLLABUS MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	HAFB100T	Introduction to food & beverage service	2
		HAFB101L	Introduction to food & beverage service Practical	2
2	Major Course 2	HARM102T	Restaurant Ethics & Menu planning	2
		HARM103L	Restaurant Ethics & Menu planning Practical	2
3	Major Course 3	HADB200T	In room dining & beverages	2
		HADB201L	In room dining & beverages Practical	2
3	Major Course 4	HAIG202T	Indian Gastronomy	2
		HAIG203L	Indian Gastronomy Practical	2
4	Major Course 5	HABO204T	Bar operation & outlet management	3
		HABO205L	Bar operation & outlet management Practical	2
4	Major Course 6	HAQF206T	Quantity food production	3
		HAQF207L	Quantity food production Practical	2
4	Major Course 7	HAFO208T	Front office management	2
		HAFO209L	Front office management Practical	2
5	Major Course 8	HARP300T	Restaurant planning & management	3
		HARP301L	Restaurant planning & management Practical	2
5	Major Course 9	HAGC302T	Garde manger & confectionary	3
		HAGC303L	Garde manger & confectionary Practical	2
5	Major Course 10	HARB304T	Revenue management & Budgeting	2
		HARB305L	Revenue management & Budgeting Practical	2
6	Major Course 11	HHFB321P	Training & Development (Food and Beverage)	4
6	Major Course 12	HHGA322P	Training & Development (Gastronomy)	4
6	Major Course 13	HHFO323P	Training & Development (Front Office)	4
6	Major Course 14	HHHK324P	Training & Development (Housekeeping)	4
7	Major Course 15	HAGT400T	Modern trends in gastronomy - I	3
		HAGT401L	Modern trends in gastronomy - I Practical	2
			OR	
		HAFO402T	Modern trends in Front office - I	3
		HAFO403L	Modern trends in Front office - I Practical	2
7	Major Course 16	HAFS404T	Modern trends in Food & beverage service – I	3
		HAFS405L	Modern trends in Food & beverage service – I Practical	2
			OR	

		HAHK406T	Modern trends in Housekeeping – I	3
		HAHK407L	Modern trends in Housekeeping – I Practical	2
8	Major Course 17	HAGY408T	Modern trends in gastronomy - II	3
		HAGY409L	Modern trends in gastronomy - II Practical	2
			OR	
		HAFR410T	Modern trends in Front office - II	3
		HAFR411L	Modern trends in Front office - II Practical	2
8	Major Course 18	HABS412T	Modern trends in Food & beverage service – II	3
		HABS413T	Modern trends in Food & beverage service – II Practical	2
			OR	
		HAHG414T	Modern trends in Housekeeping – II	3
		HAHG415T	Modern trends in Housekeeping – II Practical	2

HAFB100T: INTRODUCTION TO FOOD & BEVERAGE SERVICE

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s)

The objective of the course is to learn the basic knowledge about the departmental structures and outlets in the food & beverage service sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the Food and Beverage Industry and Service Areas. (Understand)

CO 2: Identify and demonstrate types and usage of food and beverage service equipments (Knowledge)

CO 3: Analyze types of Attributes required becoming a Food and Beverage Service Personnel. (Analyze)

CO 4: Develop, understand and demonstrate the different types of menus provided by different food outlets and their service techniques. (Create)

Module I: THE HOTEL & CATERING INDUSTRY (07 hours)

Introduction to the Hotel Industry and Growth of the hotel Industry in India

Role of catering establishment in the travel/tourism industry

Types of F&B operations (Types of different F&B Outlets)

Classification of Commercial, Residential/Non-residential

Welfare Catering - Industrial/Institutional/Transport such as air, road, rail, sea, etc.

Structure of the catering industry - a brief description of each

Module II: DEPARTMENTAL ORGANIZATION & STAFFING (08 Hours)

Organization of F&B department of the hotel

The principal staff of various types of F&B operations

French terms related to F&B staff

Duties & responsibilities of F&B staff

Attributes of a waiter

Inter-departmental relationships (Within F&B and other departments)

Module III: FOOD SERVICE OUTLETS & ANCILLARY DEPARTMENTS (8 hours)

Specialty Restaurants

Coffee Shop

Cafeteria

Fast Food (Quick Service Restaurants)

Grill Room

Banquets

Bar
Vending Machines
Discotheque
Pantry
Food pick-up area
Store
Linen room
Kitchen stewarding

Module IV: F & B SERVICE EQUIPMENTS (06 Hours)

Familiarization & Selection factors of - Cutlery - Crockery - Glassware - Flatware – Hollowware- All other equipment used in F&B Service
French terms related to the above

Suggested Readings

- 1.Lillicrap Dennis R., Food & Beverage Service, Hodder Arnold Publication, 2006.
- 2.Singaravelavan R. Food & Beverage Services, Oxford Publications, 2011
- 3.Dhawan, Vijay, Food & Beverage Service - Franc Brothers, 2009.
- 4.Walker R. John, The Restaurant (From Concept to Operation), Wiley, 2013

Mapping of Cos to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2			M	H
CO 3	L	H		
CO 4				H

HAFB101L: INTRODUCTION TO FOOD & BEVERAGE SERVICE PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn the table layouts and identifications of basic tools and hygiene practices required in food & beverage service sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the principles of basic hygiene practices and body language in the department (Understand)

CO 2: Identify the process of laying tables arranging things in order. (Knowledge)

CO 3: Analyze& demonstrate service of water and serving plates (Analyze)

CO 4: Analyze& explain care and maintenance procedures of different equipment (Analyze)

CO 5: Develop & familiarize with different tools of F&B service. (Create)

Practical:

Hygiene and Etiquettes in Restaurant

Mis- En –Place and Mis- En –Scene activities

Identification of F&B Tools, types of equipment, Cutlery, Crockery, Glass & Chinaware, Flatware, Hollowware, Table Appointments, Linen, etc

Care and Maintenance of various Tools, a type of equipment, Flatware, Hollow wares.

Side board Organization and its importance

Laying & Relaying of Table.

Rules for Laying Cover, Various types of Napkin folds

Importance of Body Language and Dinning etiquettes.

Carrying a Salver/Tray, Plates, Glasses & other types of equipment

Service of Water

Handling the Service Gear

Clearing an Ashtray, and precautions to be taken care of for handling operation.

Mapping of Cos to Syllabus

CO'S	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	H							M				
CO 2		H				H						
CO 3										H	M	
CO 4				H			M		M			
CO 5			H									M

sHARM102T: RESTAURENT ETHICS & MENU PLANNING

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn different types of menu's & controlling procedures required in food & beverage service sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain the different types of breakfast and other meals and their service techniques (Understand)

CO 2: Identify and demonstrate the different types of menus provided by different food outlets. (Knowledge)

CO 3: Analyze and understand the different aspects of control methods used in food and beverage departments (Analyze)

CO 4: Analyze& classify the different types of Cigars and cigarettes. (Analyze)

CO 5: Develop & illustrate customer care and situation handling (Create)

Module I: TYPES OF MEALS & MENU (7 hours)

Breakfast-Introduction, Types, Service Methods,
Brunch, Lunch, Hi-Tea, Dinner, Supper, and others
Introduction to menu; Types-Ala Carte & Table D'hôte
Ala carte and TDH setups

Menu Planning, considerations, and constraints, Menu Terms
French Classical Menu- 11, 13, and 17 courses separately
Classical Foods & its Accompaniments with Cover
Indian regional dishes, accompaniments, and service

Module II: PREPARATION FOR SERVICE (7 hours)

Organizing Mise-en-scene
Organizing Mise en place
TYPES OF FOOD SERVICE – silver service, pre – plated service, Cafeteria service, room service, buffet service, gueridon service, lounge service

Module III: SEQUENCE OF SERVICE & Food & Beverage Terminology (05 hours)

Handling Table reservation
KOTs & BOTs Duplicate & Triplicate System, Computerized K.O.T's
The sequence of Food Service
Table Clearing Process
Billing Methods, Payment methods, and Cash

Module IV: CUSTOMER CARE AND HANDLING SITUATIONS (05 hours)

Unavailability of Table/reservation
Wrong Order Taking, Handling Unavailability of Food items
Handling Special Requests

Order Delays, Spillages, Return Food
 Lost and found properties
 Illness
 Drunken Guest, Unethical appearance of Guest
 Dealing with children and Infants
 Handling specially able, Old age guest

Module V: TOBACCO & CIGARS (06 hours)

History
 Processing for cigarettes, pipe tobacco & cigars
 Cigarettes – Types and Brand names
 Pipe Tobacco – Types and Brand names
 Cigars – shapes, sizes, colors, and Brand names
 Care and Storage of cigarettes & cigars

Suggested Readings

Singaravelavan R. Food & Beverage Services, Oxford Publications, 2011.
 LillicrapDennis R., Food & Beverage Service, Hodder Arnold Publication, 2006.
 Prasad, Vara, Krishna R. Gopi, Food & Beverage: F&B Simplified, Pearson, 2013.
 Andrioli, Sergio, Douglas, Peter, Professional Food Service, Heinemann Professional, 1990.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2	M	M		
CO 3			M	
CO 4				H
CO 5	M		H	

HARM103L: RESTAURENT ETHICS & MENU PLANNING PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn different types of menu services, KOT analysis, and service of hot and cold non – alcoholic beverages.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

- CO 1: Discuss the different types of breakfast and other meals layout and tray set up with service techniques sequence (Understand)
 CO 2: Understand and demonstrate the different types of service provided in restaurants as per types of menus provided in 5star hotels in different food outlets. (Understand)
 CO 3: Identify different aspects of the control method used in restaurants (Knowledge)
 CO 4: Analyze Food and beverage departments by using KOT (Analyze)
 CO 5: Develop & demonstrate service of cold & hot non-alcoholic beverages. (Create)

PRACTICAL

Writing a Menu
 Breakfast Table Lay-out.
 TDH & A la Carte Cover lay-out.
 Receiving the guests
 Sequence of Service
 Taking an Order of Food & Making a KO T.
 Table Service, Practice of meet greets and repeats.
 Clearing, Crumbing, Presenting the bill

Service of Cold & Hot - Non-Alcoholic Beverages, Cigar and cigarettes

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9
CO 1	L	H	M						
CO 2				L	M		M	M	M
CO 3						M			
CO 4						M			
CO 5									H

HADB200T: IN- ROOM DINNING & BEVERAGES

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s)

The objective of the course is to learn the concept of wine and beers and other fermented beverages and the service procedures for room service department.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain the operation of the room service department. (Understand)

CO 2: Understand the concepts of wine making process, viticulture wine-based beverages. (Understand)

CO 3: Identify & describe the beer production procedure and classify beer. (Knowledge)

CO 4: Analyze and classify other fermented beverages (Analyze)

CO 5: Develop suggestive selling techniques & demonstrate order taking procedure (Create)

Module I: IN-ROOM DINING SERVICE (5 hours)

a. Introduction, general principles, and types care to be taken while dealing with active and passive guest

b. The cycle of Service, scheduling, and staffing, Forms and Formats, Order Taking, Suggestive Selling, breakfast cards, Time management- the lead time from order taking to clearance

Module II: ALCOHOLIC & NON-ALCOHOLIC BEVERAGES**(10 Hours)**

Definition & Classification of Alcoholic Beverages

Introduction to fermented beverages

Classification (Nourishing, Stimulating and Refreshing beverages)

Tea - Origin & Manufacture - Types & Brands

Coffee - Origin & Manufacture - Types & Brands

Juices and Soft Drinks

Cocoa & Malted Beverages - Origin & Manufacture

Module III: BEERS (05 hours)

Introductions to beer

A brief introduction to Beer Production

Types and Brands – Indian and International

Module IV: WINE (05 Hours)

Introduction, Grapes (Varieties) viticulture vinification, Classification, Wine making, Storage, Brand Names.

Module V: AROMATIZED BEVERAGES & SAKE (08 Hours)

Definition, Types- Wine based & spirit-based

Usage and storage

Introduction, definition, manufacturing, Storage & Brands of SAKE

Suggested Readings

Singaravelavan R. Food & Beverage Services, Oxford Publications, 2011.

Jana A & Srivastava P. United Colors of Alcohol, TRIDENT, 2015.

Albert W.A. Schmid & Lalogan John P. The Beverage Manager's Guide to Wines, Beers, and Spirits, Pearson. 2011.

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2				H	M
CO 3		M	H		
CO 4		M		M	M
CO 5	H				

COURSE CODE: IN – ROOM DINNING & BEVERAGES PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn the concept of arranging buffet setups & demonstration of preparing and serving beverages and cold, carved meats & salads.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain the application and able to prepare Flambé Dishes (Understand)

CO 2: Identify and apply the concepts of Banquet Service and Bar Setup operations (Knowledge)

CO 3: Analyze & demonstrate beverage services (Analyze)

CO 4: Create & execute buffet setups (Create)

Practical

Service of Spirits

Service of Wine

Service in Guest Room

Preparing Function prospectus

Different types of buffet setup

Preparations of Flambé dishes, Carving, Salad

Preparation/Demonstration of Classic and modern Cocktail

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
CO 1						H	
CO 2				M	M		
CO 3	M	M					H
CO 4				M	H		

HAIG202T: INDIAN GASTRONOMY

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the history & cooking techniques of Indian foods and its regional variations.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain the history & Heritage of Indian Regional Gastronomy (Understand)

CO 2: Discuss the various Regional & specialty cooking in Indian Cuisines (Understand)

CO 3: Identify & explain the knowledge on Dum cooking and Tandoor Cooking (Knowledge)

CO 4: Analyze the History and cooking of Indian Sweets (Analyze)

CO 5: Develop & explain the kitchen layout and functioning of Indian kitchen organization (Create)

Module I: Basics of Indian Cuisine (6 hours)

Introduction to Indian cuisine
Masalas: classical blends, varieties and composition
Indian herbs and spices
Introduction to basic gravies of India
Factors affecting the varieties in Indian regional cuisine

Module II: Indian kitchen layout & Organization (04 hours)

Duties and responsibilities of Indian kitchen brigade
Different Indian kitchen layouts
Equipments used in Indian volume catering establishments

Module III: Regional cuisine in India (10 hours)

Northern India: Kashmir, Punjab, Rajasthan
Eastern India : Bengal, Assam, Tripura, Mizoram, Nagaland, Manipur, Arunachal Pradesh, Meghalaya
Western India: Gujarat, Maharashtra
Southern India: Tamil Nadu, Kerala, Andhra Pradesh, Telangana
Central India: Madhya Pradesh, Uttar Pradesh, Bihar

Module IV: Gastronomic specialties and cooking in India (04 hours)

Indian street foods – Introduction, types
Festival cooking – Introduction, types, importance
Dum Cooking – Introduction, Origin, equipments used & classical dishes
Tandoor - Introduction, Origin, equipments used & classical dishes

Module V: Indian Mithai (06 hours)

Introduction
Regional variation in Indian Mithai – Ingredients, technique, types
Classical dishes – Names & description.

Suggested Readings:

Food Production Operations: Parvinder S Bali , Oxford Publication
Prashad Cooking With Indian Masters, J. Inder Singh Kalra .
A Taste Of India, Madur Jaffery, Great Britain Pavilion Books Ltd.
Zaike Ka Safar, Jiggs Kalra Daawat, Jiggs Kalra, New Delhi, Allied Publishers
The Professional Chef, Arvind Saraswat, New Delhi, Ubs Publishers

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV	Module V
CO 1	M		L		L
CO 2	M		M	L	
CO 3				M	
CO 4					H
CO 5		H			

HAIG203L: INDIAN GASTRONOMY PRACTICAL

(2 Credits – 60 hours)(L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn the various commodities & spices used in Indian food preparations and cooking skills of various forms of Indian foods.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Develop knowledge of Indian spices, pulses, sweetening agents and compose different preparations using Indian gravies (Understand)

CO 2: Identify & demonstrate the traditional home style cooking and breakfast cooking (Knowledge)

CO 3: Identify & Demonstrate fusion of traditional Indian food & street food with modern techniques (Knowledge)

CO 4: Analyze plan and organize a theme menu as in Industrial cooking (Analyze)

CO 5: Create various sweet preparations of India (Create)

Practical:

Gravies and their preparations

Popular breakfast preparations across India

Prepare Indian sweets and savories

Prepare varieties of Indian pickles & chutney

Street food in India

Introduction to large scale / quantity food production

Menu1 – Assamese cuisine

Menu 2- Punjabi cuisine

Menu 3 – Awadhi cuisine

Menu 4 – Bengali cuisine

Menu 5- Rajasthan cuisine

Menu 6- Kerala cuisine

Menu7- Maharashtra cuisine

Menu 8- Hyderabad cuisine

Menu 9- Goa cuisine

Menu 10 – Tamil Nadu cuisine

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15	Exp 16
CO 1	M						M	M	M	M	M	M	M	M	M	M
CO 2		M	M													
CO 3				M	M											
CO 4						M	M	M	M	M	M	M	M	M	M	M
CO 5			M													

SUGGESTED MENU:

<u>Menu 1 (Breakfast)</u> Kanda Poha Bedmi Puri & Alu Subji Aloo Paratha	<u>Menu 2 (Breakfast)</u> Luchi & Alu Dum Besan ka Chilla Chole Bhature	<u>Menu 3 (Breakfast)</u> Masala Uttapam Vada & Sambhar Seviyan Upma	<u>Menu 4 (Street Food)</u> Paneer Pakora Aloo tikki Chaat Pao Bhaji
<u>Menu 5 (Street Food)</u> Vada Pao Bhel Puri Dabeli	<u>Menu 6 (Street Food)</u> Punugulu Dhokla Jhal Muri	<u>Menu 7 (Basic Gravy)</u> Kadhai Aloo SubzHariyali Murgh Makhani Jeera Rice	<u>Menu 8 (Assamese cuisine)</u> Xaakaru Bhaji Aloo Pitika MasorTenga OouKhatta
<u>Menu 9 (Punjabi cuisine)</u> Lassi Channa Masala Sarson ka Saag Makki Di Roti Gajar Ka Halwa	<u>Menu 10 (Awadhi Cuisine)</u> Galouti Kebab Navratna Korma Awadhi Murgh Biryani Naan Badam Halwa	<u>Menu 11 (Bengali cuisine)</u> Piyazi Kossa mangsho Basanti Pulao AamsottoKhejur Chutney Payesh	<u>Menu 12 (Rajasthan cuisine)</u> Mirchi Bada Dal Bati Churma Gatte ki Subji Bajra Roti Chenna Malpua

<u>Menu 13 (Kerala cuisine)</u> Ethaka Appam Erissery Nadan KozhiVaruthathu Malabar Parota Palada Payassam	<u>Menu 14 (Maharashtra cuisine)</u> Koshimbir BhareliVangi Kholapuri Mutton Curry Masala Bhaat Shrikhand	<u>Menu 15 (Hyderabad cuisine)</u> Hyderabad Chicken Biryani Mirchi ka Salan Burani Raita Double ka Meetha	<u>Menu 16 (Goa Cuisine)</u> Ros Omlete Goan fish Curry Pork Vindaloo Bibinca
<u>Menu 17 (Tamil Nadu cuisine)</u> Rasam Beans Proiyal Chicken Chettinadu Lemon rice ParuppuPayassam	<u>Menu 18 (Pickles)</u> Aam ka Achar Nimbu ka Mitha Achar Bharwan Mirchi Achar Imli ka achar	<u>Menu 19 (Mithai)</u> Shahi Tukra Kaju Barfi Balushahi Gulab Jamun	<u>Menu 20 (Tandoor)</u> Tandoori chicken Achari Paneer tikka Bharwan Aloo Tikka Lasuni Naan

HABO204T: BAR OPERATIONS & OUTLET MANAGEMENT

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the layout, work scenario, and various cocktails prepared in Bar's of food outlets and the concept of function catering.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand and describe the layout of functional areas (Understand)

CO 2: Identify the concepts of function catering in the hotel industry. (Knowledge)

CO 3: Understand the gueridon service origin, specialty and their preparation. (Understand)

CO 4: Analyze& Illustrate bar operations (Analyze)

CO 5: Develop and demonstrate different Cocktail preparations (Create)

Module I: PLANNING & OPERATING VARIOUS F&B OUTLET (10 hours)

The physical layout of functional and ancillary areas, Objective of a good layout

Steps in planning, Factors to be considered while planning

Calculating space requirement

Various set ups for seating

Planning staff requirement

Menu planning, Constraints of menu planning

Selecting and planning of heavy-duty and light equipment

Requirement of quantities of equipment required like crockery, Glassware, Cutlery - steel or silver, etc.

Planning Décor, furnishing fixtures, etc.

Module II: FUNCTION CATERING (06 Hours)

Banquets

Banquet protocol

Informal banquet

Buffets

Module III: GUERIDON SERVICE (08 hours)

History of gueridon

Definition

General consideration of operations

Advantages & Dis-advantages

Types of trolleys

Factor to create impulse, Buying – Trolley, open kitchen

Gueridon equipment

Common preparations, flambé dishes, Carving, Salad making, etc., Trolley service - Beverages, Starters, Desserts, etc.

Module IV: BAR OPERATIONS (06 Hours)

Types of Bars

Cocktail

Dispense

Area of Bar

Front Bar

Back Bar

Under Bar (Speed Rack, Garnish Container, Ice well, etc.)

Bar Stock

Bar Control

Bar Staffing

Opening and closing duties

Module V: COCKTAILS & MIXED DRINKS (07 hours)

Definition and History

Classification

Recipe, Preparation, and Service of Popular Cocktail

Suggested Readings

Singaravelavan R. Food & Beverage Services, Oxford Publications, 2011

Jana A & Srivastava P. United Colors of Alcohol, TRIDENT, 2015

Sudhir A. Food & Beverage Service: A Training Manual, McGraw Hill Education, Second Edition.

Lillicrap Dennis R., Food & Beverage Service, Hodder Arnold Publication, 2006.

Albert W.A. Schmid & Laloganes John P. The Beverage Manager's Guide to

Wines, Beers and Spirits, Pearson. 2011

Prasad, Vara, Krishna R. Gopi, Food & Beverage: F&B Simplified, Pearson, 2013.

Mapping of Cos to Syllabus

CO'S	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M	H			
CO 3			H		
CO 4				H	M
CO 5				M	H

HABO205L: BAR OPERATIONS & OUTLET MANAGEMENT PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn the briefing standards of hospitality sector and demonstrate the skills of serving alcoholic beverages including cocktails.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explore the set up tray and trolley lay up for room service (Understand)

CO 2: Analyze& demonstrate the knowledge for taking orders (Knowledge)

CO 3: Analyze& demonstrate service standards for serving Beer, Wines and cold & hot non-alcoholic beverages. (Analyze)

CO 4: Create & Explain the importance of conducting briefing and de-briefing. (Create)

Practical

Understanding Room Service Amenities, Room Service equipments

Room Service Tray & Trolley Lay-out

Functional Layouts for room service

Role play: Knocking & opening the guest door, wishing the guest, placing tray, checking order, presenting the bill, greeting at the exit.

Order taking on the telephone 7. Set-up for In Rooms.

Conducting Briefing/De-Briefing.

Taking an Order & Service of Beer, Other Fermented & Brewed Beverages.

Taking an order & Service of –Sparkling, Aromatized, Fortified, Still Wines. Order of service (starting with wine approval

From the host, wrapping the bottle with the napkin, etc.)

Opening different types of wine bottles. (Different types of corkscrews) 13. Use of different glasses, holding & carrying glasses

14. Set up a table with a Prepared Menu with wines.

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M	H									M	M
CO 2			M		H	M						
CO 3				M				M	L	M		
CO 4							M					L

HAQF206T: QUANTITY FOOD PRODUCTION

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the concept of bulk cookery and various types of menus associated with bulk cookery **COURSE / LEARNING OUTCOMES:**

At the end of this course student will be able to:

CO 1: Explain the requirement of equipments for volume feeding. (Understand)

CO 2: Discuss the concepts of bulk cooking and banqueting menus. (Understand)

CO 3: Identify & conceptualize all aspects regarding the institutional and industrial catering (Identify)

CO 4: Analyze, evaluate, analyze and interpret theoretical and practical skills of usage of different commodities in the kitchen (Analyze)

CO 5: Develop & explain the quantity purchase system. (Create)

Module I: QUANTITY FOOD PRODUCTION EQUIPMENTS (08 hours)

Equipment required for mass/volume feeding

Heating and cooling equipment

Care and maintenance of equipment

Modern developments in equipment manufacture

Module II: MENU PLANNING (10 Hours)

Basic principles of menu planning-recapitulation

Points to consider in menu planning for various volume feeding outlets such as Industrial, Institutional, Mobile Catering Units

Planning menus for School/ College students, Industrial workers, Hospitals, Outdoor parties, Theme dinners, Transport facilities, cruise lines, airlines, railway Nutritional factors

Module III: INDENTING (08 hours)

Principles of Indenting for volume feeding

Portion sizes of various items for different types of volume feeding

Modifying recipes for indenting for large scale catering

Module IV: PLANNING (08 Hours)

Principles of planning for quantity food production concerning Space allocation, Equipment selection, and Staffing

Module V: VOLUME FEEDING (10 Hours)

Institutional and industrial Catering

Hospital Catering,

Highlights of Hospital Catering for patients, staff, visitors Diet menus, and nutritional requirements

Off-Premises Catering, Problems associated with off-premises catering

Reasons for growth and development Menu Planning and Theme Parties

Concept of a Central Production Unit

Mobile Catering

Characteristics of Rail, Airline (Flight Kitchens and Sea Catering)

Quantity Purchase & Storage Introduction to the purchasing system

Suggested Readings

P. S. Bali, Quantity Food Production Operations and Indian Cuisine, Oxford University Press, New Delhi, 2012

Kinton & Cessarani, Theory of Catering, ELBS, 2012

P. S. Bali, International Cuisine and Food Production Management, Oxford University Press, New Delhi, 2012

Librairie Larousse Gastronomique: The World's Greatest Culinary Encyclopedia, Clarkson Potter, 2009

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M	M			M
CO 3					M
CO 4			M	L	
CO 5					M

HAQF207L: QUANTITY FOOD PRODUCTION PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate various forms of bulk cooking and planning of menu's where bulk cooking is essential.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain & demonstrate the preparation of different menus. (Understand)

CO 2: Identify the quantity required for volume cooking (Knowledge)

CO 3: Analyze the Ability to describe and handle the food outlet (Analyze)

CO 4: Develop & apply the practical knowledge for planning an elaborate Menu's (Create)

Practical

To formulate/demonstrate 15 sets of menus as volume cooking with demo situations handling procedure.

SUGGESTED MENU:

<u>Exp 1 (continental)</u> Cream of Mushroom Baked potatoes nuggets Meat ball casserole Herb Pilaf	<u>Exp 2 (continental)</u> Sprout & cherry tomato salad Golden crevettes frites Steamed greens in mustard sauce Soft cheese buns	<u>Exp 3 (continental)</u> Roasted Mushroom & corn salad Pan fried fish cakes Veg stroganoff Herb Rice	<u>Exp 4 (continental)</u> Pumpkin & Garlic soup Zucchini fritters Steamed chicken in garlic sauce Spaghetti Aglio – olio

<u>Exp 5 (continental)</u> Spicy Corn salad Buffalo chicken wings Penne Alfredo Date crepes with compote fruit	<u>Exp 6 (continental)</u> Macaroni Bell pepper salad Veg croquettes Chicken piccata with bread sauce Cream & Nut Pudding	<u>Exp 7 (continental)</u> Chicken pasta salad Cheese balls Spaghetti Arrabiatta Lemon cheesecake	<u>Exp 8 (continental)</u> Apple and Pear salad Crispy chicken popcorn Eggplant Parmigiana Fruit Parfait
<u>Exp 9 (Indian)</u> Kachumber salad Methi Corn Bhajia Chicken tikka Masala Butter Naan	<u>Exp 10 (Indian)</u> Aloo Bonda Kadhai Paneer Jeera Rice Malpua	<u>Exp 11 (Indian)</u> Mutter cheese Tikki Gobhi Adraki Dal Hariyali Dhania Pulao	<u>Exp 12 (Indian)</u> Masala Channa Chaat Dalcha Gosht Achari Aloo Kulcha Kalakand Halwa
<u>Exp 13 (Healthy diet)</u> Mint Jaggery Sherbet Oats Tikki Aloe Vera Subji Beetroot Paratha	<u>Exp 14 (Healthy diet)</u> Cucumber & coconut Gazpacho Steamed chicken Spinach & kidney beans crepes Oats Ladoo	<u>Exp 15 (Chinese)</u> Kimchi Salad Gobhi Manchurian Sichuan Fish Veg fried rice	<u>Exp 16 (Chinese)</u> Chili cucumber salad Spring rolls Hot garlic chicken Lemon coriander fried rice

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15
CO 1	M	M					M			M		M			
CO 2			H					H	M		M				
CO 3				M									M		
CO 4					H	M								M	M

HAFO208T: FRONT OFFICE MANAGEMENT

(2 Credit – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the property management system and front desk operations along with the responsibilities of night auditor.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain and describe the entire property management system and the importance of computer in front office. (Understand)

CO 2: Identify and apply the entire check-in and check-out procedure of guest. (Knowledge)

CO 3: Analyze the process of settling bills of the guests, accounting procedures, handling front office cash and foreign exchange. (Analyze)

CO 4: Develop and analyze the idea about the night auditing and the job responsibilities of the night auditor. (Create)

Module I: PROPERTY MANAGEMENT SYSTEM (08 hours)

Importance of Computer in Front Office

Introduction to PMS

PMS application in Front Office (Reservation, Front Desk, Room, Cashier, Night Audit, set up, Reporting, back-office

Module)

Different PMS systems

Module II: CHECK-IN AND CHECK-OUT PROCEDURE (12 Hours)

Check-in Procedure in different situations like: - guest having confirmed reservation, Walk-in Guest, Group/crew, Scanty Baggage Guest, International Travelers, Club floor guest

Check out activity at various desks: - Bell Desk, lobby, Reception, Cashier

Different Methods of Settlement: -Cash, Credit Card, Cheques, Travel's cheques, Bill to company, Combined settlement method, checking of mini bar and taking of guest feedback.

Check out options: - On Desk Express Check out, Self-Check out Forms & Formats

Module III: MANAGING CASH & CREDIT (08Hours)

Front office Accounting Cycle

Credit control process in various cases: - guest pay by Credit Card, Travel agent voucher, airline, Scanty baggage, Credit control during the stay, credit facility to companies, check-in tour group. Problems may arise in credit control

The process required in cash Control

Handling Foreign Exchange

Module IV: NIGHT AUDITING (08 Hours)

Importance of Night Auditing,

Duties & Responsibility of Night Auditor

Common Revenue Centers of a Hotel

Basis steps involved in preparing Night Audit: - Complete posting, reconcile room status discrepancies, verify room rates, verify no show reservations, Cash Deposit, Clear & Back up the system, Distribute report

Vouchers/Folios/Ledgers/Allowances/Reports

Suggested Readings

S.K Bhatnagar, Front Office Management, Frank Bros. & Co. 2011

James Bardi, Hotel Front office management, John Wiley & Sons, 2011.

Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011

Raymond S Schmidgall, Hospitality Industry Managerial accounting, AHLA, 2006

Michael Kasavana and Cahell, Managing computers in hospitality industry, AHLA, 1996

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2		H	M	
CO 3			H	M
CO 4				H

HAFO209L: FRONT OFFICE MANAGEMENT PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate various forms and formats required to maintain in front desk.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain & take part in the check-in and check-out process and the application of PMS in the process. (Understand)

CO 2: Identify the role of GRA, Bell boy, Cashier, Concierge (Knowledge)

CO 3: Analyze to handle and compile different forms and formats of the department (Analyze)

PRACTICAL

Preparing & filling up Registration cards during Check-in,
 Handling Check in – walk-in, confirmed reservation, group
 Handling Check out – BTC, combined settlement method, cheque, card, cash
 Role play of bell desk
 Front office cashiering practices and night audit practice
 Role play of concierge
 Filling various vouchers, folios, handling allowances,
 Foreign Currency exchange

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8
CO 1	H	H	H					
CO 2		L	L	H	H	H		H
CO 3	M	M	M	M	M	M	H	

HARP300T: RESTAURENT PLANNING & MANAGEMENT

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn & demonstrate various forms and formats required to maintain in front desk .

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss in-depth understanding of planning and operating a restaurant. (Understand)

CO 2: Identify the different concepts of catering operations. (Knowledge)

CO 3: Understand menu management and material management. (Understand)

CO 4: Analyze& illustrate inventory control. (Analyze)

CO 5: Develop the budget of the department. (Create)

Module I: RESTAURANT PLANNING (10 hours)

The physical layout of functional & ancillary areas

Objectives of a good layout,

Steps in planning

Factors to be considered while planning, calculating space requirements

Various set-ups for sitting,

Planning staff requirements,

Menu planning

Selection of equipment, lighting, fixtures, crockery, cutlery, etc.

Module II: MENU MANAGEMENT (08 Hours)

Introduction, Types of Menus, Menu Planning Considerations & Constraints

Menu Costing and Pricing

Menu Merchandising, Menu Engineering

Menu Fatigue, Menu as an In-House Marketing Tool.

Module III: MATERIALS MANAGEMENT (04 Hours)

Introduction, Necessity & Function and Techniques

Classification and Technology used in materials management.

Module IV: INVENTORY & BUDGETARY CONTROL (14 hours)

Importance, objectives, methods, levels & technique

Perpetual inventory, monthly inventory, pricing of commodity, comparison of physical and perpetual inventory
 Introduction, Objective
 Budgetary Control Process, Stages in the preparation of Budgets
 Budgeting for F&B Operations,
 Variance Analysis.

Suggested Readings

- J Fuller & D Kirk, Kitchen Planning and Management, Butterworth- Heinemann, 1991
 Davis B, Lockwood A, Stone S, Butterworth-Heinemann. Food & Beverage Management, Elsevier, 2012.
 3. Cousins J, Foskett, D, Gillespie C. Food and Beverage Management, Pearson Education India, 2006
 4. Varghese B. Food & Beverage Service Management, Macmillan India Limited, 2009.

Mapping of Cos to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H	M		M
CO 2	M	M	H	
CO 3		H		
CO 4				H
CO 5				H

HARP301L: RESTAURENT PLANNING & MANAGEMENT PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn how to prepare duty roasters, layouts of different types of food outlets and Managerial skills to manage them.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

- CO 1: Understand the layout plan for different food outlets. (Understand)
 CO 2: Identify & analyze staff requirements and make a duty roaster for implementation. (Knowledge)
 CO 3: Analyze & explain and demonstrate operations of the restaurant, bar, and special events (Analyze) CO 4: Develop the skills to familiarize with different cocktails and preparation methods. (Create)

Practical

F&B Staff Organization-Class Room Exercise (Case Study method)
 Developing Organization Structure of various Food & Beverage Outlets
 Determination of Staff requirements in all categories
 Making Duty Roster
 Preparing Job Description & Specification
 Conducting Briefing & Debriefing
 Restaurant, Bar, Banquets & Special Events
 Drafting Standard Operating Systems (SOPs) for various F & B Outlets
 Supervising Food & Beverage operations
 Preparing Restaurant Log
 Designing & setting the bar
 Preparation & Service of Cocktail & Mixed Drinks

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1		H						M				
CO 2	M		M	H	M							
CO 3							M		M	M		
CO 4						M					L	M

HAGC302T: GARDE MANGER & CONFECTIONARY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn different layout and procedures require maintaining the standards in garde Manger and confectionary sections of commercial kitchens.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the layout and use of equipment in the larder section of the kitchen. (Understand)

CO 2: Understand the preparation of charcuterie. (Understand)

CO 3: Identify, compare and translate between appetizer and garnishes (Knowledge)

CO 4: Analyze the basic icing and topping terms with special reference to patisserie (Analyze)

CO 5: Develop & illustrate different sandwiches with making and storing methods (Create)

Module I: LARDER & CHARCUTERIE (06 hours)

Layout & equipment

Terms & larder control

Duties and responsibilities of the larder chef

Sausages & forcemeats

Brines, cures & marinades

Ham, bacon & gammon

Galantines & pate

Module II: APPETIZERS & GARNISHES (08 hours)

Classification of Appetizers

Examples of Appetizers

The historic importance of culinary Garnishes

Explanation of different Garnishes

Module III: SANDWICHES (08 Hours)

Parts of Sandwiches

Types of Bread

Types of filling – classification

Spreads and Garnishes

Types of Sandwiches

Making of Sandwiches

Storing of Sandwiches

Module IV: CAKE (06 Hours)

Introduction, types of bases, flavours, garnishes, tools and equipment & commodities

Module V: ICINGS & TOPPINGS (04 hours)

Varieties of icing, Using of Icings Difference between icings & Toppings

Suggested Readings

Le Rol A. Polsom, The Professional Chef (4th Edition), Wiley & Sons, 2011

M J Leto & W K h Bode, Larder Chef, Butterworth- Heinemann, 2006

Kinton & Cessarani, Theory of Catering, ELBS, 2012

Y. Ashok Kumar, Textbook of bakery and confectionary, PHI, 2012

W. Gisslen, Professional Baking, John Wiley & Sons, 2009

L J Hanneman, Patisserie, Routledge, 2005

Mapping of Cos to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M		M		
CO 3		H			
CO4				H	H
CO5			H		

HAGC303L: GARDE MANGER & CONFECTIONARY PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate various preparations of garde manger and confectionaries.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Demonstrate various types of sandwiches, sausages, forcemeats (Understand)

CO 2: Identify & relate different desserts (Knowledge)

CO 3: Analyze, explain and demonstrate the different bakery & confectionary-making procedures with the temperature required. (Analyze)

CO 4: Create various types of appetizers of various cuisines. (Create)

Practical

Various preparations of sandwiches

Various preparations of sausages

Various preparations of forcemeats

Various preparations of desserts from world cuisine.

Different varieties of Bread

Different varieties of Chocolate,

Different varieties of Meringues,

Different varieties of Frozen Dessert.

Various preparations of Appetizers – Indian cuisine

Various preparations of Appetizers – French cuisine

Various preparations of Appetizers – Italian cuisine 12. Various preparations of Appetizers – Chinese cuisine

SUGGESTED MENU:

<u>Exp 1 (sandwiches)</u> BLT Chicken Club Cheese Potato Grilled Pinwheel sandwich Ribbon sandwich	<u>Exp 2(Sausages)</u> Breakfast sausages Cajun Sausages Hot Italian sausages	<u>Exp 3 (Forcemeats)</u> Chicken & bellpapper rou-lade Chicken & Spinach terrine Prawn & garlic Pate'	<u>Exp 4 (Desserts)</u> Tiramisu Crepe Allemande Chocolate Mousse Lamingtons
<u>Exp 5 (Breads)</u> Focaccia Lavash Soda Bread Pita	<u>Exp 6(Chocolates)</u> Chocolate Sandesh Chocolate Marzipan Choco cashew Pudding	<u>Exp 7 (Meringues)</u> Pavlova Meringue cookies Macaroons	<u>Exp 8 (Frozen desserts)</u> Strawberry Sorbet Orange Sherbet Mango yoghurt

Exp 9 (Appetizers – Indian) Paneer Potli Mirchi Vada Chicken 65 Dahi Vada	Exp 10 (Appetizers - French) Salade Lyonnais Souffle Au Fromage Tapenade canape' Paillassons de courgettes	Exp 11 (Appetizers - Italian) Caprese salad Grilled veg Bruchetta Stuffed Dates Whipped ricotta	Exp 12 (Appetizers - Chinese) Egg Drop Soup Cong You Bing Baozi Cantonese spring rolls

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M	M	M									
CO 2				M								
CO 3					M	M	M	M				
CO 4									M	M	M	M

HARB304T: REVENUE MANAGEMENT & BUDGETING

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the yield management and the concept of room revenue used in the front desk sectors of hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the Yield Management, its concept, rates, and different booking horizons and Statistical representations. (Understand)

CO 2: Identify the budgeting and forecasting and to analyze room revenue. (Knowledge)

CO 3: Create & describe and implement role plays of guest complaint handling. (Create)

Module I: YIELD/REVENUE MANAGEMENT (09 hours)

Yield in hotel industry

Methods of measuring hotel performance/yield

Elements and benefits of yield management

Challenges in Yield management

Yield management strategies

Measuring Yield

Module II: FORECASTING (07 Hours)

Concept of forecasting

Benefits of forecasting

Data/ records required for forecasting room availability

Module III: BUDGETING (07 hours)

Types of budget & budget cycle

Making front-office budget

Factors affecting budget planning

Capital & operations budget for front office

Refining budgets, budgetary control

Forecasting room revenue

Module IV: GUEST COMPLAINT HANDLING / PROBLEM SOLVING (07 hours)

Types of complain

Process, thumb rules

Common complaints / problems

Situation handling

Suggested Readings

Colin Dix & Chirs Baird, Front office operations, Pearson, 2006.
 James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
 Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011
 Raymond S Schmidgall, Hospitality Industry Managerial accounting, AHLA, 2006
 Michael Kasavana and Cahell, Managing computers in hospitality industry, AHLA, 1996

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	L	H	H	
CO 3				H

HARB305L: REVENUE MANAGEMENT & BUDGETING PRACTICAL

(2 credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate different SOP's and files and formats regarding memberships, budgets & guest complains required in front desk of hospitality sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Explain the techniques of room up selling, enrolment in loyalty membership programs and maintain guest history (Understand)

CO 2: Identify & handle guest complain and different situations in front office. (Knowledge)

CO 3: Analyze & Construct operating budget, calculate staff requirements and allocate duties accordingly. (Analyze)

CO 4: Develop & implement all the SOP's of front office and list about different countries and their capitals, currency, flags chart etc. (Create)

PRACTICAL

Up selling of Rooms

Enrolment in loyalty membership programs

Role play on handling guest complain

Handling of inebriated guest, guest with special care, guest involved in inappropriate activity

Role of telephone operator in different situation

Maintaining guest history

Capitals, currencies, airlines and flags chart

Preparing operating budget for front office operation

Calculating staff requirement

Preparing duty rota's

Evaluation of SOP's

Mapping of COs to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11
CO 1	H	H									
CO 2			H	H	H	H					
CO 3								H	H	H	
CO 4	L	M	L	L	M		H				H

HHFB321P: TRAINING & DEVELOPMENT: FOOD & BEVERAGE SERVICE

(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective:

To provide industry exposure and hands-on training in various food and beverage service areas, enhancing students' operational skills, communication, and guest handling techniques.

COURSE / LEARNING OUTCOMES:

At the end of this course, the student will be able to:

- CO 1:** Understand the purpose and significance of industrial training in food & beverage service (Understand)
- CO 2:** Observe and analyze real-time service operations in areas like banquets, room dining, and bar (Analyze)
- CO 3:** Apply learned service skills and procedures during training in live F&B setups (Apply)
- CO 4:** Evaluate post-training improvements in communication, teamwork, and service skills (Evaluate)
- CO 5:** Design a training-based career path and development plan in the F&B sector (Create)

Module	Title	Hours	Focus
I	Restaurant Operations	50 hrs	Mise-en-place, sequence of service, styles of service, SOPs
II	Bar & Beverage Service	30 hrs	Mocktails, wine service, responsible alcohol service
III	Banquets & Events	30 hrs	Banquet setups, buffet layouts, service styles, BEO understanding
IV	Room Dining (IRD)	20 hrs	Order taking, tray setup, in-room guest interaction
V	Professional Conduct & Report Writing	30 hrs	Grooming, logbook, reflective journal, viva, report submission

Mapping of CO's with syllabus

CO's	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M	H	H	M	H
CO 3			H	M	M
CO 4				H	H
CO 5					H

HHGA322P: TRAINING & DEVELOPMENT: GASTRONOMY

(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective:

To immerse students in commercial kitchen operations to learn cooking, hygiene, teamwork, and gastronomy-based technical skills under real working conditions.

COURSE / LEARNING OUTCOMES:

At the end of this course, the student will be able to:

- CO 1:** Understand the objectives of kitchen training and the working structure of commercial kitchens (Understand)
- CO 2:** Demonstrate basic to intermediate culinary skills including hygiene, cutting, and cooking techniques (Apply)
- CO 3:** Analyze challenges and opportunities encountered during kitchen training (Analyze)
- CO 4:** Evaluate skill enhancement in terms of confidence, communication, and teamwork post-training (Evaluate)
- CO 5:** Plan and create dishes and food items using traditional and contemporary techniques (Create)

Module	Title	Hours	Focus
I	Hot Kitchen Training	60 hrs	Pre-prep, Indian gravies, mother sauces, regional cuisines
II	Bakery & Confectionery	30 hrs	Breads, cakes, pastries, modern plating
III	Hygiene, Sanitation & Reshuffle	30 hrs	Food safety, HACCP, leftover management
IV	Kitchen Management & Inventory	20 hrs	Portioning, indenting, wastage control
V	Culinary Reflections & Documentation	20 hrs	Daily logbook, report writing, recipe documentation, presentation

Mapping of CO's with syllabus

CO's	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2		H	M	H	M
CO 3			H	M	M
CO 4				H	H
CO 5					H

HHFO323P: TRAINING & DEVELOPMENT: FRONT OFFICE OPERATIONS

(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective:

To provide industry-based exposure in hotel front office operations and enable students to gain professional competence in guest relations, reservations, check-in/check-out procedures, communication, and front-office technology.

COURSE / LEARNING OUTCOMES:

At the end of this course, the student will be able to:

CO 1: Understand the structure, functions, and importance of front office operations (Understand)

CO 2: Perform basic guest handling tasks such as check-in, check-out, reservations, and billing (Apply)

CO 3: Analyze operational challenges in front office environments and propose solutions (Analyze)

CO 4: Evaluate improvements in communication, confidence, and professional behaviour post-training (Evaluate)

CO 5: Design a career plan and development strategy for front office roles (Create)

Module	Title	Hours	Focus
I	Guest Relations & Front Office Basics	50 hrs	Grooming, communication, telephone etiquette, guest engagement
II	Reservations & Guest Services	30 hrs	Reservation systems, OTA handling, check-in/check-out, up-selling
III	Front Office Technology	30 hrs	PMS usage (OPERA/IDS), cashiering, night audit basics
IV	Concierge & Lobby Operations	20 hrs	Bell desk, concierge services, luggage handling, lost & found
V	Reports, Documentation & Professional Conduct	30 hrs	Logbooks, shift reports, performance journals, viva, training report

Mapping of CO's with syllabus

COs	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M	H	M	H	
CO 3			H	M	M
CO 4				H	H
CO 5					H

HHHK324P: TRAINING & DEVELOPMENT: HOUSEKEEPING OPERATIONS

(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective:

To equip students with hands-on experience in housekeeping operations, cleaning science, linen systems, room readiness, public-area procedures, and service quality standards in live hospitality environments

COURSE / LEARNING OUTCOMES:

At the end of this course, the student will be able to:

CO 1: Understand the organizational structure and functions of housekeeping departments (Understand)

CO 2: Demonstrate skills in cleaning, bed-making, room servicing, laundry operations, and maintenance reporting (Apply)

CO 3: Analyze operational issues in guestroom and public-area management (Analyze)

CO 4: Evaluate the development of teamwork, discipline, and quality control in housekeeping (Evaluate)

CO 5: Create innovative housekeeping solutions and sustainable practices (Create)

Module	Title	Hours	Focus
I	Guestroom Operations	60 hrs	Bed-making, room cleaning, bath-room setups, amenities
II	Linen, Laundry & Sewing Room	30 hrs	Linen cycle, laundry equipment, stain removal, inventory
III	Cleaning Science & Safety	30 hrs	Cleaning agents, equipment handling, PPE, waste segregation
IV	Public Area & Maintenance Co-ordination	20 hrs	Lobby cleaning, floor care, horticulture basics, maintenance reporting
V	Documentation & Reflective Learning	20 hrs	Checklists, room inspection reports, logbooks, training report

Mapping of CO's with syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	H	H	M	M	M
CO 3			H	M	M
CO 4				H	H
CO 5					H

HAGT400T: MODERN TRENDS IN GASTRONOMY – I

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the modern advancement in the gastronomy sector and the benefits of research & development.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss and describe various global cuisines and modern aspects on gastronomy. (Understand)

CO 2: Identify and learn the benefits of gastronomic tourism (Knowledge)

CO 3: Analyze the concept of production management and its importance (Analyze)

CO 4: Develop skills and illustrate the research & product development in gastronomy and other modern trends (Create)

Module I: Global cuisine (14 hours)

Introduction – Italian, French, Mexican, Moroccan, Lebanese, Chinese, Thai, Japanese, Mediterranean.

Ingredients used, cooking techniques and specialty

International recipe and there description

Importance of global cuisine & ingredients – Health & sustainability

Module II: Ancient Grains & Super foods (06 hours)

Introduction – Ancient grains

Types , description, cooking techniques – Ancient grains

Health benefits from ancient grains

Introduction – Super foods

Types , description, cooking techniques – Super foods

Health benefits from Super foods

Module III: Gastronomic Tourism (8 hours)

Introduction, history & features

Types & categories

Benefits of gastronomic tourism

Gastronomic tourism – Designing

New trends in Gastronomic tourism

Module IV: Production Management (5 hours)

Kitchen organization

Allocation of Work Job Description, Duty Roasters

Production Planning, Production Scheduling

Production Quality & Quantity Control

Forecasting Budgeting, Yield Management

Module V: Research & Product development (06 hours)

Testing new equipment - Commercial and small equipments used in kitchen

Developing new recipes – Impact of modern trends, Themes, location, clients etc.

Food Trails – based on costing, nutritional value, calorie count, portion sizes

Suggested Readings

Jeremy Macveigh, International cuisine, 2008

Parvinder Singh Bali, International cuisine and Food production management, 2012

Robert D Saik, Food 5.0: How we feed the future, 2019

Saurabh kumar Dixit, The routledge handbook of gastronomic tourism, 2021

Anne Murcott, Warren Belasco, Peter Jackson, The handbook of food research, 2013

6. Satya J. Rustogi, Global Food Production, 2019

Mapping of Cos to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2			H		
CO 3				H	
CO4			M	M	H

HAGT401L: MODERN TRENDS IN GASTRONOMY – I PRACTICAL

(2 Credits – 60 hours) (L-T-P:0-0-2)

Objective(s):

The objective of the course is to prepare & demonstrate the global cuisines and preparations which are on the basis of innovations and research.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Demonstrate menus from global cuisine (Understand)

CO 2: Identify & demonstrate recipes from ancient grains (Knowledge)

CO 3: Identify & demonstrate recipes from super foods (Analyze)

CO 4: Develop the skills through innovations and research in gastronomy and create recipes (Create)

Practical

Expt. 1: Various preparations from – Italian cuisine

Expt. 2: Various preparations from – French cuisine

Expt. 3: Various preparations from – Mexican cuisine

Expt. 4: Various preparations from – Moroccan cuisine

Expt. 5: Various preparations from – Lebanese cuisine

Expt. 6: Various preparations from – Chinese cuisine

Expt. 7: Various preparations from – Thai cuisine

Expt. 8: Various preparations from – Japanese cuisine

Expt. 9: Various preparations from – Mediterranean cuisine

Expt. 10: Various preparations from – Ancient

grains

Expt. 11: Various preparations from – Ancient

grains

Expt. 12: various preparations from – Super foods

Expt. 13: Various preparations from – Super foods

Expt. 14: Various preparations based on innovations and research

Expt. 15: Various preparations based on innovations and re-

search

Expt. 16: Various preparations based on innovations and research

SUGGESTED MENU:

Exp 1 (Italian cuisine) Caprese salad Minestrone Milanese Spaghetti Carbonara Mango & coconut Pannacotta	Exp 2(French cuisine) French onion soup Coq au vin Ratatouille Baguette	Exp 3 (Mexican cuisine) Avocado salad Grilled veg Quesadilla Chilli corn carne Mexican rice	Exp 4 (Moroccan cuisine) Harira Makouda Kefta tagine Mint tea
Exp 5 (Lebanese cuisine) Kibbeh Falafel Fattoush Basbousa	Exp 6 (Chinese cuisine) Cantonese chicken soup Mushroom Pepper & Salt Mapo Tofu Veg Hakka Noodles	Exp 7 (Thai cuisine) Som tom salad Tom Yam soup Chicken Massaman curry Pad thai	Exp 8 (Japanese cuisine) Veg Tempura Tamagoyaki Karaage

			Yakisoba
Exp 9 (Mediterranean cuisine) Greek Salad Shakshuka Moussaka Pita bread	Exp 10 (Ancient grains) Crispy millet fritters Wild rice & mushroom soup Mexican amaranth Stew Quinoa & date brownies	Exp 11 (Ancient grains) Millet walnut salad Quinoa veg soup Chicken & kamut casserole Wild rice pudding	Exp 12 (Super foods) Grilled peach & papaya salad, Couscous meatball soup, Steamed salmon with broccoli, Blueberry banana pancake
Exp 13 (Super foods) Roasted veggies & millet salad Tomato barley soup Grilled salmon with honey ginger sauce Yogurt Parfait	Exp 14 (Innovations & research) Menu & Recipes based on innovations and research done by students in gastronomy	Exp 15 (Innovations & research) Menu & Recipes based on innovations and research done by students in gastronomy	Exp 16 (Innovations & research) Menu & Recipes based on innovations and research done by students in gastronomy

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M	M	M									
CO 2				M								
CO 3					M	M	M	M				
CO 4									M	M	M	M

OR

HAFO402T: MODERN TRENDS IN FRONT OFFICE – I

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the green practices and modern technologies used for the better services in the modern era of front desk procedures and data's for record keeping

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the quality of service as per their expectation with the help of various modern tools. (Understand)

CO 2: Explain the various technologies which have added to the modern techniques of Front Office functions. (Knowledge)

CO 3: Illustrate and examine the new concepts of vacation and accommodation ownerships. (Analyze)

CO 4: Identify the various implementations of green practices in Front Office (Create)

Module I: QUALITY SERVICE IN FRONT OFFICE (12 hours)

Lodging as a guest service business, developing a quality culture

Role of Manager in quality, determining guest service expectation,

Planning guest service process – recognizing basic concerns

Determining and delivering guest service expectations

EGQ and NPS

Recording Feedback

Post Departure Guest Relation

Module II: DIGITALIZATION (06 Hours)

Specialized mobile apps
AI and Hotel Chat bots
Self-check-in Desk Technology

Module III: TIMESHARE & VACATION OWNERSHIP (10 Hours)

Definition and types of timeshare options
Difficulties faced in marketing timeshare business
Advantages & disadvantages of timeshare business
Exchange companies -Resort Condominium International, Intervals International
How to improve the timeshare / referral/condominium concept in India- Government's role/industry role

Module IV: MODERN ACCOMMODATION CONCEPTS (06 Hours)

Benefits of Modern accommodation concepts
Examples of new conceptual hotels -Smart Hotels, Bunker Hotels, Tree House, Zostel, Under water Hotels, Glass Hotels etc.

Module V: GREEN PRACTICES (06 Hours)

Implementation of 3 R's (Reduce, Reuse, Recycle)
Eco-Bells
Contactless Check-in
No paper policy

Suggested Readings

Adam harris, Richard Castle, Kristy Espat and more.,More Reservations, happier guest: The ultimate guide for the Modern hotelier,Cloudbeds, 2022
Kelly A. McGuire, Hotel Pricing in a Social World: Driving Value in the Digital Economy, Wiley,2015
James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011
Ashok Aima, Vinay Chauhan, Jaya Bhasin, Contemporary Trends in Tourism and Hospitality Management, Primus Books, 2013

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L			
CO 2		H			
CO 3			H	H	
CO 4					H

HAFO403L: MODERN TRENDS IN FRONT OFFICE – I (PRACTICAL)

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the modern procedures of working environment of a digitally equipped front desk area of an hospitality sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

- CO 1: Apply techniques of self-check-in & check-out procedures and express check-in & check-out procedure. (Understand)
CO 2: Demonstrate handling of various situations like bomb threats and suicide threats. (Knowledge)
CO 3: Analyze guest feedback and ensuring guest satisfaction with the use of technology.(Analyze)
CO 4:Evaluate post departure procedures and credit limit criteria. (Create)

PRACTICAL

Self-Check-in Procedure
 Express check-in procedure
 Self-Check-out Procedure
 Express check-out procedure
 Role play on handling bomb threat
 Role play on handling suicide threat
 Record online guest feedback and utilization of it in future
 Ensuring Guest Satisfaction with the help of technology
 Post departure procedure
 Monitoring guest credit limits

Mapping of COs to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	H	H	H						
CO 2					H	H				
CO 3							H	H	L	L
CO 4	L	L					M	M	H	H

HAFS404T: MODERN TRENDS IN FOOD & BEVERAGE SERVICE –I

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the modern advancements and concepts introduced in the food & beverage service the hospitality sector

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the modern concepts of service area and their implementations (Understand)

CO 2: Identify new concepts of outlets and tourism through beverages in global scenario (Knowledge)

CO 3: Analyze different aspects of digitalization in service sector (Analyze)

CO 4: Develop the skills and illustrate the benefits & modern aspects through sustainability in beverage sector (Create)

Module I: Beverage Pre Mix (6 hours)

Definition, classification, Importance, Uses and benefits

Popular brands – Name, country of origin, description

Module II: Modern theme outlets (8 hours)

Types & classifications

Utilization of space

Lighting effects & design consideration

Advantages & utilization of various entertainment facilities

Module III: Beverage Tourism (9 hours)

Types & categories

Benefits of beverage tourism

New trends in beverage tourism

Module IV: Digitalization in Food & Beverage service (9 hours)

Impact of digitalization on service Industry

E – commerce

Latest trends and techniques of digital advancements in service industry

Module V: Sustainability in Food & Beverage services (9 hours)

Sustainable packaging & its importance

Energy efficient equipments
Food waste & recycling
Sustainable CSR practices

Suggested Readings

Saamia Bukhani Restaurant refined: Exploring trends in the restaurant industry, 2020
Sally Everett, Food & drink tourism: Principles and Practice, 2016
Mariam Garcia Martinez, Open innovation in the Food & Beverage Industry, 2013
Gabriela Ionescu, Sustainable Food & Beverage Industries: Assessments and Methodologies, 2021
Mehmet Sarioglan, New trends in Food & Beverage Enterprises & Production management, 2022

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	M	M			
CO 2		H	H		
CO 3				H	
CO 4					H

HAFS405L: MODERN TRENDS IN FOOD & BEVERAGE SERVICE - I PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the newly developed products and concepts which are the USP of modern food & beverage service sector of hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

- CO 1: Demonstrate the beverage pre mix for making cocktails and Mocktails. (Understand)
- CO 2: Identify & analyze the layout plan for different modern food outlets for implementation. (Knowledge)
- CO 3: Analyze, explain and demonstrate digitalization in beverage sector (Analyze)
- CO 4: Develop the skills to familiarize with different concepts of sustainability & digitalization in beverage sector (Create)

Practical

- Expt. 1: F&B Staff Organization-Class Room Exercise (Case Study method)
- Expt. 2: Developing Organization Structure of various modern Food & Beverage Outlets
- Expt. 3: Develop modern concepts for beverage tourism
- Expt. 4: Create demo itinerary for beverage tourism
- Expt. 5: Preparing Job Description & Specification for modern F&B outlets
- Expt. 6: Conducting Briefing & Debriefing
- Expt. 7: Restaurant, Bar, Banquets & Special Events
- Expt. 8: Drafting Standard Operating Systems (SOPs) for various modern F & B Outlets
- Expt. 9: Supervising Food & Beverage operations in various modern F&B outlets
- Expt. 10: Preparing concepts for digital supports and benefits from social media
- Expt. 11: Designing & drafting Standard Operating Systems (SOPs) for sustainable movement in beverage sector Expt.
- Expt. 12: Preparation & Service of Cocktail & Mixed Drinks based on pre mix.

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1												H
CO 2	H	H			H	M	L	H	M			
CO 3				M		H				M		
CO 4			H	H			M				M	

OR**HAHK406T: MODERN TRENDS IN HOUSEKEEPING – I**

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the new developments and technological advancements in house-keeping sector of hospitality

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Describe the importance of eco friendly products and practices (Knowledge)

CO 2: Identify the modern trends of hospitality housekeeping (Understand)

CO 3: Illustrate software usage in housekeeping (Apply)

CO 4: Advertise the different modern day housekeeping practices (Analyze)

Module I – Eco Practices in Housekeeping (07 hours)

Introduction

Types of eco friendly practices

Importance of eco friendly practices

Sustainable cleaning products

Module II – Hygiene & Sanitation (07 hours)

Modern theory of hygiene & sanitation in guest rooms and public areas

Importance of hygiene & sanitation

International standards

Modern equipments used for hygiene & sanitation

Module III – Eco friendly amenities & products (08 hours)

Energy conservation products

Ozone treatment

Toiletries

Eco friendly chemicals

Recyclable amenities

Module IV – Modern Technologies in Housekeeping (07 hours)

IT amenities

Uses of latest software in housekeeping

Forecasting GRA requirement

Modified intercom telephone systems

Daily housekeeping scheduling

Module V – Case Study (07 hours)

Case study 1

Case study 2

Case study 3

Suggested Readings:

1. Mayola Fernandes, Modern practices Implemented in Housekeeping by 5 – star hotels, 2020
2. Pralay Ganguli, Housekeeping management in hotel & service Industry, 2019

3. Ellen Sandbeck, Green Housekeeping, 2008.

Mapping of CO's to syllabus

	MODULE I	MODULE II	MODULE III	MODULE IV	MODULE V
CO 1	H	M	H		
CO 2	L	L	H	H	
CO 3				H	
CO 4	L		H	M	H

HAHK407L: MODERN TRENDS IN HOUSEKEEPING – I PRACTICAL

(2 Credits: 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the newly developed products and concepts which are the USP of modern housekeeping sector of hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Recognize different modern items and chemicals used in housekeeping (Knowledge)

CO 2: Discuss the effective cleaning and sanitation of guest rooms (Understand)

CO 3: Demonstrate cleaning process of guest rooms (Apply)

CO 4: Classify the uses of software in housekeeping (Analyze)

Practical

Familiarising eco friendly items of housekeeping

Introduction to eco friendly amenities

Introduction to housekeeping software

Introduction to hygiene & sanitation agents

Handling of chemicals

Deep cleaning of model guestrooms using chemicals

Surface cleaning

Duty roster making

Demonstration of room amenity replenishment

Identification of health hazards

Mapping of CO's to syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp10
CO 1	H	H		M	L					L
CO 2					L	H	H			
CO 3						H	M			L
CO 4			H					M		

HAGY408T: MODERN TRENDS IN GASTRONOMY –II

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the new offbeat cuisines of India and importance of media and opportunities in Entrepreneurships in modern gastronomic sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the concept and idea of new Indian cuisines and new developments in food industry (Understand)

CO 2: Identify the factors which leads to sustainability (Knowledge)

CO 3: Analyze the importance of media in food industry (Analyze)

CO 4: Develop your skills and illustrate the importance and challenges in food entrepreneurship. (Create)

Module I: Offbeat cuisines of India (10 hours)

A detailed study on – Uttarakhandi, Kathiawadi, Parsi , Mappila, Adivasi, Melenadu & Kokani cuisine

Traditional preparation methods

Utensils and accompaniments

Module II: Modern trends & developments (09 hours)

Lab grown meats

Plant based dairy products

Super foods

Micro greens

Edible flowers

Immune boosting foods

Meal kits

Seaweed consumption

Micro dose

Module III: Sustainability in gastronomy (08 hours)

Sustainability – Definition, importance, impacts on environment

Sustainable food cycle

Sustainable food cultivation & climate change- crops, livestock, marine

Role of NGO's, government and non government sector in sustainable food movements

Module IV: Media Importance in Gastronomy (09 hours)

Types of media benefits the gastronomy

Role of social media in gastronomy

Food photography

Food advertising

Food styling

Module V: Food entrepreneurship (08 hours)

Opportunities and challenges in food entrepreneurship

Food business opportunities in India

Research and development in food business

Suggested Readings

RDN Frye, Amanda, Barbara Scheule, Introductory Food, 2019

Signe Rousseau, Food and social media, 2012

Valentina Marinescu, Food nutrition and media, 2021

Paul collinson, Food and sustainability in the twenty –first century, 2019

Paola De Barnardi, Danny Azucar, Innovations in food ecosystems: Entrepreneurship for a sustainable future, 2019

Mapping of CO's to syllabus

	MODULE I	MODULE II	MODULE III	MODULE IV	MODULE V
CO 1	H	H			
CO 2			H		
CO 3				H	
CO 4					H

HAGY409L: MODERN TRENDS IN GASTRONOMY – II PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate & learn the offbeat cuisines of India and newly developed concepts of gastronomy which supports sustainability and modern trends.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Demonstrate menus from offbeat cuisine of India (Understand)

CO 2: Identify & demonstrate recipes based on modern trends in gastronomy (Knowledge)

CO 3: Identify & demonstrate menu's which supports sustainability in gastronomy (Analyze)

CO 4: Develop the skills through innovations and research in gastronomy and create demo entrepreneurship ideas (Create)

Practical

Expt. 1: Various preparations from – Uttarakhand cuisine

Expt. 2: Various preparation from – Kathiawadi cuisine

Expt. 3: Various preparation from – Parsi cuisin

Expt. 4: Various preparation from – Mappila cuisine

Expt. 5: Various preparation from – Adivasi cuisine

Expt. 6: Various preparations from – Melenadu cuisine

Expt. 7: Various preparations from – Konkani cuisine

Expt. 8: Various preparations from – Micro greens

Expt. 9: Various preparations from – edible flowers

Expt. 10: Various preparations from – Immune boosting foods

Expt. 11: Various preparations from – Seaweeds

Expt. 12: Various preparations from – Plant based dairy

Expt. 13: Various preparations from – sustainable food menu

Expt. 14: Various preparations from – sustainable food menu

Expt. 15: Demo entrepreneurship ideas – Based on gastronomy

Expt. 16: Demo entrepreneurship ideas – Based on gastronomy

SUGGESTED MENU:

<u>Exp 1 (Uttarakhand cuisine)</u> Aloo gutuk Phannu Kumaoni Raita Arsa	<u>Exp 2(Kathiawadi cuisine)</u> Ringan no oro Lasaniyabateta Methithepla Adadiyapak	<u>Exp 3 (Parsi cuisine)</u> Chicken farcha Dhansak Patra nimachli Berry pulao	<u>Exp 4 (Mappila cuisine)</u> Unnakkaya Fish surkha masala Parottas Thalassary biriyani
<u>Exp 5 (Adivasi cuisine)</u> Dhuska Shukti Jhor Dubki tiyan Bothalbhaat	<u>Exp 6 (Melenadu cuisine)</u> Mango Rasam Carrot kosambari Pandi curry Akki roti	<u>Exp 7 (Konkani cuisine)</u> Sol kadhi Bombil fry Bharlivangi Caldine veg curry	<u>Exp 8 (Micro greens)</u> Spring salad Broccoli micro green soup Micro green pesto sandwich Lemon – garlic pasta with arugula
<u>Exp 9 (Edible flowers)</u> Edible flower Gazpacho Rose jam & strawberry Bruchetta Edible flower canapé	<u>Exp 10 (Immune boosting foods)</u> Chicken & turmeric soup Lentil stuffed sweet potatoes	<u>Exp 11 (Seaweeds)</u> Seaweed salad with sesame dressing Grilled chicken with seaweed butter Tofu & seaweed stir fry Seaweed risotto	<u>Exp 12 (Plant based dairy)</u> Strawberry & coconut milk shake Hot garlicky tofu Savory soy milk crepes

Squash blossoms with goat cheese	Pumpkin & broccoli curry Coconut rice		Almond milk pudding
<u>Exp 13 (Sustainable foodmenu)</u> Fish head & coconut root soup Leftover lentil croquettes Crispy chicken skin stew Candied lemon peel flavored rice	<u>Exp 14 (Sustainable foodmenu)</u> Cucumber peel pickles Sweet potato & carrot peel Pakora Bottle gourd peel chutney Bitter gourd peel Puri	<u>Exp 15 (Entrepreneurship ideas)</u> Students should develop their skills on food entrepreneurship in theory classes and come up with innovative recipes which can be used for revenue generation	<u>Exp 16 (Entrepreneurship ideas)</u> Students should develop their skills on food entrepreneurship in theory classes and come up with innovative recipes which can be used for revenue generation

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M	M	M									
CO 2				M								
CO 3					M	M	M	M				
CO 4									M	M	M	M

OR**HAFR410T: MODERN TRENDS IN FRONT OFFICE – II**

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the modern rules, licenses & green certifications of newly developed concepts of front desk and hospitality sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Analyze the concept of home stay and find out about the licenses and rules and regulations to be followed in India. (Understand)

CO 2: Explain the various new technologies in reference to concierge of front office. (Knowledge)

CO 3: Summarize the various certifications which can be obtained for green practices in hotel industry and analyze the SOP's adopted towards safety and security of guest. (Analyze)

CO 4: Discuss various case studies on modern trends in front office and determine its implications and impact on hotel industry. (Create)

Module I: HOMESTAY (06 hours)

Concept of Homestay

Classification of Homestay

Homestay licenses, rules & Regulations in India

Module II: HIGH-TECH CONCIERGE TECHNOLOGY (06 Hours)

Virtual Tour

AI in Concierge

Examples of Hi-tech Concierge Technologies adopted by hotels worldwide

Module III: INTERNATIONAL CERTIFICATION OF GREEN PRACTICES (08 Hours)

Eco-leaf rating

Green Globe
Green Key
Nordic Swan rating
LEEDS

Module IV: MODERN SAFETY AND SECURITY IN FRONT OFFICE (08 Hours)

Modern Equipment used in Front Office
Key handling/ Safe Deposit
SOP of handling suspicious guest
SOP of handling single lady traveler
Change of SOP for guest handling post Covid-19

Module V: CASE STUDY (08 Hours)

Case Studies on various examples in relation to Front Office Trends

Suggested Readings

Adam harris, Richard Castle, Kristy Espat and more., More Reservations, happier guest: The ultimate guide for the Modern hotelier, Cloudbeds, 2022
Kelly A. McGuire, Hotel Pricing in a Social World: Driving Value in the Digital Economy, Wiley, 2015
James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011
Ashok Aima, Vinay Chauhan, Jaya Bhasin, Contemporary Trends in Tourism and Hospitality Management, Primus Books, 2013

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H		L		
CO 2		H			
CO 3			H	H	M
CO 4					H

HAFR411L: MODERN TRENDS IN FRONT OFFICE – II (PRACTICAL)

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the modern standard procedures and uses of virtual orientation in the field of front desk area and hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

- CO 1: Explain the concept of virtual orientation of hotel and its facilities as well as orientation of the city. (Understand)
CO 2: Model itinerary of guest. (Knowledge)
CO 3: Apply SOP's of hygiene & sanitation and other standards procedures in front office as per requirements and analyze the applications of modern apps in various procedures. (Analyze)
CO 4: Create unique experience for guest together with construction of forms and formats. (Create)

PRACTICAL

- Expt. 1: Virtual Orientation of Hotel
Expt. 2: Virtual Orientation of city in which the hotel is situated
Expt. 3: Digital itinerary creation
Expt. 4: Post Covid-19 hygiene & sanitation in front office
Expt. 5: Application of modern apps and features in front office like voice technology etc
Expt. 6: Flexible check-in and check-out procedure

Expt. 7: Providing unique experience/wow experience

Expt. 8: Dealing with fake currencies

Expt. 9: Updated forms and formats

Expt. 10: Role play

Mapping of COs to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	H								M
CO 2			H							
CO 3				H	H	H		M		M
CO 4				L	L	L	H		H	

HABS412T: MODERN TRENDS IN FOOD & BEVERAGE SERVICE –II

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the modern advancements in beverage outlets and new trending concepts of beverages.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the concepts of modern advancements in beverage outlets and trends (Understand)

CO 2: Identify & analyze the marketing strategies in beverage sector (Knowledge)

CO 3: Analyze and develop skills on modern trends in cocktails and Mocktails (Analyze)

CO 4: Develop the skills and illustrate the entrepreneurship options in beverage sector (Create)

Module I: Innovation's in Beverage sector & outlets (08 hours)

Robotics service innovation

Companion beverage bars

Advance beverage productions

Artificial Intelligence

Module II: Modern trends & developments in beverages (07 hours)

Herbal & Botanical flavours in beverages

Sober trend – Low and non alcoholic drinks

Functional drinks

Alternative spirits

Fermented beverages & teas

Module III: Marketing strategies in Food & Beverage (08 hours)

Customer loyalty programs

Digital presence in social media

Paid media promotions

Search engine optimization

Module IV: Modern cocktail & Mocktail trends (08 hours)

Canned cocktails & Mocktails

Throw back cocktails

Two spirit cocktails

Modern garnish techniques

Module V: Beverage entrepreneurship (07 hours)

Opportunities and challenges in beverage entrepreneurship

Beverage business opportunities in India
Research and development in beverage business

Suggested Readings

Sally Everett, Food & drink tourism: Principles and Practice, 2016
Mariam Garcia Martinez, Open innovation in the Food & Beverage Industry, 2013
Douglas Raggio, Start a Food & Beverage business, 2022

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			
CO 2			H		
CO 3				H	
CO 4					H

HABS413L: MODERN TRENDS IN FOOD & BEVERAGE SERVICE - II PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the modern advancements in beverage outlets and new trending concepts of beverages.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Demonstrate the beverages based on modern trends. (Understand)

CO 2: Identify & analyze the developments happening in beverage sector and demonstrate. (Knowledge)

CO 3: Analyze & demonstrate modern trends in cocktails & Mocktails (Analyze)

CO 4: Develop the skills to familiarize with different concepts of sustainable garnishes used for Cocktails and Mocktails
(Create)

Practical

Expt. 1: Demonstrate herbal & botanical flavored beverages

Expt. 2: Demonstrate zero and non-alcoholic drinks

Expt. 3: Demonstrate functional drinks

Expt. 4: Demonstrate fermented beverages

Expt. 5: Demonstrate various preparations of tea

Expt. 6: Demonstrate throw back cocktails

Expt. 7: Demonstrate two spirit cocktails

Expt. 8: Demonstrate sustainable garnishes

Expt. 9: Demonstrate zero waste Mocktails

Expt. 10: Demonstrate Immune booster Mocktails

Expt. 11: Demonstrate fruit slushies

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11
CO 1	H	M	M	M	M	M	M		M	M	M
CO 2	M	H		H	H						
CO 3			H			H	H		H	H	H
CO 4								H			

OR

COURSE CODE: MODERN TRENDS IN HOUSEKEEPING – II

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the modern advancements in rooms division and new trending concepts of rooms and the management skills.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Describe the importance of employee training (Knowledge)

CO 2: Identify the modern trends of hospitality housekeeping (Understand)

CO 3: Point out software utility in housekeeping (Analyze)

CO 4: Reframe the outsourcing process (Analyze)

Module I – Training & Motivation (08 hours)

Training methods
Disease and infection control
Covid sanitation training
Fire safety training and drills

Module II – Modern laundry operations (05 hours)

Eco friendly chemicals
Optimization of laundry settings
Outsourcing laundry practices
Water treatment
Recycling water

Module III – Safety & Security (08 hours)

Modern technologies for security
Uses of AI for guest security
Usage of IP cameras for face tracking
Modern guest security practices
International standards

Module IV – Outsourcing Services (08 hours)

Importance
Different outsourcing services
Cost efficiency
Outsourced employment

Module V – Case Study (06 hours)

Case study 1
Case study 2
Case study 3

Suggested Readings:

Raghubalan. G, Hotel housekeeping Operations & Management 3rd Edition, Oxford University Press, 2015

Bhatnagar, S.K., Front Office Management, Frank Bros. & Co. Ltd, 2013

Kappa, Margret, Nitschke, Aleta, Managing House Keeping Operation, AHILA, 1997

Ganguly, Pralay, Housekeeping Management in Hotel & Service Industry, Dreamtech, 2019

Mapping of CO's to syllabus

	MODULE I	MODULE II	MODULE III	MODULE IV	MODULE V
CO 1	H				
CO 2	L	M	H	M	
CO 3			H		M
CO 4				H	

HAHG415L: MODERN TRENDS IN HOUSEKEEPING – II PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the modern advancements in room divisions and new trending concepts of rooms and forms & formats.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Label training and other activity drills in housekeeping (Knowledge)

CO 2: Demonstrate modern laundry cleaning techniques and processes (Understand)

CO 3: Classify different software used in housekeeping department (Analyze)

CO 4: Construct different forms and formats (Create)

Practical

Expt. 1: Introduction to types of training and motivation process

Expt. 2: Fire safety training drills

Expt. 3: Introduction to modern laundry chemicals and items

Expt. 4: Cleaning of soiled linen using modern laundering techniques

Expt. 5: Removing stains from dirty linen

Expt. 6: Introduction to safety and security in hotels

Expt. 7: Software handling

Expt. 8: Outsourced employees duty roster making

Expt. 9: Forms and formats

Expt. 10: Laundry forms

Mapping of CO's to syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp10
CO 1	H	H		L	M					
CO 2			H	M						L
CO 3						L	H		L	
CO 4								H	H	M

MINOR COURSES

Semes-ter	Category	Course Code	Course Name	Cred-its
1	Minor Course 1	HAGH104T	Basics of Gastronomy & Hygiene Practices	2
		HAGH105L	Basics of Gastronomy & Hygiene Practices Practical	2
2	Minor Course 2	HACB106T	Culinary & Baking skills	2
		HACB107L	Culinary & Baking skills Practical	2
3	Minor Course 3	HARS210T	Room reports & surface cleaning	2
		HARS211L	Room reports & surface cleaning Practical	2
4	Minor Course 4	HASB212T	Housekeeping supervision & budgeting	2
		HASB213L	Housekeeping supervision & budgeting Practical	2
5	Minor Course 5	HAHM310T	Advanced housekeeping management	2

		HAHN311L	Advanced housekeeping management Practical	2
6	Minor Course 6		Training Report Presentation	4
7	Minor Course 7	HABT408T	Basics of Tourism	3
7	Minor Course 8	HARM409T	Research Methodology	2
8	Minor Course 9	HAOB410T	Organizational Behaviour	3

HAGH104T: BASICS OF GASTRONOMY & HYGIENE PRACTICES

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the basic and introductory knowledge of gastronomy sector of hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the hygiene and skills required in workplace. (Understand)

CO 2: Identify and analyze basic food commodities and their preparations (Knowledge)

CO 3: Analyze the basic knowledge of baking and breads. (Analyze)

CO 4: Demonstrate the safety procedures in handling kitchen equipment's (Create)

CO 5: Develop the operation flow of the food production department (Create)

Module I: INTRODUCTION TO GASTRONOMY & HIERARCHY (08 hours)

Attitudes, behaviour & personal hygiene in the kitchen

Uniforms & protective clothing

Aims and objectives of cooking food

Various textures & consistencies

Classical & Modern Brigade

Duties and responsibilities of various chefs

Module II: METHODS OF COOKING FOOD (05 hours)

Methods of Cooking: Roasting, Grilling, Frying, Baking, Broiling, Poaching, Boiling

Principles of each of the above

Care and precautions to be taken

Selection of food for each type of cooking

Module III: Introduction to Bakery (05 hours)

Introduction & types of ovens

Basic bakery ingredients – uses, importance

Different types of breads – Description, country of origin

Module IV: COMMODITIES & TERMS USED IN GASTRONOMY (06 Hours)

Cuts & classification of vegetables

Classification of fruits

Egg cookery

Stocks & its uses

Thickening & Raising agents

List of culinary terms & their explanation

Module V: Food Hygiene (05 Hours)

Food & its relation to health

Food allergy and precautions

General Principles of Food Hygiene

Food Hazards & risk

Types (Infections and intoxications) & its preventive measures

HACCP (Basic Principle and implementation)

Suggested Readings

Parvinder S Bali, Food Production Operations. Oxford University Press, 2014

Philip E. Thangam, Modern Cookery (Vol- I), Orient Longman, 1946.

R. Kinton & V. Cessarani, Foundation Practical Cookery, Hodder Education, 2009.

D. Foskett, R. Kinton & V. Cessarani, Theory of Catering. Hodder & Stoughton Educational, 1999

K. Arora, Theory of Cookery, Frank Brothers, 1992

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	M	M	L	L	
CO 2					H
CO 3				M	
CO 4				H	
CO 5	M	H	M		

HAGH105L: BASICS OF GASTRONOMY & HYGIENE PRACTICES PRACTICAL

(2 Credits: 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to demonstrate the basic and introductory kitchen tools of commercial kitchen & basic cuts of vegetables.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the usage of kitchen tools (Understand)

CO 2: Identify the safety principles at the food production area (Knowledge)

CO 3: Analyze commonly used raw material (Analyze)

CO 4: Analyze& demonstrate basic cuts of vegetables (Analyze)

CO 5: Develop & demonstrate basic bread preparations (Create)

Practical

Expt. 1: Familiarization and Understanding kitchen equipment and tools

Expt. 2: Understanding Personal Hygiene and Kitchen Hygiene & its importance.

Expt. 3: Understanding kitchen layouts, kitchen knife, and hand tools

Expt. 4: Identification of commonly used raw material

Expt. 5: Basic hygiene practices& Importance of Kitchen Uniform.

Expt. 6: Various Safety practices to be observed in the kitchen

Expt. 7: Basic cuts of vegetables

Expt. 8: Methods of Cooking

Expt. 9: Various classical preparation of Egg.

Expt. 10: Preparation of Stock, Soup & Sauces

Expt. 11: Fire Fighting

Expt. 12: Basic bread preparations

Mapping of COs to the syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M		M									
CO 2		M			M	H					M	

CO 3								M	M			
CO 4				H			M			M		
CO5												M

HACB106T: CULINARY & BAKING SKILLS

(2 Credits: 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn & develop theoretical skills of various kinds of soup, sauces & stocks and various kinds of meat & fish cookery.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the basic recipes and outline the different Soups and Sauces preparations (Understand)

CO 2: Identify different food commodities. (Knowledge)

CO 3: Analyze the various processes of cooking methods required for fish & meat cookery (Analyze)

CO 4: Develop & illustrate meat and fish cookery (Create)

CO 5: Identify various types of bakery & confectionary items (Knowledge)

Module I: Soups (05 hours)

Definition, Importance, classification – Broth, Bouillon, puree, cream, velouté, chowder, bisque, consommé

Cold soups

International soups

Garnishes and accompaniments

Module II: Sauces (04 hours)

Definition, Importance, classification of sauces and mother sauces

Derivatives of mother sauces

Contemporary & Proprietary sauces

Difference between sauce and gravy

Module III: FISH COOKERY (04 hours)

Introduction to fish cookery

Classification of fish with examples

Cuts of fish with menu examples

Selection of fish and shellfish

Effects of heat on the cooking of fish

Module IV: MEAT COOKERY (06 hours)

Introduction to meat cookery

Cuts

Variety meats

Poultry

Menu examples of each

Module V: Basic Bakery & confectionary (05 hours)

Muffins – Introduction, types

Cookies & Doughnuts – Introduction, types

Pastries- Types and uses

Module VI: Food commodities (06 hours)

Nuts – classification & uses

Fruits – classification & uses

Herbs – types & uses

Pulses & cereals – types and uses.

Suggested Readings

K G Dubey, The Indian Cuisine, PHI, 2013

P. S. Bali, Quantity Food Production Operations and Indian Cuisine, Oxford University Press, New Delhi, 2012

Kinton & Cessarani, Theory of Catering, ELBS, 2012

W. Gisslen, Professional Baking, John Wiley & Sons, 2009

Philip E. Thangam, Modern Cookery (Vol- I), Orient Longman, 1946.

K. Arora, Theory of Cookery, Frank Brothers, 1992.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	H				
CO 2						H
CO 3			M	H		
CO4			H	M		
CO5					H	

HACB107L: CULINARY & BAKING SKILLS PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s)

The objective of the course is to demonstrate the basic kitchen preparation such as soups, sauces and basic recipes of meats, fish & poultry and easy to prepare food items in commercial kitchens.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the uses of different kitchen equipment & commodities. (Understand)

CO 2: Identify, demonstrate and explain cuts of fish and meat (Knowledge)

CO 3: Identify, demonstrate basic preparation of sauces & soups (Knowledge)

CO 4: Analyze & illustrate cuts of poultry (Analyze)

CO 5: Create & demonstrate different preparations of cookies, muffins, doughnut and pastries (Create)

PRACTICAL

Expt. 1: Familiarization and Understanding kitchen equipment and tools

Expt. 2: Cuts of fish with menu examples

Expt. 3: Cuts of Meat with menu examples

Expt. 4: Various preparation of cookies, muffins, doughnut and pastries

Expt. 5: Cuts of Poultry with menu examples

Expt. 6: To illustrate the various uses of kitchen commodities in food preparations.

Expt. 7: To demonstrate various derivatives of sauces and their uses.

Expt. 8: To demonstrate various soups and their garnishes.

Expt. 9: To demonstrate various cuts of fruits and their uses.

Expt. 10: To demonstrate various uses of nuts in gastronomy.

Expt. 11: To demonstrate various uses of pulses & cereals.

Expt. 12: To demonstrate the uses of various herbs and spices.

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	M					M			M	M	M	M

CO 2		M	M									
CO 3							H	H				
CO 4					M							
CO5				H					M	M		

SUGGESTED MENU:

<u>Menu 1</u> Consommé Julienne Cream of Tomato soup Chicken & Corn Broth Pumpkin and Apple soup	<u>Menu 2</u> French Onion soup Mulligatawny Gazpacho Minestrone	<u>Menu 3 (Mother sauce)</u> Baked potato gratin Grilled lamb leg with Es-pagnole sauce Meat balls in Tomato sauce	<u>Menu 4(Mother sauce)</u> Macedoine Mayonnaise Grilled veg with Hollandaise sauce Poached chicken in Velouté sauce
<u>Menu 5</u> Fish Fingers with Tar-tar sauce Grilled fish with lemon butter 8sauce Fish croquettes	<u>Menu 6</u> Potato Mustard salad Shepherd's Pie Meat casserole Herb Pilaf	<u>Menu 7</u> Chicken Cutlet Pan fried chicken Boiled vegetables Herbed Mashed potatoes	<u>Menu 8</u> Fruit & Nut salad Spiced lentil soup Veg Au Gratin Vanilla custard
<u>Menu 9</u> Waldorf Salad Potato Lyonnais Fish casserole Cinnamon crepes with apple sauce	<u>Menu 10</u> Greens with basic vinaigrette Chicken Stew Pilaf rice Caramel custard	<u>Menu 11</u> Trio of mushroom Salad Ratatouille Beans ragout Herbed Pancakes	<u>Menu 12</u> French Lentil salad Grilled vegetables Chicken in Vinegar sauce Soft Buns
<u>Menu 13</u> Coconut Cookies Fruit & Nut cookies Banana Muffins Chocolate Muffins	<u>Menu 14</u> Namak Para Jim Jam Cookies Strawberry Muffins Swiss rolls	<u>Menu 15</u> Chocolate doughnuts Bread sticks Cinnamon rolls	<u>Menu 16</u> Profit roles Apple Pie Chocolate Éclairs

HARS210T: ROOM REPORTS & SURFACE CLEANING

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s)

The objective of the course is to learn the importance and procedures of cleaning different kinds of surfaces and formats & reports generated by room divisions.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the different room status and the reports & formats used by room division. (Understand)

CO 2: Identify the guest services provided by room division and the procedures followed. (Knowledge)

CO 3: Analyze, recall and describe the entire room reservation system of the hotel (Analyze)

CO 4: Develop & illustrate cleaning procedures for different surfaces (Create)

Module I: ROOM STATUS AND REPORTS USED IN ROOM DIVISION (10 hours)

Occupied, Vacant

Out Of Order / Out Of Service

Occupancy Report

Arrival Report

Managers Flash

Discrepancy Report

Turn away report

Say over list, expected arrival list, Expected departure list

Other forms and formats

Module II: GUEST SERVICES (05 Hours)

Handling Guest Mail
Keys and keys Handling
Guest Paging
Safety Deposit Lockers
Wakeup call
Room Movement
Lost and Found

Module III: ROOM RESERVATION (05 hours)

Importance, Functions, Different Channels & sources, and Types of reservation.
Cancellations and Amendments
Handling Individual & Group reservations
Various Forms & Formats

Module IV: CARE AND CLEANING OF DIFFERENT SURFACES (10 Hours)

Metals
Glass
Leather, Leatherettes, Resins
Plastic
Ceramics
Wood
Wall finishes
Floor finishes

Suggested Readings

Manoj Kr. Yadav, A Professional Guide to Rooms Division Operations, John Wiley & Sons, 2019
Colin Dix & Chirs Baird, Front office operations, Pearson, 2006.
James Bardi, Hotel Front office management, John Wiley & Sons, 2011.
Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.
Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H	M	H	
CO 2		H	L	
CO 3		L	H	
CO 4				H

COURSE CODE: ROOMS REPORTS & SURFACE CLEANING PRACTICAL

(2 Credits- 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate the importance and procedures of cleaning different kinds of surfaces and formats & reports generated by room divisions.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

- CO 1: Familiarize with different room status and the reports used in room division (Understand)
CO 2: Analyze & Demonstrate, role play on – room reservation, key handling, wakeup call, telephone handling and lost and found. (Analyze)
CO 3: Create & demonstrate on different surface cleaning – glass, metal and wood (Create)

PRACTICAL

- Expt. 1: Identification of room status and outline of various reports generated in room division – room status report, arrival report, discrepancy report, occupancy report
- Expt. 2: Handling room reservation
- Expt. 3: Role play of key handling and safety deposit locker
- Expt. 4: Role play of Room Movement
- Expt. 5: Role play of handling guest wakeup call
- Expt. 6: Role play of handling guest telephone at control desk
- Expt. 7: Role play on lost and found
- Expt. 8: Cleaning of different surfaces - Glass cleaning, Metal Cleaning, Wood Cleaning
- Expt. 9: Practical involving following activities- Scrubbing, polishing, wiping, washing, rinsing, swabbing, mopping, sweeping, brushing, buffing
- Expt. 10: Practical involving following activities- Scrubbing, polishing, wiping, washing, rinsing, swabbing, mopping, sweeping, brushing, buffing

Mapping of COs to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	M								
CO 2		H	H	H	H	H	H			
CO 3								H	H	H

HASB212T: HOUSEKEEPING SUPERVISION & BUDGETING

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the supervision skills and budget control methods used in the house-keeping department of hospitality sector.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the basic contents of housekeeping and guestrooms (Understand)

CO 2: Analyze the supervision process of housekeeping (Analyze)

CO 3: Develop & reframe the budgetary control methods (Create)

Module – I: Standard Contents of a Guest room (08 hours)

Guestroom furniture

Furniture arrangement

Guestroom fixture and fittings

Beds, mattresses and bedding

Soft furnishing

Guestroom accessories

Placement of guest supplies

Module – II: Supervision in Housekeeping (07 hours)

Role of a supervisor

Specific functions of supervisors

Importance of a supervisor

Module – III: Housekeeping Control Desk (07 hours)

Coordination with other departments

Handling telephone calls

Paging systems and methods

Situation handling

Room move / Room shift

Module – IV: Budgeting for housekeeping expenses (08 hours)

Types of budget
 Housekeeping expenses
 Budget planning process
 Income statement of the rooms division
 Controlling expenses
 Inventory control and stock – taking
 Purchasing

Suggested Readings

Andrews, Sudhir, Hotel Housekeeping, Tata McGraw Hill, 2009.
 Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.
 Bhatnagar, S.K., Front Office Management, Frank Bros. & Co. Ltd., 2013
 Branson, C, Lennox Margaret. Hotel, Hostel & Hospital Housekeeping, Hodder Education, 1988.
 Kappa, Margret, Nitschke, Aleta. Managing House Keeping Operation, AHLA, 1997

Mapping of CO's with syllabus

CO'S	Module I	Module II	Module III	Module IV
CO1	H	L	M	
CO2		H		
CO3				H

HASB213L: HOUSEKEEPING SUPERVISION & BUDGETING PRACTICAL

(2 Credits – 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate the skills required to understand the function of chambermaid's trolley and cleaning agents & equipments.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Developing skills for the loading of a chambermaid's trolley (Understand)

CO 2: Identify & explain a guestroom layout (Knowledge)

CO 3: Analyze & understand the usage of cleaning agents and equipment (Analyze)

Practical

Familiarising guest room amenities

Identification of housekeeping equipment (Manual / Mechanical)

Familiarising with chambermaid's trolley

Cleaning of different surfaces

Practical involving following activities- Scrubbing, polishing, wiping, washing, rinsing, swabbing, mopping, sweeping, brushing, buffing

Stain removal

Practical activities involving the usage of cloths and their types, abrasives, polishes, chemical agents, and commercially available products

Mapping of COs to the syllabus

CO'S	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7
CO 1		L	H				
CO 2	M						
CO 3			L	M	H	H	M

HAHM310T: ADVANCED HOUSEKEEPING MANAGEMENT

(2 Credits: 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn various aspects of decorations required in rooms & focused areas and causes & prevention aspects of safety and security.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Discuss the basics of ancillary activities (Understand)

CO 2: Analyze the security systems of a hotel (knowledge)

CO 3: Develop & identify the decorations of the department (Create)

Module – I: Linen and Laundry (05 hours)

The linen and laundry room

Storage, exchange, par stock, linen control, laundry process

Dry cleaning

Handling guest laundry

Uniforms and sewing room

Module – II: Safety and Security (08 hours)

Work environment safety

Potential hazards in housekeeping

Fire prevention and fire safety

First aid

Crime prevention

Medical emergencies

Scanty baggage

Lost and found

Module – III: Interior designing (07 hours)

Basic types of design

Elements and principles of design

Design for physically challenged

Colour and lighting

Flooring

Carpets and floor maintenance

Window and window treatment

Module – IV: Flower Arrangement (04 hours)

Flower arrangement basics

Designing flower arrangement

Japanese / oriental flower arrangement

Common flowers and foliages

Suggested Readings

Andrews, Sudhir, Hotel Housekeeping, Tata McGraw Hill, 2009.

Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.

Bhatnagar, S.K., Front Office Management, Frank Bros. & Co. Ltd., 2013

Branson, C, Lennox Margaret. Hotel, Hostel & Hospital Housekeeping, Hodder Education, 1988.

Kappa, Margret, Nitschke, Aleta. Managing House Keeping Operation, AHILA, 1997

Mapping of CO's with syllabus

	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2		H		
CO3			H	H

HAHM311L: ADVANCED HOUSEKEEPING MANAGEMENT PRACTICAL

(2 Credits: 60 hours) (L-T-P: 0-0-2)

Objective(s):

The objective of the course is to learn & demonstrate the concept of interior decorations, bed making & flower arrangements.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Develop skills & construct a model room with various concepts of interior decoration (Understand)

CO 2: Analyze & demonstrate the process of bed-making (Analyze)

CO 3: Create & illustrate various flower arrangement techniques (Create)

Practical

Flower arrangement

Making floor plans, wall elevations, and templates

Creating a model of a guest room / public area with interior decoration themes

Cleaning of guestroom

Bed making & Turn-down service

Mini-bar handling

Mapping of CO's to syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6
CO 1	L		H			M
CO 2			L	L	H	
CO 3	H		L			

HHPR325P: TRAINING REPORT PRESENTATION

(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective:

To document, reflect upon, and present the knowledge and skills acquired during industrial training across all departments of hospitality.

COURSE / LEARNING OUTCOMES:

At the end of this course, the student will be able to

CO 1: Analyze and document industrial exposure in core hospitality departments: F&B, Culinary, Front Office, and Housekeeping (Analyze)

CO 2: Apply knowledge from classroom learning to real-time work settings through logbook entries and weekly reflections (Apply)

CO 3: Evaluate the company culture, SOPs, and administrative processes from an operational perspective (Evaluate)

CO 4: Create a comprehensive training report highlighting tasks performed, skills gained, and observations (Create)

Module	Title	Hours	Focus
I	Departmental Log-book	40 hrs	Daily record of activities (F&B, kitchen, front office, housekeeping)
II	Reflective Report Writing	30 hrs	Introduction to the property, department-wise learning, SOPs followed
III	Visual Documentation	20 hrs	Property images (if permitted), task photos, learning outcomes
IV	Presentation Preparation	10 hrs	Viva voice, slide prep, report polishing
V	Final Viva and Presentation	20 hrs	Report submission and oral defense before panel

Mapping of CO's with syllabus

CO's	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	M	M	M
CO 2	M	M	H	M	H
CO 3	M	L	L	M	M
CO 4	L	M	H	H	H

HABT408T: BASICS OF TOURISM

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the basic knowledge about the tourism sector in hospitality with its different aspects.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Contextualize tourism within broader cultural, environmental, and economic dimensions of society. (Knowledge)

CO 2: To outline the resources of tourism and different aspects of tour operations. (Understand)

CO 3: Explain the diverse nature of tourism, including culture and place, global/ local perspectives, and experience design and provision. (Understand)

CO 4: Examine the different elements of geography and the relationship with tourism. (Analyze)

CO 5: Illustrate the tour operations (Apply)

Module I: CONCEPT OF TOURISM (06 hours)

Origin, objectives, Elements, Scope & Nature of tourism

Job opportunities and employment generation in the tourism Industry

Module II: TOURISM PRODUCTS AND RESOURCES (08 hours)

Architectural heritage

Culture & Fairs and festivals of India

Natural and other tourism resources

Module III: TOUR OPERATIONS (08 hours)

Meaning & Definition

Types of Tourists: Inbound, Outbound & Domestic.

Tour Packaging—definition, components of a tour package

Types of Package Tour: Independent Tour, Inclusive Tour, Escorted Tour, Business Tour

Guides & escorts– The role and function Qualities required to be a guide or escort

Module IV: ITINERARY PLANNING (08 hours)

Steps to planning a Tour, Planning Route map

Transport booking–reservation,

Accommodation–Reservation & Food facilities

Tour Costing

Module V: SOCIO-ECONOMIC IMPACT OF TOURISM (07 hours)

Impact of tourism on culture

People to people contact enhancement

Environmental hazards

Suggested Readings

Sudhir Andrews, Introduction to Tourism and Hospitality, Tata McGraw Hill, 2010.

Charles R. Goeldner, Tourism principles, practices, philosophies, John Wiley Pub, 2007.

A.K. Bhatia, International Tourism, Sterling Publications, 2006.

P.N. Seth, Introduction to Hospitality, Sterling Publications, 2001.

Mapping of Cos to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M	H		
CO3	M				
CO4				L	M
CO5			H		

HARM409T: RESEARCH METHODOLOGY

(2 Credits: 30 hours) (L-T-P: 2-0-0)

Objective(s):

The objective of the course is to learn the basic knowledge about the research work and different approaches, process and methods of data collection in research work.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the idea of conducting a research (Explain)

CO 2: Analyze the different approaches of a research process (Analyze)

CO 3: Explain the research concepts (Understand)

CO 4: Define the different methods of data collection and different research designs (Knowledge)

Module I – Introduction to Research (06 hours)

Define research

Objectives of research

Types of research

Significance of research

Research process

Criteria's of a good research

Module II – Defining Research Problem (04 hours)

Research problem

Selecting the problem

Necessity of defining the problem

Techniques involved in defining a problem

Module III – Research Design (05 hours)

Meaning of research design
Need for research design
Features of a good design
Concepts of research design
Principles of research design

Module IV – Sampling Design (04 hours)

Census and sample survey
Steps in sample design
Criteria's of selecting a sampling procedure
Types of sample design

Module V – Data Collection (05 hours)

Collection of primary data
Observation method, interview method, questionnaire
Methods of data collection
Collection of secondary data
Primary data vs. Secondary data

Suggested Readings

Kothari, Garg, Research Methodology 4th Edition, New Age International, New Delhi
Creswell, David Creswell, Research Design, Sage Publication, New Delhi
Sarangi, Research Methodology, Taxmann, New Delhi
Kothari, Research Methodology 2nd Edition, New Age International, New Delhi

Mapping of CO's to syllabus

	MODULE I	MODULE II	MODULE III	MODULE IV	MODULE V
CO 1	H	M			
CO 2	H	L		M	L
CO 3	H	M	H	L	
CO 4			H	M	H

HAOB410T: ORGANIZATIONAL BEHAVIOUR

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the basic knowledge about the behaviours & approaches of employees and employers towards an organization.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the organizational theory and structure (understand)

CO 2: Identify behavioural and individual perspectives (Knowledge)

CO 3: Analyze focus group behaviour (Analyze)

CO 4: Reframe different cultures and developments in an organization (Evaluate)

Module – I: Organizational theory (10 hours)

Introduction to organization
Organization theory
Organization structure
Effectiveness of organizational structure

Module – II: Organizational behaviour and individual perspective – I (08 hours)

Overview of organizational behaviour
Individual behaviour and learning
Perception

Attitudes and values

Module – III: Organizational behaviour and individual perspective – II (08 hours)

Personality and emotions

Stress management

Motivation

Job design and Job satisfaction

Module – IV: Group behaviour (06 hours)

Group formation and structure

Communication

Conflict management

Team building and leadership

Power and politics

Module – V: Organizational culture and development (10 hours)

Organizational culture and climate

Organizational change

Organizational development

Emerging trends in organizational behaviour

Suggested Readings

Robbins. Stephen, Judge. Timothy, Essentials of Organizational Behaviour 14th edition, Pearson, 2017, New York

Aswathappa. K, Organizational Behaviour, Himalaya Publishing House, 2018, Pune

Luthans. Fred, Organizational Behaviour, McGraw Hill, 2018, New Delhi

McShane. L. Steven, Glinoy. Mary Ann, Organizational Behaviour 8th Edition, McGraw Hill, 2017, New York

Mapping of CO's to syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	H	L	
CO 3			L	H	
CO 4	L			M	H

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	HAIR108L	Introduction to room division	3
2	S E Course 2	HAFA109L	Functional areas & cleaning agents	3
3	S E Course 3	HAIM214L	Introduction to marketing	3

HAIR108L: INTRODUCTION TO ROOMS DIVISIONS

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the history and classifications of hotel sector of hospitality and the organizational chart along with duties and responsibilities of various levels in room divisions.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the history of the Hospitality Industry and the core areas of rooms division and analyze its co-ordination with other departments. (Understand)

CO 2: Analyze the classification of hotels and the different types of guest rooms and accommodations. (Analyze)

CO 3: Develop the layout of front office/housekeeping, organizational chart, duties & responsibilities and personality traits of room division staff. (Create)

Module I: INTRODUCTION TO HOSPITALITY INDUSTRY & ROOMS DIVISION (06 hours)

Hospitality and its origin

Hotels, their evolution, and growth

A brief introduction to hotel core areas with special reference to Rooms Division

Coordination with other departments

Module II: CLASSIFICATION OF HOTELS AND HOTEL ROOMS (12 Hours)

Size

Star

Location & clientele

Ownership basis

Independent hotels

Management contracted hotel

Chains

Franchise/Affiliated

Supplementary accommodation

Time shares and condominium

Types of Guest Rooms

Module III: LAYOUT AND ORGANIZATIONAL CHART OF ROOM DIVISION (12 hours)

Layout of Front Office and Housekeeping department – Small, Medium & Large hotels

Organizational Chart of Housekeeping and Front Office – Small, Medium & Large hotels

Duties and responsibilities of staff

Personality Traits

Suggested Readings

Manoj Kr. Yadav, A Professional Guide to Rooms Division Operations, John Wiley & Sons, 2019

Colin Dix & Chirs Baird, Front office operations, Pearson, 2006.

James Bardi, Hotel Front office management, John Wiley & Sons, 2011.

Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.

Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III
CO 1	H		L
CO 2	L	H	
CO 3	L		H

HAIR108L: INTRODUCTION TO ROOMS DIVISIONS PRACTICAL

Objective(s):

The objective of the course is to learn the identification of various rooms along with hygiene standards and importance of communication and etiquettes.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the importance of hygiene standards and basic manners required for guest services. (Understand)

CO 2: Identify different equipment and furniture used in room division (Knowledge)

CO 3: Analyze & implement communication (verbal & non-verbal) for various guest services. (Analyze)

CO 4: Develop different types of guest rooms and identify the supplies and their positions.
(Create)

PRACTICAL

Basic Manners, Grooming & Hygiene Standards, its importance,
Room Division Communication (verbal/non-verbal) - Body language, Gestures, Facial expression, eye contact, voice

Identification of equipment and furniture used in rooms division.

Telephone etiquettes, Dialogues

Welcoming Guest

Escorting, Message handling, Familiarization with guest room.

Guest Room Supplies and Position

Layout of different types of guest room

Team Building

Mapping of COs to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	L		M	M	M				
CO 2			H				M	M	M	
CO 3		H		H	H	H		H		H
CO 4			L				H		H	

HAFA109L: FUNCTIONAL AREAS & CLEANING AGENTS

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn the basic concepts of rooms divisions which are very necessary for day to day smooth function in room division.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the basic functional areas of room division and outline the layouts of the areas. (Understand)

CO 2: Identify & recall and describe the entire guest cycle. (Knowledge)

CO 3: Analyze & elaborate on the basic concept of tariff decisions, pricing of rooms and meal plans. (Analyze)

CO 4: Develop & analyze the different types of cleaning techniques, cleaning equipments and cleaning agents along with their care and maintenance. (Create)

Module I: FUNCTIONAL AREAS & CLEANING AGENTS (8 hours)

Hotel Entrance, Lobby

Bell Desk

Reception Desk, Cashier

Concierge

Reservation

Telephone Operator

Housekeeping Control Desk

Linen Room, Uniform Room

Laundry

Florist Room

Layout of the areas

Module II: TARIFF (06 Hours)

Room tariff, Tariff fixation / calculating room tariff

Types of room tariff: Rack rate, discounted rates.

Meal Plan and its type

Forms & Format/ Tariff Card/Brochure

Module III: GUEST CYCLE (06 hours)

Pre-arrival, Arrival, Stay, Departure & Post Departure

Module IV: CLEANING AND CLEANING AGENTS USED IN HOTELS (10 Hours)

Principles of cleaning, hygiene, and safety factors in cleaning

Methods of organizing cleaning

Frequency of cleaning daily, periodic, special

Design features that simplify cleaning

Types of cleaning equipment

Types of cleaning agents

General Criteria for selection

Use, Care, and Storage

Distribution and Controls

Suggested Readings

1. Manoj Kr. Yadav, A Professional Guide to Rooms Division Operations, John Wiley & Sons, 2019

2. James Bardi, Hotel Front office management, John Wiley & Sons, 2011.

Sudhir Andrews, Front Office: A Training Manual, Tata McGraw Hill, 2011

Raghubalan, G. Hotel Housekeeping Operation, and Management, Oxford University Press, 2007.

Mapping of COs to Syllabus

CO'S	Module I	Module II	Module III	Module IV
CO 1	H			L
CO 2		M	H	
CO 3		H	L	
CO 4				H

HAFA109L: FUNCTIONAL AREAS & CLEANING AGENTS PRACTICAL**Objective(s):**

The objective of the course is to learn & demonstrate the use and maintenance of various cleaning agents & equipments and role play on various situations based on room divisions.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the different equipment and cleaning agents used in room division (Understand)

CO 2: Analyze the care and maintenance of cleaning equipment and cleaning agents (Knowledge)

CO 3: Analyze different functional areas of room division. (Analyze)

CO 4: Create & Demonstrate, role play on – bell desk operation, concierge operations, handling telephone & few cleaning procedure along with the forms and formats required to be filled (Create)

PRACTICAL

Expt. 1: Identification of equipment used in functional areas of room division

Expt. 2: Care and maintenance of the equipment

Expt. 3: Familiarization of cleaning agents according to classification

Expt. 4: Layout the various functional areas of room division – laundry, linen room, lobby

Expt. 5: Role play of bell desk operations

Expt. 6: Role play of Paging

Expt. 7: Role play of concierge operations

Expt. 8: Role play of handling telephone

Expt. 9: Room attendant trolley set up

Expt. 10: Fill forms and formats

Mapping of Cos to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	M	H						H	
CO 2		H	M							
CO 3				H	L	L	L	L		
CO 4		L			H	H	H	H	L	H

HAIM214L: INTRODUCTION TO MARKETING

(3 Credits: 45 hours) (L-T-P: 3-0-0)

Objective(s):

The objective of the course is to learn & demonstrate the use and maintenance of various cleaning agents & equipments and role play on various situations based on room divisions.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

CO 1: Understand the concept of marketing (Understand)

CO 2: Identify the consumer buying behavior (Knowledge)

CO 3: Analyze the market segmentation process (Analyze)

CO 4: Develop an understanding about marketing components (Create)

Module – I: Introduction to Marketing (07 hours)

Introduction

Market & Marketing

Marketing process

Concepts of marketing

Functions of marketing

Importance of marketing

Market orientations

Module – II: The Marketing Process (08 hours)

Introduction

4P's of marketing

Modern components of marketing mix (3P's)

Developing an effective marketing mix

Market planning

Market implementation and control

Module – III: Consumer Buying Behaviour (06 hours)

Introduction

Characteristics

Types of buying decision behaviour, Henry Assael Model, Consumer & buying decision and Process

Buyer decision process for new products

Buying motives & behaviour models

Module – IV: Business Buyer Behaviour (07 hours)

Introduction

Characteristics of business markets

Difference between consumer and business buyer behaviour

Buying situation in industrial / business market

Buying roles in industrial marketing
 Factors that influence business buyers
 Steps in business buying process

Module – V: Segmentation, Targeting & Positioning (08 hours)

Introduction
 Concepts of market segmentation
 Benefits of market segmentation
 Requisites of effective market segmentation
 Process of market segmentation
 Bases of segmenting consumer markets
 Targeting, Market positioning, Advertising and sales promotion
 Sales force management

Suggested Readings:

Kotlar, Phillip, Marketing Management, Prentice Hall, New Delhi
 Stanton, Etzel, Walker, Fundamentals of Marketing, Tata-McGraw Hill, New Delhi
 Saxena, Rajan, Marketing Management, Tata-McGraw Hill, New Delhi
 McCarthy, E.J, Basic Marketing: A managerial approach, Irwin, New Delhi

Mapping of CO's to syllabus

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M		L	H
CO 2			H	H	
CO 3					H
CO 4	M	H		L	

INTERNSHIPS

Semes-ter	Category	Course Code	Course Name	Credits
2	Internship	HABV110I	Basic Vocational Training	4
4	Internship	HASV215I	Specialization Vocational Training	4
5	Internship	HAIP301P	Internship	2

VOCATIONAL TRAINING –I **

Note: If the student wants to discontinue the program of “B.sc in Hospitality & Hotel Administration” after 1st year of study, then the student have to undergo a vocational training to get the “certificate” in the same program.

HABV110I: BASIC VOCATIONAL TRAINING

(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective(s):

The objective of the course is to complete the training program of 2 months and prepare the training report which was learned during the training exposure and also completes the log book.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

- CO 1: Understand and analysis to the practical experience and actual working environment for developing their skills and capabilities, as well as enhancing their intellectual and emotional persona. (Understand)
- CO 2: Identify & integrate classroom theory with workplace practice. (Knowledge)
- CO 3: Analyze& gain an understanding of administrative functions and company culture. (Analyze)
- CO 4: Develop skills to demonstrate various activities of all the core departments. (Create)

Module I - TRAINING EXPOSURE SUMMARY (50 hours)

The 08 weeks of vocational training would be from any two key areas of hospitality such as Food Production, Food and Beverage Service, Accommodation Operation, and Front Office Operations and student has to collect information's which will be needed to them during compiling of the training report.

Module 2 - TRAINING REPORT (40 hours)

During the training report the students has to complete the training report which will includes the details of the training organization, there USP, facilities of the various department
The outcome and experience they gain from the training

Module 3 - LOG BOOK (30 hours)

During the training the student has to duly sign the log book from the departmental authorities as a proof of their experience and learning skills from the specific department.

Mapping of Cos to Syllabus

	Module I	Module 2	Module 3
CO 1	H	H	M
CO 2	M	M	H
CO 3	M	L	L
CO4	H	M	M

VOCATIONAL TRAINING - II**

Note: If the student wants to discontinue the program of "B.sc in Hospitality & Hotel Administration" after 2nd year of study, then the student have to undergo a vocational training to get the "Diploma" in the same program.

HASV215I: SPECIALIZATION VOCATIONAL TRAINING

(4 Credits – 120 hours) (L-T-P: 0-0-4)

Objective(s):

The objective of the course is to complete the training program of 2 months and prepare the training report which was learned during the training exposure and also completes the log book.

COURSE / LEARNING OUTCOMES:

At the end of this course student will be able to:

- CO 1: Understand and analysis to the practical experience and actual working environment for developing their skills and capabilities, as well as enhancing their intellectual and emotional persona. (Understand)
CO 2: Identify & integrate classroom theory with workplace practice. (Knowledge)
CO 3: Analyze& gain an understanding of administrative functions and company culture. (Analyze)
CO 4: Develop skills to demonstrate various activities of all the core departments. (Create)

Module I - TRAINING EXPOSURE SUMMARY (50 hours)

The 08 weeks of vocational training would be from the hospitality organization for the one key area such as Food Production, Food and Beverage Service, Accommodation Operation, and Front office Operations and student has to collect information's which will be needed to them during compiling of the training report.

Module 2 - TRAINING REPORT (40 hours)

During the training report the students has to complete the training report which will includes the details of the training organization, there USP, facilities of the various department
The outcome and experience they gain from the training

Module 3 - LOG BOOK (30 hours)

During the training the student has to duly sign the log book from the departmental authorities as a proof of their experience and learning skills from the specific department.

Mapping of Cos to Syllabus

	Module 1	Module 2	Module 3
CO 1	H	H	M
CO 2	M	M	H
CO 3	M	L	L
CO4	H	M	M

RESEARCH PROJECT /DISSERTATION

B.sc HHA (Honours)				
Semes-ter	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	HHRP401P	Research Project Phase I	6
8	Research Project/Dissertation	HHRP402P	Research Project Phase II	6
B.sc HHA (Honours) with Research				
Semes-ter	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	HADI411P	Dissertation I	18
8	Research Project/Dissertation	HADI412P	Dissertation II	20

B.sc Hospitality & Hotel Administration (Honours)**HHRP401P: RESEARCH PROJECT PHASE I****(6 credits – 180 hours) (L-T-P: 0-0-12)**

The Research Project for the **B.Sc. Hospitality & Hotel Administration** program is an extended academic inquiry that enables students to analyse and interpret existing literature, identify gaps, and contribute innovative ideas relevant to the hospitality sector. **Phase I** requires students to prepare and present the Project Title, Review of Related Literature, Research Objectives, Research Questions or Hypotheses, and the Proposed Methodology, ensuring a clear conceptual foundation for the study. Assessment for this phase is based on a formal presentation followed by a Viva Voce examination, carrying a total of **100 marks**, and evaluates the student's clarity in defining the problem, depth of literature engagement, logical structuring of objectives and methodology, and overall ability to justify and defend the proposed research.

HHRP402P: RESEARCH PROJECT PHASE II**(6 credits – 180 hours) (L-T-P: 0-0-12)**

The Research Project for the **B.Sc. Hospitality & Hotel Administration** program is an extended academic study that guides students in analysing a research question through critical interpretation of existing literature and original inquiry. **Phase II** requires students to present the complete research work, including data analysis, interpretation of findings, conclusion, study limitations, and future research directions, demonstrating their ability to connect empirical results with theoretical frameworks in hospitality. The assessment for this phase consists of a comprehensive presentation followed by a Viva Voce examination, carrying **100 marks**,

evaluating the quality of analysis, clarity of interpretation, depth of critical thinking, and the student's ability to defend the overall research outcomes.

B.sc Hospitality & Hotel Administration (Honours) with Research

PCDI411P: DISSERTATION I

(18 Credits -540 Hours) (L-T-P: 0-0-36)

Every student enrolled in the B.Sc. Hospitality & Hotel Administration program shall undertake a research project under the supervision of an assigned faculty mentor. Students may select their research topic and begin preliminary groundwork by the end of the second semester. During Phase I, they are required to complete the Literature Review and present both the Literature Review and the Research Proposal. Students must also initiate data collection as per their approved methodology. The Phase I report must be submitted to the department within the notified deadline. The Department will publish the mode of evaluation, components, and weightages for Phase I and Phase II (Full Marks: 100 each) at the beginning of the semester. The assessment for the research project will include a PowerPoint presentation of the work followed by a Viva Voce examination.

PCDI412P: DISSERTATION II

(20 Credits -600 Hours) (L-T-P: 0-0-40)

Every student of the **B.Sc. Hospitality & Hotel Administration** program shall undertake a research project under the supervision of a designated faculty mentor. Students may select their research topic and are expected to begin preliminary work by the end of the **7th semester**. During **Phase I**, they must complete the Literature Review and present both the Literature Review and the Research Proposal, along with completing data collection within the same semester. **Phase II** of the dissertation is ideally carried out during the **8th semester**, culminating in the submission of the thesis to the department within the notified deadline. The Department will publish the evaluation structure, components, and weightages for **Phase I (100 marks)** and **Phase II (100 marks)** at the beginning of the semester. The final assessment will include a PowerPoint presentation of the research followed by a Viva Voce examination.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

**PROGRAMME: BACHELOR OF TECHNOLOGY (BTECH) – ARTIFICIAL INTELLIGENCE AND
MACHINE LEARNING**

****COURSE STRUCTURE (NEP BATCH 2024)***

SEMESTER I						
Type	Type of Course/ Category	Course Code	Course Title	L-T-P	Cred- its	Page No
Theory	Humanities and Social Science	EGTW107T	English for Technical Writing	2-0-0	2	906
Lab	Humanities and Social Science	EGOP108L	Oral Communication Practice Lab	0-0-2	1	907
Theory	Basic Science	MAMT115T	Mathematics-I	3-0-0	3	907
Theory	Basic Science	PSPH113T	Physics	3-1-0	3	908
Lab	Basic Science	PSPH114L	Physics Lab	0-0-2	1	909
Theory	Basic Science	MAAI116T	Mathematical Concepts for AI	2-1-0	3	910
Theory	Basic Science	CHCY120T	Chemistry	3-0-0	3	911
Lab	Basic Science	CHCY119L	Chemistry Lab	0-0-2	1	913
Theory	Engineering Sci- ence	CSPP102T	Programming and Problem Solv- ing	3-0-0	3	915
Lab	Engineering Sci- ence	CSPP103L	Programming and Problem Solv- ing Lab	0-0-2	1	916
Theory	Engineering Sci- ence	CSDT104T	Design Thinking and Idea Lab	1-0-0	1	916
	Mandatory Course	BTUH0001	Universal Human Values I: Stu- dent Induction Program	0-0-0	NC	918
Total Credits					22	
SEMESTER II						
Theory	Basic Science	MAMT117T	Mathematics-II	3-1-0	4	918
Theory	Engineering Sci- ence	CSOP105T	Object Oriented Programming	3-0-0	3	919
Theory	Engineering Sci- ence	CSDS106T	Data Structures	3-0-0	3	921
Theory	Engineering Sci- ence	CSDM107T	Discrete Mathematical Structures	3-1-0	4	
Theory	Engineering Sci- ence	CSMC108T	Modern Computer Architecture	3-0-0	3	923
Lab	Engineering Sci- ence	CSOP109L	Object Oriented Programming Lab	0-0-2	1	920
Lab	Engineering Sci- ence	CSDS110L	Data Structures Lab	0-0-2	1	922
Audit			Constitution of India	0-0-0	NC	
	Humanities and Social Science	BTUH0002	Universal Human Values II : un- derstanding Harmony and Ethical Human Conduct	2-1-0	3	925
			Internship for regular stu- dents/Intyernship for exit stu- dents			

Total Credits					22	
Skill based internship for exit students					6	
SEMESTER III						
	Professional Core		Algorithm Analysis and Design	3-0-0	3	927
	Professional Core		Database Systems	3-0-0	3	929
	Professional Core		Computer Networks	3-0-0	3	930
	Professional Core		Introduction to Machine Learning	3-0-0	3	932
	Professional Core		Artificial Intelligence	3-1-0	4	933
	Professional Core		Algorithm Analysis and Design Lab	0-0-2	1	929
	Professional Core		Database Systems Lab	0-0-2	1	930
	Professional Core		Computer Networks Lab	0-0-2	1	931
	Professional Core		Introduction to Machine Learning Lab	0-0-2	1	933
Audit			Wadhani Foundation Course on Entrepreneurship	0-0-0	NC	
			Internship Activity (Internship credit transfer from 2 nd semester for regular students)		1	
Total Credits					21	
Any one course from following options can be opted under "Open Elective-I"						
1. Internet of Thing (IoT) 2. Robotics						
Semester IV						
	Professional Core		Theory of Computation	3-1-0	4	937
	Professional Core		Software Engineering	3-0-0	3	938
	Professional Core		Deep Learning	3-0-0	3	940
	Professional Core		Operating System	3-0-0	3	941
	Professional Core		Theory of computation Ecosystems	3-0-0	3	942
	Professional Core		Minor Project	3-0-0	3	
	Basic Science		Environmental Science	3-0-0	0	
	Professional Core		Software Engineering Lab	0-0-2	1	939
	Professional Core		Deep Learning Lab	0-0-2	1	941
	Professional Core		Operating System Lab	0-0-2	1	942
Audit			Indian Knowledge System	2-0-0	2	
			Internship for regular students/ internship for exit students			
Total Credits					24	
Skill based internship for exit students					6	
Semester V						
	Professional Core		Data and Visual analytics in AI	3-0-0	3	946
	Professional Core		Natural Language Processing	3-0-0	3	947
	Professional Core		Advanced Machine Learning	3-0-0	3	949
	Professional Core		Optimization Techniques in Machine Learning	3-1-0	4	949
	Professional Core		Minor Project	--	3	951
	Professional Core		Data and Visual analytics in AI lab	0-0-2	1	952

	Professional Core		Natural Language Processing lab	0-0-2	1	952
	Professional Core		Advanced Machine Learning lab	0-0-2	1	953
			Internship Credit from 4 th semester for regular students		2	
Total Credits					21	
Semester VI						
			Industry / Research Lab Internship		16	954
	Internship Option		Alternate option			
	Within India or Abroad(MITACS/DAAD/ Any other aligned with GOI schemes)		Alternatively, Courses can also be offered from Open Electives/Professional Electives			
	To enhance hands-on skills (As per NEP 2020)		Two Course of 3 credits each and one Major project for 10 credits			
	Refer Appendix-IV for some suggested Internships		Students may opt for a virtual internship along with courses			
Total Credits					16	
Skill base dinternship for exit students					6	
Semester VII						
	Professional Core		Soft Computing	3-0-0	3	959
	Professional Elective		Professional Elective-I	3-0-0	3	954
	Professional Elective		Professional Elective-II	3-0-0	3	956
	Professional Elective		Open Elective-I	3-0-0	3	
	Professional Core		Soft Computing Lab	0-0-2	1	969
	Professional Elective		Professional Elective-I Lab	0-0-2	1	
	Professional Elective		Professional Elective-II Lab	0-0-2	1	
	Professional Core		Capstone Project (Part-I)		6	
			Wadhani Foundation Course on Employability	0-0-0	0	
Total Credits					21	
Any one course from following options can be opted under “Open Elective-I” 1. Machine Learning with Python 2. AI for Everyone						
Semester VIII						
	Professional Elective		Professional Elective-III	3-0-0	3	
	Professional Elective		Professional Elective-IV	3-0-0	3	
	Professional Elective		Professional Elective-III Lab	0-0-2	1	
	Professional Elective		Professional Elective-IV Lab	0-0-2	1	
	Professional Core		Capstone Project (Part-II)	-	10	
			Open Elective -II		3	
Any one course form the following options can be opted under Open elctive –II Internet of Things (IoT)- (OE001) Robotics (OE002)						

Total Credits		21	
Total Credits	168		

****Undergraduate Degree Course Structure Based on AICTE Model Curriculum 2024 (Subject to Change)****

Main emphasis should be on Project Based Learning / Experiential Learning.

There should be an option to delay internship semester to 7th/ 8th Semester as per institute convenience and availability of internship slots for different group of students.

SEMESTER-I

CSXXXXXX: English for Technical writing
(2 credits - 30 Hours)

Course Objective

The main aim of the course is to build competence in English grammar and vocabulary and to enhance effective communication by developing Reading, Writing, Listening, and Speaking skills of students.

Course Outcomes:

After completion of the course, students would be able to:

- CO 1. Understand various technical writing skills.
- CO 2. Apply the technical writing and communication skills in their academic and professional life.
- CO 3. Gain self-confidence with improved command over English.
- CO 4. Understand the technical aspects of communication for better performance in extra-curricular activities, recruitment processes, and prospective jobs.

Module 1: Fundamentals of Communication Skills

Scope and Significance of Communication Skills, Listening, Speaking, Reading, and Writing, Technical Communication, Tools of Effective Communication.

Module 2: Writing Skills

Basics of Grammar – Placing of Subject and Verb, Parts of Speech, Uses of Tenses, Active-Passive, Narration.

Module 3: Vocabulary Building and Writing

Word Formation & Synonyms, Antonyms, Words Often Confused, One-Word Substitutes, Idioms and Phrasal Verbs, Abbreviations of Scientific and Technical Words.

Module 4: Speaking Skills

Introduction to Phonetic Sounds & Articulation, Word Accent, Rhythm and Intonation, Interpersonal Communication, Oral Presentation, Body Language and Voice Modulation (Paralinguistics and Non-Verbal), Negotiation and Persuasion, Group Discussion, Interview Techniques (Telephonic and Video Conferencing).

Module 5: Technical Writing

Job Application, CV Writing, Business Letters, Memos, Minutes, Notices, Report Writing & Structure, E-mail Etiquette, Blog Writing.

Suggested Readings:

The Essence of Effective Communication, Ludlow R. and Panton F., Pubs: Prentice Hall, 1992.

Effective Communication Skills, Kulbhushan Kumar, Khanna Publishing House, 2019.

A University Grammar of English, Quirk R. and Sidney G., 3rd Edition, Pubs: Pearson Education, 2008.

High School English Grammar, Wren and Martin, Pubs: S. Chand & Company Ltd, 2007.

Essentials of Business Communication, Guffrey M.E., 8th Edition, Pubs: South-Western College Publishing, 2009.

Technical Communication: Principles and Practice, Raman M. and Sharma S., 2nd Edition, Pubs: Oxford University Press, 2012.

Effective Business Communication, Rodrigues M.V., Pubs: Concept Publishing Company, Delhi, 2003.

English Vocabulary in Use, McCarthy M. and Felicity O'Dell, 2nd Edition, Pubs: 2010.

**CSXXXXXX: Oral Communication Practice Lab
(1credit-15Hours)**

Laboratory/Practicals:

Introducing Oneself, Exercise on Parts of Speech & Exercise on Tense.

Exercise on Agreement, Narration, Active-Passive Voice & Dialogue Conversation.

Exercise on Writing Skills and Listening Comprehension (Audio CD).

Practice of Phonemes, Word Accent, Intonation, JAM Session.

Individual Presentation, Extempore, and Picture Interpretation.

Vocabulary Building Exercises (One-Word Substitute, Synonyms, Antonyms, Words Often Confused, etc.) & Group Discussion.

AlternativeNPTEL/SWAYAMCourse:

S.No.	NPTELCourseName	Instructor	HostInstitute
1.	Communication Skills-Video course	Dr.T. Ravichandran	IIT Kanpur
2.	Communication Skills	Dr. Zuchamo Yanthan	Indira Gandhi National Open University

**MAMT115T: Mathematics I
(4credits-60Hours)**

Course Objective:

To make the students well versed with the concepts of linear algebra. The students should also be able to solve calculus and vector calculus-based problems.

Course Outcomes:

After completion of course, students would be able to:

CO 1: Recall and analyse the idea of basic algebra. (Remembering and analysing)

CO 2: Understand and apply calculus and multivariate calculus. (Understanding and applying)

CO 3: Understand and apply vector calculus. (Understanding and applying)

CO 4: Understand and apply differential equations. (Understanding and applying)

Detailed Contents:**Module 1: Linear Algebra** (12 Hours)

Vector spaces, Subspaces, basis and dimension, linear transformations, representation of transformations by Matrices, linear functionals, transpose of linear transformations, canonical forms.

Module 2: Vector Calculus (8 Hours)

Applications. Integrals of Vector Functions: Line integrals, Green's formula, path independence, Surface integral: definition, evaluation, Stoke's formula, Gauss-Satoransky divergence theorem.

Module 3: Calculus & Multivariate Calculus (12 Hours)

Continuity and differentiability of a function of single variable, statement of Rolle's Theorem, Lagrange's mean value theorem and applications. Double and Triple Integrals: Calculations, Areas, Volumes, change of variables. Integral Calculus: Definite Integrals as a limit of sums, Applications of integration to area, volume, surface area, Improper integrals.

Module 4: Differential Equations (8 Hours)

Ordinary Differential Equations: First order linear equations, Bernoulli's equations, Exact equations and integrating factor, Second order and Higher order linear differential equations with constant coefficients

Alternative NPTEL/SWAYAM Course (if any):

NPTEL Course Name: Basic calculus for Engineers, Scientists and Economists

Instructor: Prof. Joydeep Dutta

Host Institute: IIT Kanpur

Text Books/Suggested References:

1. G. B. Thomas, R. L. Finney. Calculus and Analytic Geometry, Ninth Edition, Pearson Education, 2010
2. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Co., Delhi.
3. B. V. Ramana. Higher Engineering Mathematics, Tata McGraw Hill, 2017
4. E. Kreyszig. Advanced Engineering Mathematics, Wiley, 2015
5. Calculus and Analytic Geometry, G. B. Thomas and R. L. Finney, Pearson Education, 2010

Mapping Cos to the syllabus

COs	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		M	H	M
CO3		H	M	
CO4		M		H

CSXXXXXX: Physics

(2credits-30Hours)

Course Objective:

This course will help the students to familiarize with Ultrasonics, SHM, Oscillations, Wave motion, diffraction, polarization, laser, fiber optics and holo graphy concepts.

Course outcomes: After completion of course, students would be able to:

CO 1. Understand the latest developments in certain areas of Physics which have important applications for societal needs.

CO 2. Understand lasers and fiber optics, which have important applications for societal needs.

CO 3. Understand the latest developments in certain areas of Physics which have important applications for societal needs.

CO 4. Develop the capability to tackle problems in general and in the various areas covered in the course.

Module1:Ultrasonics & SH

Production, Detection, and Uses of Ultrasonics, Reverberation, Sabine's Formula (no derivation), Review of Basic Kinematics (Displacement, Velocity, Acceleration, Time Period, and Phase of Vibration) and Dynamics (Restoring Force and Energetics) of Simple Harmonic Motion, Differential Equation of SHM, Superposition of Two SHM in One Dimension, Charge Oscillations in LC Circuits.

Module2:Oscillations

Damped Oscillations: Concept and cause of damping, differential equation of a damped oscillator and different kinds of damping, Methods of describing damping of an oscillator – logarithmic decrement, relaxation time, quality factor, band width. Series LCR circuit as a damped oscillator. Forced Oscillations: States of forced oscillations, differential equation of forced oscillator – its displacement, velocity and impedance, behavior of displacement and velocity with driver's frequency, Power, bandwidth, Quality factor and amplification of forced oscillator, resonance in forced oscillators, forced oscillations in series LCR circuit

Module3:WaveMotionandinterference

Wave equation and its solution, characteristic impedance of a string, reflection and transmission of waves on a string at a boundary, reflection and transmission of energy, the matching of impedances, Division of wave front and amplitude; Fresnel's bi prism, Newton's rings, Michelson interferometer and its applications for determination of λ and $d\lambda$.

Module4:Diffraction&Polarization

Fresnel and Fraunhofer diffraction, qualitative changes in diffraction pattern on moving from single slit to double slit, plane transmission grating, dispersive power & resolving power of a grating, Methods of polarization, analysis of polarized light, quarter and half wave plates, double refraction.

Module5: Lasers, Fiber Optics and Holography

Elementary Idea of LASER Production, Spontaneous Emission, Stimulated Emission, Einstein's Coefficients, Helium-Neon, Ruby, and Semiconductor Lasers, Applications of Lasers. Basics of Optical Fiber – Its Numerical Aperture, Coherent Bundle, Step Index and Graded Index Fiber, Material Dispersion, Fiber Optic Sensors, Applications of Optical Fiber in Communication Systems. Holography: Basic Principle, Theory, and Requirements.

Suggested Readings

Engineering Physics by A.B. Bhattacharya, Khanna Publishing House, 2020.

Physics for Engineers by N.K. Verma, Prentice Hall India, 2017.

Physics of Vibrations and Waves by H.J. Pain, 5th Edition, Wiley, 2006.

Optics by Ajoy Ghatak, McGraw Hill Education India, 2017.

CSXXXXXX: Physics Lab (1credit-15Hours)

Laboratory/Practicals:

To find the wavelength of sodium light using Fresnel's biprism.

To determine the wavelength of He-Ne laser using a transmission grating.

To determine the slit width using the diffraction pattern.

To determine the wavelength of sodium light by Newton's rings method.

To determine the wavelength of sodium light using a diffraction grating.
 To find the specific rotation of a sugar solution using a Bi-quartz Polarimeter.
 To design a hollow prism and use it to find the refractive index of a given liquid.

Alternative NPTEL/SWAYAM Course(if any):

S.No.	NPTEL Course Name	Instructor	HostInstitute
1.	Classical Physical	Prof.V.Balakrishnan	IIT Madras
2.	Modern Optics	Prof.ParthaRoyChaudhuri	IIT Kharagpur

MAAI116T: Mathematical Concepts for AI
(4credits-60Hours)
Course Objective:

This course should help the students understand the basic mathematical background of AI. Also, the students should be able to apply statistics and probability to analyse various datasets.

Course outcomes:

After completion of course, students would be able to:

CO 1: To understand the mathematical background of AI. (Understanding)

CO 2: Understand and apply calculus. (Understanding and applying)

CO 3: Relate the essential tool of matrices and algebra in a comprehensive manner. (Analysing)

CO 4: Apply the concept of probability and statistics in real life and apply hypothesis testing on different datasets. (Applying)

Detailed contents:**Module 1: Equations, Functions and Graphs (8 Hours)**

Introduction to linear equations, Intercepts and slopes, System of equations, Exponentials, radicals and logarithms, Polynomials, Polynomial operations, Factorizations, Introduction to quadratic equations, Functions

Module 2: Derivatives and Optimizations (8 Hours)

Rate of change, Introduction to limits, Continuity, finding limits, Differentiability, Derivative rules and operations, using derivatives to analyse functions, Second order derivatives, Optimization functions, Multivariate differentiation

Module 3: Vectors and Matrices (12 Hours)

Introduction to vectors, Vector addition, vector multiplication, Introduction to matrices, matrix multiplication, properties of matrices, types of matrices, Matrix division, solving system of equations with matrices, Matrix transformations, Eigen values and eigen vectors, rank of matrix; Echelon form, Normal form, Gauss-Jordan method, Gauss elimination method, Eigenvalues and eigenvectors.

Module 4: Probability and Statistics (12 Hours)

Basic rules and axioms events, sample space, dependent and independent events, conditional probability, Random variables- continuous and discrete, expectation, variance, distributions- joint and conditional, Bayes' Theorem, Popular distributions- binomial, Bernoulli, Poisson.

Alternative NPTEL/SWAYAM Course (if any):

NPTEL Course Name: Essential Mathematics for Machine Learning

Instructor: Prof. Sanjeev Kumar, Prof. S. K. Gupta

Host Institute: IIT Roorkee

Text Books/Suggested References:

1. Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Cambridge University Press., 2020
2. Advanced Engineering Mathematics, Reena Garg, Khanna Book Publishing Co., Delhi.
3. Machine Learning, Rajiv Chopra, Khanna Book Publishing Co., Delhi.
4. Introduction to Applied Linear Algebra: Vectors, Matrices, and Least Squares, Stephen Boyd, Lieven Vandenberghe, Cambridge University Press., 2018
5. Probability and statistics for Engineers and Scientists, Walpole, Myers, Myers and Ye, Pearson Education, 2012
6. Advanced Engineering Mathematics, Wylie and Barrett, McGraw Hill, 1995
7. <https://www.udemy.com/course/mathematical-foundation-for-machine-learning-and-ai/>

Mapping Cos to the syllabus

COs	Module 1	Module 2	Module 3	Module 4
CO1	L	M	M	M
CO2	L	H		
CO3			H	
CO4				H

Alternative NPTEL/SWAYAM Course(if any):

S.No.	NPTEL Course Name	Instructor	Host Institute
1.	Essential Mathematics for Machine Learning	Prof. Sanjeev Kumar Prof .S. K. Gupta	IIT Roorkee

CSXXXXXX: Chemistry
(3credits-45Hours)

Course Objective: The student with the knowledge of the basic chemistry, will understand and explain scientifically the various chemistry related problems in the industry/engineering field. The student will be able to understand the new developments and breakthroughs efficiently in engineering and technology. The introduction of the latest (R&D oriented) topics will make the engineering student upgraded with the new technologies.

Course Outcomes: The course will enable the students:

- CO 1.** To analyze microscopic chemistry in terms of atomic and molecular orbitals and inter-molecular forces.
- CO 2.** To rationalize bulk properties and processes using thermodynamic considerations.
- CO 3.** To distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- CO 4.** To rationalize periodic properties such as ionization potential, electro negativity, oxidation states, and electro negativity.
- CO 5.** To list major chemical reactions that are used in the synthesis of molecules.

ModuleI: Atomic and Molecular Structure

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nano particles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbit also f di atomic molecules and plots of them

Multicentre Orbitals. Equations for atomic and molecular orbitals. Energy Level Diagrams of Diatomic Molecules. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal Field Theory and the energy level diagrams for transition metal ions and their magnetic properties. Band Structure of Solids and the role of doping on band structures

ModuleII: Spectroscopic techniques and applications

Principles of Spectroscopy and Selection Rules. Electronic Spectroscopy. Fluorescence and Its Applications in Medicine. Vibrational and Rotational Spectroscopy of Diatomic Molecules. Applications. Nuclear Magnetic Resonance and Magnetic Resonance Imaging. Surface Characterization Techniques. Diffraction and Scattering.

ModuleIII: Inter molecular forces and potential energy surfaces

Ionic, Dipolar, and van der Waals Interactions. Equations of State of Real Gases and Critical Phenomena. Potential Energy Surfaces of H_3 , H_2F , and HCN and Trajectories on These Surfaces.

Module IV: Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy, and free energy. Estimations of entropy and free energies. Free energy and electromotive force (emf). Cell potentials, the Nernst equation, and applications. Acid-base, oxidation-reduction, and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

ModuleV: Periodic properties

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electro negativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries.

Module VI: Stereochemistry

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds.

Module VII: Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Readings

University chemistry, by B. H. Mahan

Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane

Fundamentals of Molecular Spectroscopy, by C. N. Banwell

Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan

Physical Chemistry, by P. W. Atkins

Organic Chemistry: Structure and Function by K. P. C. Vollhardt and N. E. Schore, 5th Edition <http://bcs.whfreeman.com/vollhardtschore5e/default.asp>.

Alternative NPTEL/SWAYAM Course:

S.No.	NPTEL Course Name	Instructor	Host Institute
1	CHEMISTRY-I	PROF.MANGALASUNDER KRISHNAN	IITM

CSXXXXXX: Chemistry Lab
(1credit-15Hours)

Laboratory Outcomes: The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn:

- CO 1.** To estimate rate constants of reactions from concentration of reactants/products as a function of time.
CO 2. To measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc.
CO 3. To synthesize a small drug molecule and analyze a salt sample.

Laboratory/Practicals:

Choice of 10-12 experiments from the following:

Determination of Surface Tension and Viscosity.
 Thin Layer Chromatography.
 Ion Exchange Column for Removal of Hardness of Water.
 Determination of Chloride Content of Water.
 Colligative Properties Using Freezing Point Depression.
 Determination of the Rate Constant of a Reaction.
 Determination of Cell Constant and Conductance of Solutions.
 Potentiometry - Determination of Redox Potentials and EMFs.
 Synthesis of a Polymer/Drug.
 Saponification/Acid Value of an Oil.
 Chemical Analysis of a Salt.
 Lattice Structures and Packing of Spheres.
 Models of Potential Energy Surfaces.
 Chemical Oscillations - Iodine Clock Reaction.
 Determination of the Partition Coefficient of a Substance Between Two Immiscible Liquids.
 Adsorption of Acetic Acid by Charcoal.
 Use of the Capillary Viscometer to Demonstrate the Isoelectric Point as the pH of Minimum Viscosity for Gelatin Sols and/or Coagulation of the White Part of Egg.

EXPERIMENTS THAT MAY BE PERFORMED THROUGH VIRTUAL LABS:

S.No.	ExperimentName	ExperimentLink(s)
1	Determination of surface tension and viscosity.	http://pcv-au.vlabs.ac.in/physical-chemistry/Determination_of_Viscosityof_Organic_Solvents/
2	Ion exchange column for removal of hardness of water.	http://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis_Determination_of_Chemical_Parameters/

3	Determination of chloride content of water.	http://vlabs.iitb.ac.in/vlabs-dev/labs/nitk_labs/Environmental_Engineering_1/experiments/determination-of-chloride-nitk/simulation.html
4	Colligative properties using freezing point depression.	http://pcv-au.vlabs.ac.in/physical-chemistry/Cryoscopy/
5	Determination of the rate constant of a reaction.	http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
6	Determination of cell constant and conductance of solutions.	http://icv-au.vlabs.ac.in/inorganic-chemistry/Water_Analysis_Determination_of_Physical_Parameters/
7	Potentiometry-determination of redox potentials and emfs.	http://pcv-au.vlabs.ac.in/physical-chemistry/EMF_Measurement/
8	Saponification/acid value of an oil.	http://biotech01.vlabs.ac.in/bio-chemistry/Estimation_of_Saponification_Value_of_Fats_or_Oils/
9	Lattice structures and packing of spheres.	https://vlab.amrita.edu/?sub=1&brch=282&sim=370&cnt=1

CSxxxxxx: PROGRAMMING FOR PROBLEM SOLVING**(3 credits-45 Hours)****Course Objectives****Course Outcomes**

Define and describe various terms and concepts of C programming language (Remembering)
 Compare and interpret information based on their understanding of the concepts of C language syntax, data types, control statements, functions, pointers, arrays, structures, files, graphics and hardware programming using C. (Understanding)
 Solve problems using standard algorithms and translate pseudo-codes into C programs and implement them. (Applying)
 Analyze their skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. (Analyze)
 Combine the various concepts and ideas learnt in C to plan, propose and develop a product. (Creating)
 Evaluate various algorithms used for searching, sorting etc., in terms of correctness and computation cost. (Evaluate)

Module I (8 Hours)

Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), and Idea of Algorithm: steps to solve logical and numerical problems. Types of Algorithm: Sequentially executed, Conditional Based, repetitive structure, Representation of Algorithm: Flowchart/Pseudo code with examples, from algorithms to programs; source code, variables (with data types) variables and memory, locations, Syntax and Logical Errors in compilation, object and executable code.

Module II (12 Hours)

Operators, precedence of operators, Arithmetic expressions, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Module III (5 Hours)

Arrays, Arrays (1-D, 2-D), Character arrays and Strings

Module IV (5 Hours)

Basic Algorithm Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module V (8 Hours)

Functions (including built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion.

Module VI (7 Hours)

Structures, Defining structures and Array of Structures, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), File handling.

Suggested Readings

Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M				
CO2			H			H
CO3	H	H				
CO4	L				H	H

CO5				H		
CO6	L			H		

CSxxx: PROGRAMMING FOR PROBLEM SOLVING LAB
(2 credits)

Course Outcomes

Relate the programming logic (Remembering)

Illustrate the theoretical concepts learnt in C programming language. (Understanding)

Apply existing algorithms in writing programs using C language and also do graphics programming. (Applying)

Analyze their skills for choosing the right data structure, functions, data types and develop logic to write programs in C. (Analyzing)

Evaluate the sorting and searching algorithms through implementation in terms of correctness and computation cost. (Evaluating)

Combine the various concepts and ideas learnt in C to plan, propose and develop a product. (Creating)

Mapping of COs to Syllabus

Course Outcomes	M1	M2	M3	M4	M5	M6
CO1	H				L	
CO2	H	H				
CO3				H	M	
CO4	L				H	H
CO5	M	L		H		
CO6			H		H	M

CSXXXXXX: Design Thinking
(1 credit-15Hours)

Course Objective:

The objective of this Course is to provide the new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student in preparing for an engineering career.

Course Outcomes: After completion of course, students would be able to:

Compare and classify the various learning styles and memory techniques and Apply them in their engineering education

Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products

Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products

Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development

Perceive individual differences and its impact on every day decisions and further Create a better customer experience

Unit 1: An Insight to Learning

Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting

Unit 2: Remembering Memory

Understanding the Memory process, Problems in retention, Memory enhancement techniques

Unit 3: Emotions: Experience & Expression

Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

Unit 4: Basics of Design Thinking

Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – **Empathize, Define, Ideate, Prototype, Test**

Unit 5: Being Ingenious & Fixing Problem

Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving

Unit 6: Process of Product Design

Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, **Assignment–Engineering Product Design**

Unit 7: Prototyping & Testing

What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, **Sample Example**, Test Group Marketing

Unit 8: Celebrating the Difference

Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

Unit 9: Design Thinking & Customer Centricity

Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design

Unit 10: Feedback, Re-Design & Re-Creat

Feedback loop, Focus on User Experience, Address “ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – **“Solving Practical Engineering Problem through Innovative Product Design & Creative Solution”**.

Suggested Readings

M. Morris Mano, Computer System & Architecture, Prentice Hall of India, 2002.
 John L. Hennessy and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann/Elsevier, 4th Edition, 2007.
 Hayes, J. P., Computer Architecture and Organization by McGraw-Hill Companies, 1998
 Parallel Computer Architecture: A Hardware/Software Approach David Culler and J. P. Singh with Anoop Gupta, Morgan Kaufmann, 1998.
https://onlinecourses.nptel.ac.in/noc20_cs41/preview
<https://www.coursera.org/learn/introduction-high-performance-computing#syllabus>

Alternative NPTEL/SWAYAM Course (if any):

S.No.	Course Name	Instructor	Host Institute
1.	COMPUTER ARCHITECTURE	PROF. SMRUTIRANJAN SARANGI	IIT Delhi
2.	ADVANCED COMPUTER ARCHITECTURE	PROF. JOHN JOSE	IIT Guwahati

CSXXXXXX: Universal Human Values I: Student Induction Program

SEMESTER-II

**CSXXXXXX: Mathematics II
(4 credits-60 Hours)**

Course Objective:

To make the students understand the behaviour of various series. They should also be able to calculate probabilities and statistics of different datasets.

Course Outcomes: After completion of course, students would be able to:

Understand the behavior of series and their applications.

Understand number system and its applications.

Understand the concept of probability and apply in real life.

Understand and apply the concept of statistics.

Module 1: Sequences and Series

Limit of a sequence, monotone and Cauchy sequences and properties of convergent sequences, examples. Infinite series, positive series, tests for convergence and divergence, integral test, alternating series, Leibniz test.

Module 2: Functional Series

Pointwise and uniform convergence, basic aspects of Power series, Fourier series

Module 3: Math Foundation

Statements, Quantifiers, Operation on sets and functions, Relations, Proofs.

Module 4: Number System

Countability of algebraic numbers, Transcendental numbers and construction of Liouville's number, Equivalence classes, construction of real numbers (using Cauchy sequences), Fermat's little theorem and using it for Miller-Rabin primality test, Wilson's theorem and Primitive root theorem.

Module 5: Probability

Sample space and events, definitions of probability, properties of probability, conditional probability. Random variables: distribution functions, discrete and continuous random variables, moments of random variables, conditional expectation, Chebyshev inequality, functions of random variables. Special Distributions: Bernoulli, Binomial, Geometric, Pascal, Poisson, Exponential, Uniform, Normal distributions, Limit Theorems: Law of large numbers

Suggested Readings

Probability and statistics for Engineers and Scientists, Walpole, Myers, Myers and Ye, Pearson Education, 2012.

Advanced Engineering Mathematics, Reena Garg, Khanna Book Publishing Co., Delhi

Advanced Engineering Mathematics, Wylie and Barrett, McGraw Hill, 1995

Advanced Engineering Mathematics, M.D. Greenberg, Pearson Education Asia, 2002

Alternative NPTEL/SWAYAM Course (if any):

S.No.	NPTEL Course Name	Instructor	Host Institute
1.	Engineering Mathematics-I	Prof. Jiten-dra Kumar	IIT Kharagpur
2.	Probability and Statistics	Prof. Somesh-Kumar	IIT Kharagpur

CSXXXXXX: Object Oriented Programming

(3 credits-45 Hours)

Objective:

The course aims to introduce students to the foundational concepts of programming using Python. It equips learners with the skills to write clean, modular, and efficient Python code for problem-solving. The course emphasizes the use of built-in data types, control structures, functions, and file handling. It then transitions into object-oriented programming concepts such as classes, objects, inheritance, and polymorphism. Students will also develop the ability to debug, test, and apply object-oriented design principles.

Course outcomes:

After completion of course, students would be able to:

CO1: Recall fundamental Python syntax, data types, and programming constructs used in basic script development.

CO2: Explain the working of conditional statements, loops, functions, and object-oriented concepts like inheritance and polymorphism.

CO3: Use Python to implement solutions for simple real-life problems involving control structures, data handling, and class-based design.

CO4: Analyze problems to decide when and how to apply OOP principles effectively including the selection of appropriate Python features for given problems.

CO5: Design and develop Python applications using classes, inheritance, and polymorphism to solve moderately complex problems.

Module I: Python Basics

Introduction to Python Programming; Python vs. C: memory management, dynamic typing; Python syntax and indentation; Data types: numbers, strings, booleans; Variables and input/output; Operators and expressions; Type casting and basic error handling

Module II: Control Flow and Data Structures

Conditional statements; Loops; Lists and tuples; Sets and dictionaries; List comprehensions; Iterating through sequences; Arrays; User-defined datatypes

Module III: Functions and Modules

Defining and calling functions; Parameters and return values; Namespace, Scope and lifetime of variables; Built-in functions; Creating and importing modules; Advanced function concepts (lambda, map/ filter/ reduce); Recursion basics

Module IV: Object-Oriented Programming

Introduction to various programming paradigms; Advantages of OOP; Comparison of OOP with Procedural Paradigm; Aggregation and Composition; Introduction to classes and objects; Attributes and methods; Constructors; The self keyword; Special methods (__init__, __str__, etc.); Class variables vs. instance variables; Method types: instance, class, static methods; Operator overloading

Module V: OOP Concepts & Advanced Features

Inheritance (single, multiple, multilevel); Base classes and Derived classes; Composition vs. Inheritance; Invocation of Constructors and Destructors in Inheritance; Method overriding and polymorphism; Iterators and generators as objects; Encapsulation and abstraction; Metaclass/abstract classes; Exception handling; File I/O; Regular expressions; Introduction to unit testing

Suggested Readings

Taming Python by Programming, Jeeva Jose, Khanna Book Publishing Co., Delhi.

Learning Python, 5th Edition, by Mark Lutz, O'Reilly Media, Inc., ISBN: 9781449355739

Python Crash Course: A Hands-On, Project-Based Introduction to Programming by Eric Matthes, No Starch Press.

Programming in Python, R.S. Salaria, Khanna Book Publishing Co., Delhi.

How to Think Like a Computer Scientist: Learning with Python, by Allen Downey, Jeff Elkner and Chris Meyers, SoHo Books, 2009.

Mastering Object-Oriented Programming, R.S. Salaria, Khanna Book Publishing Co., Delhi

Introduction to Computing & Problem Solving with Python, Jeeva Jose, Khanna Book Publishing, 2019.

<https://www.coursera.org/learn/python-basics>

<https://www.coursera.org/specializations/python-3-programming>

Head First Python by Paul Barry, O'Reilly, 2010.

Alternative NPTEL/SWAYAM Course:

Sl. No.	Course Name	Instructor	Host Institute
1	Problem solving Aspects and Python Programming	Dr.S.Malliga, Dr.R.Thangarajan, Dr.S.V.Kogilavani	Kongu Engineering College
2	Python For Data Science	Prof. Raghunathan Rengasamy	IIT Madras
3	The Joy of Computing Using Python	Prof. Sudarshan Gupta Prof.Yayati lyengar	IIT Ropar, IIIT Dharwad

CSXXXXXX: Object Oriented Programming Lab (1credit-15Hours)

Laboratory/ Practicals:

Write a program that asks the user for their name and greets them with their name.

Write a program that asks the user for a number n and gives them the possibility to choose between computing the sum and computing the product of 1,...,n.

Write a function that checks whether an element occurs in a list.

Write three functions that compute the sum of the numbers in a list: using a for-loop, a while-loop and recursion.

Given two strings, write a program that efficiently finds the longest common subsequence.

Implement a Time class with members variables for hours, minutes, and seconds. Implement the init method to initialize these variables for an object.

Implement overloaded add functions to add two Time objects.

Write programs to demonstrate inheritance.
Write programs to demonstrate polymorphism.
Write programs to demonstrate exception handling.

CSXXXXXX: Data Structures (3credits-45Hours)

CourseObjective:

The student should be able to describe and implement various data structures including lists, arrays, stacks, queues, binary search trees, graphs, hash tables, and matrices. The student will be able to analyze and apply various algorithms for shortest path calculation, sorting and searching applications.

CourseOutcomes: After completion of course, students would be able to:

Understand the different types of data structure to be implemented using any programming language.
Choose the data structures that effectively model the information in a problem and analyze the efficiency trade-offs (run time and memory usage) among alternative data structure implementations or combinations.

Design, implement, test, and debug programs using a variety of data structures including stacks, queues, hash tables, binary and general tree structures, search trees, and graphs.

Apply efficient data structure (linked lists, stacks and queues) to solve a particular problem.

Module 1: Introduction and Elementary Data Structures

Introduction: Introduction to Data Structures and data types, Efficient use of memory, Recursion, time and space complexity of algorithms, Big O Notation and theta notations.

Elementary Data Structures: Stacks, queues, Infix, Postfix & Prefix conversions, evaluations of expressions, multiple stacks and queues, priority queues as heaps, double ended queue, implementation of stacks and queues

Module 2: Linked Lists

Singly linked lists, linked stacks and queues, polynomial addition, sparse matrices, doubly linked lists and dynamic storage management, circular linked list, Applications of Stacks, Queues and Linked lists, Garbage collection, Josephus Problem

Module 3: Trees

Basic terminology, binary trees, binary tree traversal, representations of binary tree, application of trees, decision tree, game trees, Threaded Trees, Binary Search Tree, AVL tree, B-tree

Module 4: Graph Theory

Graph representations, Graph Traversals, Dijkstra's algorithm for shortest path, Prim's and Kruskal's Algorithm for Minimal Spanning tree

Module 5: Sorting and Searching

Searching: Linear search, binary search and hash search. Sorting: Insertion sort, selection sort, bubble sort, quick sort, merge sort, heap sort, and Bucket sort

Suggested Readings

Data Structures, R.S. Salaria, Khanna Book Publishing, 2019.

Data Structures and Program Design in C By Robert L. Kruse, C.L. Tondo, Bruce Leung, Pearson Education, 2007.

Expert Data Structures with C/3rd Edition, R.B. Patel, Khanna Book Publishing, 2020.

Expert Data Structures with C++/2nd Edition, R.B. Patel, Khanna Book Publishing, 2020.

Data Structures Using C & C++, By Langsam, Augenstein, Tanenbaum, Pearson Education, 1989.

Fundamentals of Data Structures, By Ellis Horowitz and Sartaj Sahni, Computer Science Press, 2011.

An introduction to data structures with applications, By J.P. Trembley & P.G. Sorensen, TMH, 2004.

Alternative NPTEL/SWAYAM Course (if any):

S.No.	Course Name	Instructor	Host Institute
1.	Data Structures and Algorithms- Videocourse	Prof. Naveen Garg	IIT Delhi
2.	Data Structures	Dr. S. Sasikala	University of Madras

CSXXXXXX: Data Structures Lab (1 credit-15 Hours)

Laboratory/Practicals:

Implement infix to postfix conversion using Stack

Write a program for swapping nodes in a linked list without swapping data.

Write a program to reverse a Linked List of given size.

Write a program for finding the first circular tour that visits all petrol pumps.

Implement Inorder tree traversal without recursion.

Write a program to check whether a given graph is Bipartite or not.

CSXXXXXX: Discrete Mathematical Structures (4 credits-60 Hours)

Course Objective:

Students should be able to understand Discrete Mathematical Structures (DMS) for the development of theoretical computer science, problem solving in programming language using Discrete Structure and importance of discrete structures towards simulation of a problem in computer science and engineering.

Course Outcomes:

After completion of course, students would be able to:

Understand the basics of various discrete structures.

Apply applications of discrete structures in Computer Science and Engineering.

Module 1: Mathematical Reasoning

Mathematical reasoning, Propositions, Negation, disjunction and conjunction, Implication and Equivalence, Truth tables, Predicates, Quantifiers, Natural deduction, Rules of Inference, Methods of proofs, Resolution principle, Application to PROLOG.

Module 2: Set Theory

Paradoxes in set theory, Inductive definition of sets and proof by induction, Peano postulates, Relations, Properties of relations, Equivalence Relations and partitions, Partial orderings, Posets, Linear- and well-ordered sets.

Module 3: Combinatorics and Functions

Elementary Combinatorics, counting techniques, Recurrence relation, Generating functions, Functions; mappings, Injection and Surjections, Composition of functions, Inverse functions, Special functions, Pigeonhole principle, Recursive function theory.

Module 4: Graph Theory

Elements of graph theory, Euler graph, Hamiltonian path, trees, Tree traversals, Spanning trees, Representation of relations by graphs.

Module 5: Groups, Rings, Fields, Discrete Probability

Definition and elementary properties of groups, Semigroups, Monoids, Rings, Fields, Vector spaces and lattices, Introduction, Discrete random variables, Application to Binary Search Tree.

Suggested Readings

K.H. Rosen, Discrete Mathematics and applications, 6th Edition, Tata McGraw Hill 2007.

S.B. Singh, Discrete Structures/3rd Edition, Khanna Book Publishing, 2019.

S.B. Singh, Combinatorics and Graph Theory/3rd Edition, Khanna Book Publishing, 2018.

C. L. Liu, Elements of Discrete Mathematics, 2nd Edn., Tata McGraw-Hill 2000.

J.L. Mott, A. Kandel, T.P. Baker, Discrete Mathematics for Computer Scientists and Mathematicians, Second edition, Prentice Hall of India 1986.

W.K. Grassmann and J.P. Tremblay, Logic and Discrete Mathematics, A Computer Science Perspective, Prentice Hall Inc 1996

Alternative NPTEL/SWAYAM Course (if any):

S.No.	Course Name	Instructor	Host Institute
1.	Discrete Mathematical Structures - Videocourse	Prof. Kama Krithivasan	IIT Madras
2.	Discrete Mathematics	Prof. Sudarshanlyengar, Prof. Neeldhara	IIT Ropar, IIT Gandhinagar

CSXXXXXX: Modern Computer Architecture
(3 credits-45 Hours)
Course Objective:

Students should be able to understand basic principles of Computer Systems. They should be able to understand various logic design techniques and their applications. They should be capable of using high performance computing architecture.

Course Outcomes: After completion of course, students would be able to:

Understand the organization of the Control unit, Arithmetic and Logical unit, Memory unit and the I/O unit.
Analyse different computer architectures and their applications.
Understand modern design structures of Pipelined and Multiprocessor systems.
Understand distributed computing architecture and high-performance computing.

Module 1: Basics

Designing combinational and sequential logic, computer registers and instructions, timing, and control, instructions cycle, memory reference instruction, I/O interruption, Adder and Subtractor circuits, Booth Multiplication Algorithm, Pipelining Review, control hazards and the motivation for caches, cache characteristics and basic superscalar architecture basics,

Module 2: Multi-core Architecture

Memory technologies, hierarchical memory systems, the locality principle and caching, direct-mapped caches, block size, cache conflicts, associative caches, write strategies, advanced optimisations, performance improvement techniques, DRAM – organisation, access techniques, scheduling algorithms and signal systems. Tiled Chip Multicore Processors (TCMP), Network on Chips (NoC), NoC router – architecture, design, routing algorithms and flow control techniques, Advanced topics in NoC and storage – compression, prefetching, QoS.

Module 3: Distributed Computing Systems and Concurrency

Relation to Parallel Multiprocessors/multicomputer Systems, Distributed and Concurrent Programs, Message Passing vs. Shared Memory Systems, Synchronous vs. Asynchronous Executions, Design Issues and Challenges, Distributed Computing Technologies, Clocks and Synchronization, Coordination and Agreement Algorithms, Global State and Distributed Transactions.

Module 4: High Performance Computing (HPC)

HPC Architecture, Parallel Processing, Parallel Memory Models, Data vs. Task Parallelism, High Throughput Computing, Vectorization, Multithreading.

Module 5: High Performance Computing with CUDA

CUDA programming model, Basic principles of CUDA programming, Concepts of threads and blocks, GPU and CPU data exchange

Suggested Readings

M. Morris Mano, Computer System & Architecture, Prentice Hall of India, 2002.
John L. Hennessy and David A. Patterson, Computer Architecture – A Quantitative Approach, Morgan Kaufmann/ Elsevier, 4th Edition, 2007.
Hayes. J. P., Computer architecture and organization by McGraw-Hill Companies, 1998
Parallel Computer Architecture: A Hardware/Software Approach David Culler and J. P. Singh with Anoop Gupta, Morgan Kaufmann, 1998.
https://onlinecourses.nptel.ac.in/noc20_cs41/preview
<https://www.coursera.org/learn/introduction-high-performance-computing#syllabus>

S.No.	CourseName	Instructor	HostInstitute
1.	COMPUTERARCHITECTURE	PROF.SMRUTIRANJAN SARANGI	IITDelhi
2.	ADVANCED ARCHITECTURE	COMPUTER PROF.JOHNJOSE	IITGuwahati

Alternative NPTEL/SWAYAM Course(ifany):**CSXXXXXX:Universal Human Values-II: Understanding Harmony and Ethical Human Conduct
(3 credits-45Hours)****CourseObjective:**

The objective of this Course is to provide the new ways of creative thinking and Learn theinnovation cycle of Design Thinking process for developing innovative products which usefulfora student in pre-paringforan engineeringcareer.

CourseOutcomes:

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Therefore, the course and further follow up is expected to positively impact common graduate attributes like:

Holistic vision of life

Socially responsible behaviour

Environmentally responsible work

Ethical human conduct

Having Competence and Capabilities for Maintaining Health and Hygiene

Appreciation and aspiration for excellence(merit) and gratitude for all

Module 1 – Introduction to Value Education (6 lectures and 3 tutorials for practicesession)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture2: Understanding Value Education

Tutorial1:Practice Session PS1 Sharing about Oneself

Lecture3:Self-exploration as theProcess for Value Education

Lecture4:Continuous Happiness and Prosperity–theBasic Human Aspirations

Tutorial2:PracticeSession PS2 Exploring Human Consciousness

Lecture5:Happiness and Prosperity–Current Scenario

Lecture 6: Method to Fulfill the Basic Human Aspirations

Tutorial3:PracticeSessionPS3Exploring Natural Acceptance

Module2–Harmony in theHuman Being(6lecturesand3tutorialsforpracticesession)

Lecture7:Understanding Human being as the Co-existence of theSelf and the Body

Lecture 8: Distinguishing between the Needs of the Self and the Body

Tutorial 4: Practice Session PS4 Exploring the difference of Needs of Self and Body

Lecture 9: The Body as an Instrument of the Self

Lecture 10: Understanding Harmony in the Self

Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the Self

Lecture 11: Harmony of the Self with the Body

Lecture 12: Program to ensure self-regulation and Health

Tutorial 6: Practice Session PS6 Exploring Harmony of Self with the Body

Module 3 – Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)

Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction

Lecture 14: 'Trust' – the Foundational Value in Relationship

Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust

Lecture 15: 'Respect' – as the Right Evaluation

Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect

Lecture 16: Other Feelings, Justice in Human-to-Human Relationship

Lecture 17: Understanding Harmony in the Society

Lecture 18: Vision for the Universal Human Order

Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

Module 4 – Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)

Lecture 19: Understanding Harmony in the Nature

Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature

Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature

Lecture 21: Realizing Existence as Co-existence at All Levels

Lecture 22: The Holistic Perception of Harmony in Existence

Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence

Module 5 – Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)

Lecture 23: Natural Acceptance of Human Values

Lecture 24: Definitiveness of (Ethical) Human Conduct

Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct

Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order

Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education

Lecture 27: Holistic Technologies, Production Systems and Management Models – Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession

Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

In order to connect the content of the proposals with practice (living), 14 practice sessions have been designed. The full set of practice sessions is available in the Teacher's Manual as well as the website.

Practice Sessions for Module 1 – Introduction to Value Education

PS1 Sharing about Oneself

PS2 Exploring Human Consciousness

PS3 Exploring Natural Acceptance

Practice Sessions for Module 2 – Harmony in the Human Being

PS4 Exploring the difference of Needs of Self and Body
PS5 Exploring Sources of Imagination in the Self
PS6 Exploring Harmony of Self with the Body

Practice Sessions for Module 3 – Harmony in the Family and Society

PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for Module 4 – Harmony in the Nature (Existence)

PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for Module 5 – Implications of the Holistic Understanding – a Look at Professional Ethics

PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

Suggested Readings

A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1.
Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-

Reference

Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
Human Values, A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
The Story of Stuff (Book).
The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
Small is Beautiful - E. F. Schumacher.
Slow is Beautiful - Cecile Andrews
Economy of Permanence - J C Kumarappa
Bharat Mein Angreji Raj - Pandit Sunderlal
Rediscovering India - by Dharampal
Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
India Wins Freedom - Maulana Abdul Kalam Azad
Vivekananda - Romain Rolland (English)
Gandhi - Romain Rolland (English)

SEMESTER–III

CSXXXXXX: Algorithm Analysis and Design (3 credits-45 Hours)

Course Objective:

The students should be able to analyze various algorithms mainly for time and space complexity. They should be able to develop algorithm for solving various computational problems by applying various

algorithm design strategies. They should be able to understand the effect of choice of data structures on the complexity of algorithm.

Course Outcomes:

After completion of course, students would be able to:

Apply the best data structure for designing an algorithm to solve a given problem.

Evaluate different algorithms with respect to time and space complexity.

Create algorithms to solve various computational problems.

Understand different complexity classes.

Module1: Basic Concepts of Algorithms

Notion of Algorithm, Fundamentals of Algorithmic Solving, Important problem types, Fundamentals of the Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical analysis of non-recursive algorithms. Mathematical analysis of recursive algorithm: recurrence relations, solution of recurrence relations using substitution method

Module2: Brute Force, Divide and Conquer Strategy

Selection sort, Bubble sort, Sequential searching (Linear Search), Brute force string matching, General method, Mergesort, Quick Sort, Binary Search, Strassen's matrix multiplication

Module3: Greedy Approach and Dynamic Programming

Fractional Knapsack problem, Minimum cost spanning tree: Prim's and Kruskal's algorithm, Single source shortest path problem, Principle of optimality, Multi-stage graph problem, all pair shortest path problem, 0/1 Knapsack problem, Traveling salesperson problem

Module4: Backtracking and Branch and Bound

General method backtracking, N-Queen problem, 0/1 Knapsack problem, General method of branch & bound, 0/1 Knapsack problem, Traveling sales person problem

Module 5: Lower Bound Theory and Complexity Classes

Lower bounds, Decision trees, P, NP and NP Complete problems

Suggested Readings

Algorithm Design, Jon Kleinberg and Eva Tardos, 1st Edition, Pearson Education 2014.

Design & Analysis of Algorithms, Gajendra Sharma, Khanna Book Publishing 2018.

Fundamentals of algorithms, Horowitz E, Sahni S, Rajasekaran S., University Press 2008.

Introduction to algorithms, Cormen, Leiserson, Rivest, Stein, 3rd Edition, PHI. 2012

An introduction to analysis of algorithms, R. Sedgewick, 1st edition, Pearson Education 1996.

Data Structures and Program Design in C By Robert L. Kruse, C.L. Tondo, Bruce Leung, Pearson Education. 2007.

Alternative NPTEL/SWAYAM Course (if any):

S.No.	Course Name	Instructor	Host Institute
1.	Design and analysis of algorithms	Prof. Madhavan Mukund	Chennai Mathematical Institute
2.	Design and analysis of algorithms	Prof. Abhiram Ranade	IIT Bombay

CSXXXXXX:Algorithm Analysis and Design Lab
(1credit-15Hours)

Laboratory/Practicals:

Write a program to implement different sorting techniques.
Write a program to find minimum cost spanning tree.
Write a program to implement travelling salesperson problem.
Write a program to find Longest Path in a Directed Acyclic Graph.
Write a program for Shortest path with exactly k edges in a directed and weighted graph.
Write a program to find maximum number of edge disjoint paths between two vertices

CSXXXXXX:Database Systems
(3credits-45Hours)

Course Objective:

Students should be able to understand various basics of DBMS and query languages. They should learn different types of database systems and their applications in different scenarios.

Course Outcomes:

After completion of course, students would be able to:

Understand the basics of databases and data management.

Understand various theoretical and practical principles involved in the design and use of database systems with the help of database

Design and implement databases for various scenarios.

Design a database scenario for handling big data.

Module 1: Introduction

Characteristics and fundamental concepts of Databases, Types of Data Models and Data Modelling, Elements of Database Systems, Classification and comparison of Database Management Systems (Relational and NoSQL), concurrency control, Lock based concurrency control, Time stamping methods.

Module 2: Structured and semi-structured data management

Structured data, relational databases, Relational model, Functional Dependencies, normal forms, algorithms for query optimization, Semi-structured data, document-databases, semi-structured data abstraction, representation, and search.

Module 3: Transaction Management

Transaction concept, transaction state, ACID properties, serializability, Recoverability, Implementation of isolation, Testing for serializability.

Module 4: Unstructured Data Management

Unstructured text, Information retrieval systems, document retrieval and ranking.

Module 5: Big Data Management

Platforms for Big Data, algorithms for Map-Reduce & Hadoop, Platforms for Big Graphs, algorithms for large graphs.

Suggested Readings

Database System Concepts, Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill, 2006
 Fundamentals of Database Systems, Elmasri and Navathe, Pearson Education 2013
 Database Management Systems, Ramakrishnan and Gehrke, McGraw Hill 2003
 "An Introduction to Database Systems", C.J. Date, A. Kannan, S. Swamynathan, Pearson Education, 2006
 Database Management Systems, R.P. Mahapatra, Khanna Book Publishing 2016.
 J.D. Ullman, "Principles of Database Systems", 2nd Ed., Galgotia Publications
 Learning Spark: Lightning-Fast Big Data Analysis/ Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia / O'Reilly Media; 1st edition / ISBN-13: 978-1449358624 / ISBN-10: 1449358624
 Data on the Web: From Relations to Semistructured Data and XML / Serge Abiteboul, Peter Buneman, Dan Suciu / 1st Edition / ISBN-13: 978-1558606227 / ISBN-10: 155860622X
 10. Introduction to Information Retrieval / Christopher Manning, Prabhakar Raghavan, Hinrich Schütze / book and slides available online

Alternative NPTEL/SWAYAM Course(if any):

S.No.	NPTEL Course Name	Instructor	Host Institute
1.	Data Base Management System	Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay	IIT Kharagpur
2.	Introduction To Database Systems	Prof. Sreenivasa Kumar	IIT Madras

CSXXXXXX: Database Systems Lab
(1 credit-15 Hours)

Laboratory/Practicals:

Implement normal forms in a database.
 Implement basic SQL commands on a database.
 Implement information and ranking using any language.
 Implement document retrieval and ranking using any algorithm.
 Implement Map-reduce algorithm on any big data task.

CSXXXXXX: Computer Networks
(3 credits-45 Hours)

Course Objective:

Students should be able to have an understanding of the fundamental concepts of computer networking and have a basic knowledge of the various network models and their uses. They should be able to analyse, implement protocols and independently study literature concerning computer networks.

Course Outcomes: After completion of course, students would be able to:

Understand basic computer network technology.
 Understand the different types of network topologies and protocols.
 Analyse the different types of network devices and their functions within a network.
 Analyse the architecture and principles of today's computer networks.
 Understand the requirements for the future Internet and its impact on the computer network architecture.

Module1: Computer Networks and The Internet

What is the Internet; network edge; network core; Delay, Loss and throughput in Packet-Switched Networks; Protocol Layers and their Service Models.

Module2: Application Layer

Principles of Network Applications; The Web and HTTP; File Transfer: FTP; Electronic Mail in the Internet; DNS - The Internet's Directory Service; Peer-to-Peer applications; Socket Programming – Creating network applications.

Module3: Transport Layer

Introduction and Transport-Layer Services; Multiplexing and Demultiplexing; Connectionless Transport: UDP; Principles of Reliable of Data Transfer; Connection-Oriented Transport: TCP; Principles of Congestion Control, TCP Congestion Control.

Module 4: Network Layer

Introduction; Virtual circuit and datagram networks; What is inside a router; Internet Protocol (IP): Forwarding and Addressing in the Internet; Routing Algorithms; Routing in the Internet; Broadcast and Multicast Routing.

Module 5: Data Link Layer

Introduction to the link layer; Error Detection and Correction Techniques; Multiple Access Links and Protocols; Switched local area networks.

Suggested Readings

James F. Kurose and Keith W. Ross, "Computer Networking: A top-down approach", Pearson Education, 6th edition. 2012

A.S. Tanenbaum, "Computer Networks", 5th Edition, PHI 2010

Bhavneet Sidhu, "An Integrated Approach to Computer Networks", Khanna Book Publishing House 2019.

G. Keiser, "Local Area Networks", 2nd Edition, TMH 2002

D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, PHI 2000

William Stallings, "Data & Computer Communication", PHI, 10th Edition 2013

B.A. Forouzan, "Data Communications and Networking", TMH, 5th Edition 2012

B.A. Forouzan, "Local Area Networks", TMH. 2002

B.A. Forouzan, "TCP/IP Protocol Suite", TMH. 2004

Alternative NPTEL/SWAYAM Course (if any):

S.No.	Course Name	Instructor	Host Institute
1.	Computer Networks-Video course	Prof. Sujoy Ghosh	IIT Kharagpur
2.	Computer Networks and Internet Protocol	Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty	IIT Kharagpur,

CSXXXXXX: Computer Networks Lab (1 credit-15 Hours)

Laboratory/Practicals:

Write a program for using TCP and UDP Sockets.
Write a simulation of sliding window protocols.
Write a simulation of Routing Protocols.
Configure given network topologies using any network simulator software.
Write programs for error detecting codes.
Write a program for Client Server Communication.

CSXXXXXX: Introduction to Machine Learning
(3 credits-45 Hours)

Course Objective:

The students will understand the basics of Machine Learning. They will also learn and will be able to apply different machine learning models to various datasets.

Course Outcomes:

After completion of course, students would be able to:

CO 1: Understand basic applications and issues of Machine Learning.

CO 2: Understand the different types of datasets.

CO 3: Analyze and work with different datasets.

CO 4: Analyze various Machine Learning techniques and algorithms.

CO 5: Apply various algorithms to different datasets.

Module 1: Introduction

What Is Machine Learning?, How Do We Define Learning?, How Do We Evaluate Our Networks?, How Do We Learn Our Network?, What are datasets and how to handle them?, Feature sets, Dataset division: test, train and validation sets, cross validation.

Module 2: Basics of machine learning

Applications of Machine Learning, processes involved in Machine Learning, Introduction to Machine Learning Techniques: Supervised Learning, Unsupervised Learning and Reinforcement Learning, Real life examples of Machine Learning.

Module 3: Supervised learning

Classification and Regression: K-Nearest Neighbor, Linear Regression, Logistic Regression, Support Vector Machine (SVM), Evaluation Measures: SSE, MME, R², confusion matrix, precision, recall, F-Score, ROC-Curve.

Module 4: Unsupervised learning

Introduction to clustering, Types of Clustering: Hierarchical, Agglomerative Clustering and Divisive clustering; Partitional Clustering-K-means clustering.

Module 5: Basics of Deep Learning

Introduction to Deep Learning: Foundational concept of neural networks, Feed forward Neural Networks, Recurrent Neural Networks, Convolutional Neural Networks, and Radial Basis Function Networks, basics of Convolutional Neural Network, Sequence Models, Neural networks and Generative AI, Use case with Neural networks and Generative AI Gaussian Mixture Models, Natural Language Processing, Computer Vision.

Suggested Readings

Introduction to Machine Learning, By Jeeva Jose, Khanna Book Publishing Co., 2020.

Machine Learning for Dummies, By John Paul Mueller and Luca Massaron, For Dummies, 2016.

Machine Learning, By Rajeev Chopra, Khanna Book Publishing Co., 2021.

Machine Learning: The New AI, By Ethem Alpaydin, The MIT Press, 2016.

Machine Learning, Tom M. Mitchell, McGraw Hill Education, 2017.
<https://www.udacity.com/course/intro-to-machine-learning--ud120>
<https://www.coursera.org/learn/machine-learning-duke>

Alternative NPTEL/SWAYAM Course (if any):

S.No.	NPTEL Course Name	Instructor	Host Institute
1.	Introduction to Machine Learning	Prof. Balaraman Ravindran	IIT Madras
2.	Machine Learning	Prof. Carl Gustaf Jansson	KTH, The Royal Institute of Technology

**CSXXXXXX: Introduction to Machine Learning Lab
(1 credit-15 Hours)**

Laboratory/Practicals:

Python Introduction:

Loops and Conditions and other preliminary stuff,

Functions, Classes and Modules,

Exceptions, Database access,

Mathematical computing with Python packages like: numpy, Matplotlib, pandas, Tensor Flow, Keras

Implement basic ML models like SVM, KNN, K-Means, Logistic Regression, Linear Regression

**CSXXXXXX Artificial Intelligence
(4 credits-60 Hours)**

Course Objective:

Students will learn the basic concepts and techniques of Artificial Intelligence. They should be able to develop AI algorithms for solving practical problems.

Course outcomes: After completion of course, students would be able to:

Understand the basic concepts and techniques of Artificial Intelligence.

Apply AI algorithms for solving practical problems

Describe human intelligence and AI

Explain how intelligent system works.

Apply basics of Fuzzy logic and neural networks.

Explain Expert System and implementation

Module 1: Introduction

Artificial Intelligence and its applications, Artificial Intelligence Techniques, Level of models, criteria of success, Intelligent Agents, Nature of Agents, Learning Agents. AI Techniques, advantages, and limitations of AI, Impact and Examples of AI, Application domains of AI. The AI Ladder - The Journey for Adopting AI Successfully, Advice for a career in AI, Hotbeds of AI Innovation.

Module 2: Problem solving techniques

State space search, control strategies, heuristic search, problem characteristics, production system characteristics., Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative-Deepening.

Module3: Logic

Propositional logic, predicate logic, Resolution, Resolution in propositional logic and predicate logic, Clause-form, unification algorithm,

Module4: Knowledge Representation schemes and reasoning

Mapping between facts and representations, Approaches to knowledge representation, procedural vs declarative knowledge, Forward vs. Backward reasoning, Matching, conflict resolution, Non-monotonic reasoning, Default reasoning, statistical reasoning, fuzzy logic Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts

Module5: Planning

The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning.

Tutorial List:

Numerical type questions on CNN-

Parameter tuning
Convolution function
Different types of filters
Fuzzy Logic and Neural Networks

Suggested Readings

A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Book Publishing, 2019.
Artificial Intelligence: A modern approach by Stuart Russel, Pearson Education, 2010.
Artificial Intelligence by Richard Knight, The McGraw Hill, 2017.
Artificial Intelligence: A new synthesis by Nils and Nilsson, Elsevier, 1997.
Artificial Intelligence by Luger, Pearson Education, 2002.
Artificial Intelligence by Padhy, Oxford Press, 2005.
<https://www.edx.org/course/artificial-intelligence-ai>
<https://www.udemy.com/course/artificial-intelligence-az/>

Alternative NPTEL/SWAYAM Course:

S.No.	NPTEL Course Name	Instructor	Host Institute
1.	An Introduction to Artificial Intelligence	Prof. Mausam	IIT Delhi
2.	Artificial Intelligence	Prof. Sudeshna Sarkar	IIT Kharagpur

Any one course from following options can be opted under 'Open Elective I':

IOT Robotics

CSXXXXXX IOT (3 credits-45 Hours)

Course Objective:

Understanding core technology, applications, sensors used and IOT architecture along with the industry perspective. Principles and operations of different types of sensors commonly used on mobile platform will be taught in a manner that by the end of the course the students will be able to design and implement

real time solutions using IOT.

Course outcomes: After completion of course, students would be able to:

Understand core technology, applications, sensors used and IOT architecture along with The industry perspective. Understand Raspberry's working and implementation.
Understand various communication protocols used in IoT.
Apply various IOT technologies in real-life applications.

Module 1:

Introduction to IoT: What is IoT, how does it work? Difference between Embedded device and IoT device, Properties of IoT device, IoT Ecosystem, IoT Decision Framework, IoT Solution Architecture Models, Major IoT Boards in Market

Module 2:

Setting Up Raspberry/Arduino to Create Solutions: Explore Raspberry Pi, setting up Raspberry Pi, showing working of Raspberry Pi using SSH Client and Team Viewer, Understand Sensing actions, Understand Actuators and MEMS

Module 3:

Communication Protocols used in IoT: Types of wireless communication, Major wireless Short-range communication devices, properties, comparison of these devices (Bluetooth, WIFI, ZigBee, 6LoWPAN), Major wireless Long-range communication devices, properties, comparison of these devices (Cellular-IoT, LPWAN)

Module 4 :

IoT Applications: Industrial Internet 4.0, Applications such as: Smart home, wearables, smart city, smart grid, connected car, connected health (digital health, telehealth, telemedicine), smart retail

Module 5:

Sensors: Applications of various sensors: Google Maps, Waze, WhatsApp, Ola Positioning sensors: encoders and accelerometers, Image sensors: cameras, Global positioning sensors: GPS, GLONASS, IRNSS, Galileo and indoor localization systems, Motion & Orientation Sensors: Accelerometer, Magnetometer, Proximity Sensor, Gyroscope Calibration, noise modeling and characterization and noise filtering and sensor data processing. Privacy & Security

Suggested Readings

Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on Approach), 1st Edition, VPT, 2014

Francis da Costa, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2014

Cuno Pfister, Getting Started with the Internet of Things, O'Reilly Media, 2011

Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing, 2015

Alternative NPTEL/SWAYAM Course:

S.No.	NPTELCourseName	Instructor	HostInstitute
1.	Introduction to Internet of Things	Prof.Sudip Misra	IIT Kharagpur
2.	Introduction to Industry4.0 and Industrial Internet of Things	Prof.Sudip Misra	IIT Kharagpur

CSXXXXXXRobotics
(3 credits-45Hours)
CourseObjective:

The students will be able to understand the basic concepts and fundamentals of robotics. They will also be able to use AI in the field of robotics.

Courseoutcomes: After completion of course, students would be able to:

Understand the basics of robotics

Understand game playing concepts involving robotics and AI.

Apply robotics to create robot driven systems.

Analyze and co-relate robotics with AI and use in real-world applications.

Module1:

Introduction: Introduction to Robotics Fundamentals of Robotics, Robot Kinematics: Position Analysis, Dynamic Analysis and Forces, Robot Programming languages & systems: Introduction, the three levels of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

Module2:

Need of AI in Robotics: History, state of the art, Need for AI in Robotics. Thinking and acting-humanly, intelligent agents, structure of agents.

Module3:

Game Playing: AI and game playing, plausible move generator, static evaluation move generator, game playing strategies, problems in game playing.

Module4:

Robotics fundamentals: Robot Classification, Robot Specification, notation, kinematic representation - and transformations, dynamic techniques; trajectory planning and control.

Module5:

Robotics and its applications: DDD concept, Intelligent robots, Robot anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems-Specifications of Robot-Speed of Robot, Robot joints and links-Robot classifications-Architecture of robotics systems-Robot Drive systems-Hydraulic, Pneumatic and Electric system

Suggested Readings

Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Peter Corke, Springer, 2011.

Robotics: Everything You Need to Know About Robotics from Beginner to Expert, Peter McKinnon, Createspace Independent Publishing Platform, 2016.

Introduction to AI Robotics, Second Edition, By Robin R. Murphy, MIT press, 2001.

Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques, Francis X.

Govers, Packt Publishers, 2018

Alternative NPTEL/SWAYAM Course:

S.No.	NPTEL Course Name	Instructor	Host Institute
1.	Introduction to Robotics	Prof. Asokan T, Prof. Balaraman Ravindran, Prof. Krishna Vasudevan	IIT Madras
2.	Robotics	Prof. Dilip Kumar Pratihari	IIT Kharagpur

SEMESTER-IV**CSXXXXXX: Theory of Computation
(4 credits-60 Hours)****Course Objective:**

Students should be able to understand fundamental mathematical and computational principles that are foundations of computer science. They should learn about abstract models of computation, finite representations for languages and gain formal understanding of algorithms and procedures.

Course Outcomes:

After completion of course, students would be able to:

Evaluate computer science problems as mathematical statements and to formulate proofs.

Understand properties of the corresponding language classes defined by various computation models and the relations between them.

Understand the general properties of computation and learn how to increase efficiency at which computers solve problems.

Understand how to model different computation problems using state machines.

Module 1: Automata

Introduction to formal proof, Additional forms of proof, Inductive proofs, Finite Automata (FA), Deterministic Finite Automata (DFA), Non-deterministic Finite Automata (NFA), Finite Automata with Epsilon transitions.

Module 2: Regular Expressions and Languages

Regular Expression, FA and Regular Expressions, proving languages not to be regular, Closure properties of regular languages, Equivalence and minimization of Automata.

Module 3: Context-Free Grammars and Languages

Context-Free Grammar (CFG), Parse Trees, Ambiguity in grammars and languages, Definition of the Pushdown automata, Languages of a Pushdown Automata, Equivalence of Pushdown automata and CFG Deterministic Pushdown Automata.

Module 4: Properties of Context-Free Languages

Normal forms for CFG, Pumping Lemma for CFL, Closure Properties of CFL, Turing Machines, Programming Techniques for TM, Variations of TM, Non-Universal TM, Universal TM.

Module5: Undecidability

Alanguage that is not Recursively Enumerable (RE), An undecidable problem that is RE Undecidable problems about Turing Machine, Post's Correspondence Problem, The classes P and NP.

Suggested Readings

J.E.Hopcroft, R.Motwani and J.D.Ullman, "Introduction to Automata Theory, Languages and Computations", second Edition, Pearson Education 2007

H.R.Lewis and C.H.Papadimitriou, "Elements of the theory of Computation", Second Edition, Pearson Education 2003

R.B.Patel, "Theory of Computation (with Formal Languages)/2nd Edition", Khanna Book Publishing 2020.

Thomas A. Sudkamp, "An Introduction to the Theory of Computer Science, Languages and Machines", Third Edition, Pearson Education. 2007

J.Martin, "Introduction to Languages and the Theory of computation" Third Edition, Tata McGraw Hill. 2007

Alternative NPTEL/SWAYAM Course (if any):

S.No.	Course Name	Instructor	Host Institute
1.	Theory of Computation-Videocourse	Prof. Somenath Biswas	IIT Kanpur
2.	Theory of Computation	Prof. Ragunath Tewari	IIT Kanpur

**CSXXXXXX: Software Engineering
(3 credits-45 Hours)****Course Objective:**

Students should learn the concept and importance of Software Engineering. They should be able to construct software that is reasonably easy to understand, modify, maintain and reliable. They should learn strengths and weaknesses of various Software Engineering Techniques used in industrial applications.

Course Outcomes:

After completion of course, students would be able to:

Understand the process of designing, creating and maintaining software.

Create software for various application domains.

Understand the challenges of large scale software development.

Understand the importance of software design and development practices.

Module1: Introduction and Software Process Models

Software, Software Engineering, Myths, Software Process, Work Products, Importance of Software Engineering, Standard for Software Process, Waterfall Model, Prototyping Model, Iterative Enhancement Model, Spiral Model, RAD model, 4th Generation models, Formal Methods, Agile Development

Module2: Requirement Engineering and Software Project Management

Software Requirements, Types of Requirements, Requirement Engineering Cycle, Requirements Specification document, Characteristics of Requirements, Requirement verification and validation, Role of Management in Software Development, Project Estimation Techniques, Staffing, Scheduling, Earned Value Analysis, Software Risks, Software Configuration Management, Software Process and Project metrics.

Module3:Software Design and Coding

Process, Data and Behavioural Modelling, Design Concepts, Modularity, Architectural design, Coupling and Cohesion, Top-down and bottom-up design, Object-oriented Analysis, Function-oriented and Object-Oriented Design approach, Software Design Document, Coding styles and documentation,

Module4:Testing and Software Quality

Testing principles, testing strategies, Black-box and White-box Testing Techniques, Levels of testing-unit, integration, system, regression, Test Plan, Test Cases Specification, Software debugging, Software-Maintenance, Software Quality Assurance (SQA), SQA tasks, Software amplification and removal, Formal Technical Reviews, Software Quality Factors, ISO 9126, SEI CMM, CMMI, Software Reliability. Software Availability.

Module5: Computer Aided Software Engineering and Advanced Topics

Computer Aided Software Engineering (CASE) and its Scope, CASE support in Software Life Cycle, Architecture of CASE Environment, Upper CASE and Lower CASE, Exposure to CASE tools. Software Process Improvement, Component Based Software Engineering, Web Engineering, Reverse Engineering, Software Engineering challenges of Big Data, Mobile Applications.

Suggested Readings

Software Engineering-A Practitioners Approach, By R. Pressman, McGraw Hill International edition, 2004

Software Engineering, N.S. Gill, Khanna Publishing Co., Delhi 2018.

Software Engineering, Ian Sommerville, Addison-Wesley, 2010

An Integrated Approach to Software Engineering, Pankaj Jalote, Narosa, 2014

Fundamentals of Software Engineering, By Rajib Mall, PHI Learning Pvt. Ltd, 2014

Software Engineering (3rd ed.), By K. K. Aggarwal & Yogesh Singh, New Age International Publishers, 2007

Alternative NPTEL/SWAYAM Course(if any):

S.No.	NPTEL Course Name	Instructor	Host Institute
1.	Software Engineering	Prof. Rajib Mall	IIT Kharagpur
2.	Software Engineering- Videocourse	Prof. N.L. Sarda, Prof. Rushikesh K Joshi, Prof. Umesh Bellur	IIT Bombay

**CSXXXXXX: Software Engineering Lab
(1 credit-15 Hours)**

Laboratory/Practicals:

Programming Exercises for software design concepts.

Programming Exercises for software testing concepts.

Programming Exercises for Project Management concepts.

Design and Develop UML diagrams for any Software Project.

Project Development with Software Engineering practices.

CSXXXXXX:Deep Learning
(3credits-45Hours)

CourseObjective:

To introduce the fundamentals of deep learning and the main research activities in this field. To learn architectures and optimization methods for deep neural network training.

CourseOutcomes: After completion of course, students would be able to:

Understand the fundamentals of deep learning and the main research activities in this field

Remember architectures and optimization methods for deep neural network training

Implement, apply and test relevant learning algorithms in TensorFlow

Critically evaluate the method's applicability in new contexts and construct new applications

Module1: Introduction

History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Backpropagation

Module2: Activation functions and parameters

Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, Principal Component Analysis and its interpretations, Singular Value Decomposition, Parameters vs Hyper-parameters

Module3: Auto-encoders & Regularization

Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Encoder Decoder Models, Attention Mechanism, Attention over images, Batch Normalization

Module4: Deep Learning Models

Introduction to CNNs, Architecture, Convolution/pooling layers, CNN Applications, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Introduction to RNNs, Back propagation through time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, GRU, LSTMs

Module5: Deep Learning Applications

Image Processing, Natural Language Processing, Speech recognition, Video Analytics

Suggested Readings

Ian Goodfellow, Yoshua Bengio, Aaron Courville. Deep Learning, the MIT press, 2016

Bengio, Yoshua. "Learning deep architectures for AI." Foundations and trends in Machine Learning 2.1, Now-Publishers, 2009

Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi

2020.4. <https://nptel.ac.in/courses/106/106/106106184/>

5. <https://www.coursera.org/specializations/deep-learning>

Alternative NPTEL/SWAYAM Course(if any):

S.No.	CourseName	Instructor	HostInstitute
1.	Deep Learning	Prof. Mitesh M. Khapra	IIT Ropar
2.	Deep Learning	Prof. Prabir Kumar-Biswas	IIT Kharagpur

**CSXXXXXX:DeepLearningLab
(1credit-15Hours)**

Laboratory/Practicals:

Implementation of following deep learning algorithms in Python using TensorFlow: Convolution Neural Network
Implementation of following deep learning algorithms in Python using TensorFlow: Recurrent Neural Network
Project work involving application of Deep Learning

**CSXXXXXX:Operating System
(3credits-45Hours)**

Course Objective:

Students should be able to describe the services provided by and the design of an operating system. They should be able to understand the structure and organization of the file system, process synchronization, process scheduling, system calls and different approaches to memory management.

Course Outcomes: After completion of course, students would be able to:

Understand the basics of an operating system and its major components.

Understand and implement shell programming.

Create and/or modify concurrent programs.

Apply security as well as recovery features in the design of an algorithm.

Module 1: Concepts of Operating Systems

Computer system overview, concept of an operating system, batch system, multiprogramming, multiprocessing, multi user, time sharing, personal system, parallel system, real time system, simple monitors, general system architecture, System components, operating system services, system calls, system programs, system structure, Approaches to OS design and implementation: Microkernel, Layered, Kernel Approach

Module 2: Processes and Threads

Concept of process, process states, process state transitions, process control block, operations on processes, threads, concurrent processes, mutual exclusion and synchronization, principles of deadlocks, integrated deadlocks strategy, scheduling levels, scheduling criteria, Interprocess synchronization, Inter process communication, Linux, IPC Mechanism, Remote procedure calls, RPC exception handling, security issues

Module 3: Memory Management and Data Management

Logical and physical address space, storage allocation and management techniques, swapping concepts of multiprogramming, paging, segmentation, virtual storage management strategies, demand paging, page replacement algorithm, thrashing, File organization, record blocking, access

method, directory structure, protection file system structure, allocation methods, free space management, directory implementation, disk structure, disk scheduling, disk management, buffering, swap space management, RAID levels

Module4:OS Security

Types of Threats in OS, Basic OS Security Mechanisms, Understanding the Threats: Malware Taxonomy: Viruses, Worms, Rootkits, Defence: An Overview, Logging, Auditing, and Recovery, OS-level Memory Protection

Module5:Case Studies and OS Abstractions

Linux/Unix OS design and architecture, Unix shell, Unix operating system services, user perspective, representation of files in Unix system processes and their structure, input-output system, memory management in Unix, Processes: fork, wait, exec, exit, kill, getpid, brk, nice, sleep, trace, Files: open, close, read, write, lseek, stat, sync, Directories: mkdir, rmdir, link, unlink, mount, umount, users +, Security: chown, chmod, getuid, setuid, Inter process communication: signals, pipe, Networking: socket, accept, snd, recv, connect

Suggested Readings

Operating system, Galvin & Silberschatz, 7th Edition, John Wiley 2004

Operating Systems - A Concept Based Approach, Dhamdhare, TMH 2006

Operating System Concepts, Ekta Walia, Khanna Book Publishing 2020.

Operating systems Internals and design principles By William Stallings, Pearson Education, 2012

Operating Systems - A Design Oriented Approach, Crowley, TMH, 2001

Operating systems Design and Implementation, Andrew S. Tanenbaum, Pearson Education 2009

Alternative NPTEL/SWAYAM Course (if any):

S.No.	Course Name	Instructor	Host Institute
1.	Operating System Fundamentals	Prof. Santanu Chattopadhyay	IIT Kharagpur
2.	Operating System	Prof. Sorav Bansal	IIT Delhi

**CSXXXXXX: Operating System Lab
(1 credit-15 Hours)**

Laboratory/Practicals:

To perform shell programming.

Implement memory management techniques like paging or segmentation.

Implement any file allocation technique (Linked, Indexed or Contiguous).

Use the following system calls of UNIX operating system: mkdir, rmdir, link, unlink, mount, umount, users +, chown, chmod, getuid, setuid.

Use the following system calls of UNIX operating system: fork, wait, exec, exit, kill, getpid, brk, nice, sleep, trace, open, close, read, write, lseek, stat, sync

Use the following system calls of UNIX operating system: signals, pipe, socket, accept, snd, recv, connect.

**CSXXXXXX: Theory of computation Ecosystems
(3 credits-45 Hours)**

Course Objective:

The student should study the development of start-up projects in the realm of globalisation, crowdsourcing and the emergence of "open-source" innovations. They should be able to search for the governmental

means of support for open innovation projects, private investment resources, and assess the level of maturity of the project.

Course Outcomes:

After completion of course, students would be able to:

Understand economic models in the digital environment and types of monetisation used for open innovations.

Create a business model of value in the open-knowledge environment.

Module 1: Introduction

Introduction to Entrepreneurship Strategy: from Ideation to Exit, identifying the trade-offs, Intellectual activity & knowledge economy, sharing economy – approach to construct social-economic models, Business as construction of value creation chain in the context of open knowledge,

Module 2: Digital technologies as an open innovation's environment

Transaction costs: trust and reviewing system (personification), Hard & software - Robotics and Intelligence: Computing Recognition and Decision Making, Infrastructure Building, Cyberphysical systems as a product and as an infrastructure.

Module 3: The organization and management of open innovation projects

History the emergence of open innovation, Analysis of elements of open innovation in the traditional management, Agile – flexible project management. Methodologies within agile approach, from project to product: steps of converting ideas into goods, Stakeholders of open innovation project: customers, investors, employees etc. Indicators of effectiveness for the various groups of stakeholders.

Module 4: Start-up environment: institutions that support and finance innovative projects

Types of financing, Infrastructures supporting small innovative enterprises and start-ups, Programs to support innovative projects at the federal and regional level.

Module 5: Operational and Strategy Management

Introduction to Operations Management:

Operations Analysis, Coordination and Planning, Quality Management, Project Management, and Logistics and Supply Chain Management, strategy management, technological strategy.

Suggested Readings

Text Books:

Innovation and Entrepreneurship by Peter F. Drucker (Classic Drucker Collection, 2007)

Joseph A. Schumpeter's views on entrepreneurship and innovation by Perihan Hazel.

Suggested References:

<https://www.coursera.org/learn/startups-in-open-innovation>.

<https://www.coursera.org/learn/entrepreneurship-strategy>.

<https://ocw.mit.edu/courses/entrepreneurship/topic-list/>

Alternative NPTEL/SWAYAM Course (if any):

	SWAYAM Course Name	Instructor	Host Institute
1.	Innovation and Start-up Policy	Prof. Rahul K. Mishra	IILM Institute for Higher Education

CSXXXXXX: Introduction to Machine Learning Lab
(1 credit-15 Hours)

Laboratory/Practicals:

Python Introduction:

Loops and Conditions and other preliminary stuff,

Functions, Classes and Modules,

Exceptions, Database access,

Mathematical computing with Python packages like: numpy, Matplotlib, pandas, Tensor Flow, Keras

Implement basic ML models like SVM, KNN, K-Means, Logistic Regression, Linear Regression

CSXXXXXX Environmental Science
(3 credits-45 Hours)
Course Objective:

People working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

Solve various engineering problems applying ecosystem to produce eco-friendly products.

Use relevant air and noise control methods to solve domestic and industrial problems.

Use relevant water and soil control methods to solve domestic and industrial problems.

To recognize relevant energy sources required for domestic and industrial applications.

Solve local solid and waste problems.

Course outcomes: After completion of course, students would be able to:

Understand the ecosystem and terminology and solve various engineering problems applying ecosystem knowledge to produce eco-friendly products.

Understand the suitable air, extent of noise pollution, and control measures and acts.

Understand the water and soil pollution, and control measures and acts.

Understand different renewable energy resources and efficient processes of harvesting.

Understand solid Waste Management, ISO 14000 & Environmental Management.

Unit-1: Ecosystem

Structure of ecosystem, Biotic & Abiotic components.

Food chain and food web.

Aquatic (Lentic and Lotic) and terrestrial ecosystem.

Carbon, Nitrogen, Sulphur, Phosphorus cycle.

Global warming - Causes, effects, process, Green House Effect, Ozone depletion.

Unit-2: Air and Noise Pollution

Definition of pollution and pollutant. Natural and man-made sources of air pollution (Refrigerants, I.C., Boiler). Air Pollutants: Types, Particulate Pollutants: Effects and control (Bag filter, Cyclone separator, Electrostatic Precipitator).

Gaseous Pollution Control: Absorber, Catalytic Converter, Effects of air pollution due to Refrigerants, I.C., Boiler.

Noise pollution: sources of pollution, measurement of pollution level, Effects of Noise pollution, Noise pollution (Regulation and Control) Rules, 2000.

Unit-3: Water and Soil Pollution

Sources of water pollution, Types of water pollutants, Characteristics of water pollutants Turbidity, pH, total suspended solids, total solids BOD and COD: Definition, calculation.

Waste Water Treatment: Primary methods: sedimentation, froth floatation, Secondary methods: Activated sludge treatment, Trickling filter, Bioreactor, Tertiary Method: Membrane separation technology, RO (reverse osmosis).

Causes, Effects and Preventive measures of Soil Pollution: Causes-Excessive use of Fertilizers, Pesticides and Insecticides, Irrigation, E-Waste.

Unit-4: Renewable sources of Energy

Solar Energy: Basics of Solar energy. Flat plate collector (Liquid & Air). Theory of flat plate collector. Importance of coating. Advanced collector. Solar pond. Solar water heater, solar dryer. Solar stills.

Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel. Anaerobic digestion. Biogas production mechanism. Utilization and storage of biogas.

Wind energy: Current status and future prospects of wind energy. Wind energy in India. Environmental benefits and problem of wind energy.

New Energy Sources: Need of new sources. Different types of new energy sources. Applications of (Hydrogen energy, Ocean energy resources, Tidal energy conversion.) Concept, origin and power plants of geothermal energy.

Unit-5: Solid Waste Management, ISO 14000 & Environmental Management

Solid waste generation- Sources and characteristics of: Municipal solid waste, E-waste, biomedical waste.

Metallic wastes and Non-Metallic wastes (lubricants, plastics, rubber) from industries. Collection and disposal: MSW (3R, principles, energy recovery, sanitary landfill), Hazardous waste.

Air quality act 2004, air pollution control act 1981 and water pollution and control act 1996. Structure and role of Central and state pollution control board.

Concept of Carbon Credit, Carbon Footprint.

Environmental management in fabrication industry.

ISO 14000: Implementation in industries, Benefits.

Suggested Readings

S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi.

C.N.R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.

Arceivala, Soli Asolekar, Shyam, Waste Water Treatment for Pollution Control and

Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN: 978-07-062099-

Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Wiley, New York, 2000, ISBN 10: 0471144940.

O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi

Rao, C.S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.

Rao, M.N. Rao, H.V.N., Air Pollution, Tata Mc-Graw Hill Publication, New Delhi, 1988, ISBN: 0-07-451871-8.
Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York; 1978, ISBN: 9780070354760.
Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
Patvardhan, A.D., Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN: 978-81-7993-502-6
Metcalf & Eddy, Waste Water Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.
Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi (Edition 2018)

Teachers should use the following strategies to achieve the various outcomes of the course.

Different methods of teaching and media to be used to attain classroom attention.

Massive open online courses (MOOCs) may be used to teach various topics/subtopics.

15-20% of the topics which are relatively simpler or descriptive in nature should be given to the students for self-learning and assess the development of competency through classroom presentations.

Micro-projects may be given to groups of students for hands-on experiences.

Encouraging students to visit sites such as Railway station and research establishments around the institution.

CSXXXXXX Minor Project (3 credits-45 Hours)

SEMESTER V

CSxxxx: DATA AND VISUAL ANALYTICS IN AI (3 credits-45 Hours)

Course Objectives

The student will be able to understand techniques and algorithms for creating effective visualizations based on principles from graphic design. They will also be introduced to several industry-standard software tools to create a compelling and interactive visualization of various types of data.

Course Outcomes

Understand the key techniques and theory used in visualization, including data models, graphical perception, and techniques for visual encoding and interaction. (Understanding)

Apply knowledge to a number of common data domains and corresponding analysis tasks, including multi-variate data, networks, text, and cartography. (Applying)

Describe big data and use cases from selected business domains. (Analyzing)

Explain NoSQL big data management and other technologies such as Hadoop and HDFS. (Analyzing)

Module I (8 Hours)

Introduction: Data for Graphics, Design principles, Value for visualization, Categorical, time series, and statistical data graphics, Introduction to Visualization Tools

Module II (12 Hours)

Graphics Pipeline and Aesthetics and Perception Introduction, Primitives: vertices, edges, triangles, Model transforms: translations, rotations, scaling, View transform, Perspective transform, window transform, Graphical Perception Theory, Experimentation, and the Application, Graphical Integrity, Layering and Separation, Color and Information, Using Space

Module III (8 Hours)

Visual Display of Quantitative Information, Data-Ink Maximization, Graphical Design, Exploratory Data Analysis, Heat Map.

Module IV (9 Hours)

Query, Analysis and Visualization of Multi-Dimensional Relational Databases, Interactive Exploration, tSNE, Interactive Dynamics for Visual Analysis, Visual Queries, Finding Patterns in Time Series Data, Trend visualization, Animation, Dashboard, Visual Storytelling.

Module V (8 Hours)

Graph Visualization and Navigation, Online Social Networks, Social Data Analysis, Collaborative Visual Analytics, Text, Map, Geospatial data.

Suggested Readings

The Visual Display of Quantitative Information by E. Tufte, Graphics Press, 2nd Edition, 2001
 Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, Khanna Publishing 2019.
 Data Visualization Handbook by J. Koponen, J. Hildén, CRC Press, 2019
 The Book of Trees: Visualizing Branches of Knowledge by M. Lima, Princeton Architectural Press, 2014
 Handbook of Graph Drawing and Visualization by R. Tamassia, CRC Press, 2013
 Interactive Data Visualization for the Web by S. Murray O'Reilly Press, 2nd Edition, 2017

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Introduction to Data Analytics	Prof. Nandan Sudarasanam & Prof. B. Ravidran	IIT Madras
2	Deep Learning for Visual Computing	Prof. Debdoot Sheet	IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M	M			
CO2		H			
CO3	H	H	H	M	L
CO4	L		M	H	H

CSNLxxxx: NATURAL LANGUAGE PROCESSING

(3 Credits - 45 Hours)

Objectives

The students should be able to study language and the tools that are available to efficiently study and analyze large collections of text. They should learn about and discuss the effects of electronic communication on our language.

Course Outcomes

Recall algorithms and methods for building computational models of natural language processing (Remembering)
 Explain syntactic analysis, semantic representations, discourse analysis, and statistical and corpus-based methods for text processing and knowledge acquisition. (Understanding)
 Apply the methods of natural language processing. (Applying)
 Analyse Issues involved in natural language processing. (Analysing)
 Evaluate and generate applications that can benefit from natural language processing, such as information extraction, question answering, machine translation, and spoken language understanding. (Evaluating & creating)

Module I (10 hours)

A computational framework for natural language, description of English or an Indian language in the framework, lexicon, algorithms and data structures for implementation of the framework, Finite state automata, the different analysis levels used for NLP (morphological, syntactic, semantic, pragmatic, Recursive and augmented transition networks. Applications like machine translations.

Module II (15 hours)

Word Level Analysis: Regular Expressions, Finite-State Automata, Morphological Parsing, Spelling Error Detection and correction, Words and Word classes, Part-of Speech Tagging. Syntactic Analysis: Context-free Grammar, Constituency, Parsing-Probabilistic Parsing. Machine readable dictionaries and lexical databases, RTN, ATN.

Module III (10 hours)

Semantic Analysis: Meaning Representation, Lexical Semantics, Ambiguity, Word Sense Disambiguation. Discourse Processing: cohesion, Reference Resolution, Discourse Coherence and Structure. Knowledge Representation, reasoning.

Module IV (7 hours)

Natural Language Generation (NLG): Architecture of NLG Systems, Generation Tasks and Representations, Application of NLG. Machine Translation: Problems in Machine Translation, Characteristics of Indian Languages, Machine Translation Approaches, Translation involving Indian Languages.

Module V (3 hours)

Information Retrieval: Design features of Information Retrieval Systems, Classical, Non-classical, Alternative Models of Information Retrieval, valuation Lexical Resources: World Net, Frame Net, Stemmers, POS Tagger.

Suggested Readings:

Natural Language understanding by James Allen, Pearson Education, 2002.
 NLP: A Paninian Perspective by AksharBharati, VineetChaitanya, and Rajeev Sangal, Prentice Hall, 2016.
 Meaning and Grammar by G. Chirchia and S. McConnell Ginet, MIT Press, 1990.
 An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition by Daniel Jurafsky and James H. Martin, Pearson Education, 2006.
 Natural language processing in Prolog by Gazdar, &Mellish, Addison-Wesley
<https://www.coursera.org/specializations/natural-language-processing>

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Natural Language Processing	Prof. Pawan Goyal	IIT Kharagpur
2	Natural Language Processing	Prof. Pushpak Bhattacharya	IIT Bombay

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	H	M		
CO 3		M	H	L	
CO 4		M	M	H	M
CO 5				M	H

CSPxxxx: ADVANCED MACHINE LEARNING
(3 credits-45 Hours)

Course Objectives

To introduce advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation.

To design and implement various machine learning algorithms in a range of real-world applications.

Course Outcomes

Understand advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. (Understanding)

Apply various machine learning algorithms in a range of real-world applications. (Applying)

Integrate and apply their expertise to produce solutions for real-world problems. (Applying and Creating)

Interpret and Analyze results with reasoning using different ML techniques. (Analyzing)

Module I (10 Hours)

Introduction to ANN, Perceptron, Cost Function, Gradient Checking, multi-layer perceptron and backpropagation algorithm that is used to help learn parameters for a neural network, Random Initialization.

Module II (11 Hours)

Probability theory and Bayes rule, Naive Bayes learning algorithm, Bayes nets.

Module III (8 Hours)

Representing concepts as decision trees, Recursive induction of decision trees, best splitting attribute: entropy and information gain. Searching for simple trees and computational complexity, Overfitting, noisy data, and pruning.

Module IV (8 Hours)

Reinforcement learning through feedback network, function approximation.

Module V (8 Hours)

Bagging, boosting, stacking and learning with ensembles. Random Forest

Suggested Readings

Tom Mitchell, Machine Learning, McGraw Hill, 1997.

Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.

Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021

Ethem Apaydin, Introduction to Machine Learning, 2e. The MIT Press, 2010.

Kevin P. Murphy, Machine Learning: a Probabilistic Perspective, The MIT Press, 2012.

<https://www.coursera.org/learn/bayesian-methods-in-machine-learning?specialization=aml>

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Machine Learning for Engineering and Science Applications	Dr. Balaji Srinivasan	IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M	L			
CO2		H	L		
CO3	H	H	H	M	M
CO4	L			H	H

CSPxxxx: OPTIMIZATION TECHNIQUES IN MACHINE LEARNING
(4 credits- 60 Hours)

Course Objectives

The students will be able to understand and analyze how to deal with changing data. They will also be able to identify and interpret potential unintended effects in your project. They will understand and define procedures to operationalize and maintain your applied machine learning model.

Course Outcomes

Know the concept of optimality criteria for various types of optimization problem (Remembering)

Assess / Evaluate the most important algorithms, function classes, and algorithm convergence guarantees. (Evaluate)

Compose existing theoretical analysis with new aspects and algorithm variants. (Understand)

Formulate scalable and accurate implementations of the most important optimization algorithms for machine learning applications. (Applying)

Characterize trade-offs between time, data and accuracy, for machine learning methods. (Analyze)

Module I (10 Hours)

Introduction: What is optimization, Formulation of LPP, Solution of LPP: Simplex method, Basic Calculus for optimization: Limits and multivariate functions, Derivatives and linear approximations: Singlevariate functions and multivariate functions.

Module II (11 Hours)

Machine Learning Strategy: ML readiness, Risk mitigation, Experimental mindset, Build/buy/partner, setting up a team, Understanding and communicating change.

Module III (8 Hours)

Responsible Machine Learning: AI for good and all, Positive feedback loops and negative feedback loops, Metric design and observing behaviours, Secondary effects of optimization, Regulatory concerns.

Module IV (8 Hours)

Machine Learning in production and planning: Integrating info systems, users break things, time and space complexity in production, when to retain the model? Logging ML model versioning, Knowledge transfer, Reporting performance to stakeholders.

Module V (8 Hours)

Care and feeding of your machine learning model: MLPL Recap, Post deployment challenges, QUAM monitoring and logging, QUAM Testing, QUAM maintenance, QUAM updating, Separating Datastack from Production, Dashboard Essentials and Metrics monitoring.

Suggested Readings

Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.

Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021

Optimization for Machine Learning, SuvritSra, Sebastian Nowozin and Stephen J. Wright, MIT Press, 2011.

Optimization in Machine Learning and Applications, Suresh Chandra Satapathy, Anand J. Kulkarni, Springer, 2019.

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL ID	NPTEL Course Name	Instructor	Host Institute
1	NA	NOC: Optimization for Machine Learning: Theory and Implementation (Hind)	Prof.Pravesh Biyani	IIIT Delhi

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2		H			
CO3	H	L	H		L
CO4	L		M	H	
CO5				L	H

CSXXXX: MINOR PROJECT

(3 Credits – 45 Hours)

Course Outcomes

1. Recall the software development life cycle and fundamental phases of system/application/software design and research. (Remembering)
2. Explain how to carry out a project work and explain the importance of different phase of a system design, workflow and time estimation with research outlook. (Understanding)
3. Implement a system and plan how to perform research for real time application. (Applying)
4. Compare the feasibility of a project in terms of time, effort and money.(Analyze)
5. Evaluate a project based on its efficiency applicability robustness, user friendliness etc., with socio economic factors (Evaluating)
6. Design applications by critically examining and scientifically designing each phase of the project.(Creating)

INDIAN CONSTITUTION

(3 credits-45 Hours)

Course Objectives

This course is designed to introduce the students to the basics of Constitutional Law. The students will be introduced to a brief historical background to the framing of India's Constitution, the salient features of the Constitution of India and the nature of polity established under this Constitution in India. It will also help the students understand the kind of government established, the values and commitments of this Constitution and the basic framework of governance established hereunder. It is also designed to appraise the learners of the roles to be played by different political institutions in India.

Course Outcomes

Know the importance of Constitution and Government, Fundamental Rights and Duties, Directive Principles. (Remembering)

Learn about the role of PM, President, Council of Ministers, and Local Administration. (Understand)

Understand the functioning of three wings of the government i.e., executive, legislative and judiciary. (Understanding)

Become Good Citizens and know their fundamental rights, duties, and principles. (Applying)

Analyze the decentralization of power between central, state and local self-government. (Analyze)

Module I (8 Hours)

The Constitution – Introduction: The History of the Making of the Indian Constitution, Preamble and the Basic Structure, and its interpretation, Fundamental Rights and Duties and their interpretation, State Policy Principles

Module II (10 Hours)

Union Government: Structure of the Indian Union, President – Role and Power, Prime Minister and Council of Ministers, Lok Sabha and Rajya Sabha.

Module III (10 Hours)

State Government: Governor – Role and Power, Chief Minister and Council of Ministers, State Secretariat.

Module IV (9 Hours)

Local Administration: District Administration, Municipal Corporation, Zila Panchayat.

Module V (8 Hours)

Election Commission: Role and Functioning, Chief Election Commissioner, State Election Commission.

Suggested Readings:

'Indian Polity' by Laxmikanth, 5th Edition, McGraw Hill Edition

Ethics and Politics of the Indian Constitution, Rajeev Bhargava, Oxford University Press, New Delhi, 2008

The Constitution of India, B.L. Fadia, Sahitya Bhawan; New edition (2017)

Introduction to the Constitution of India, D. D Basu, Lexis Nexis; Twenty-Third 2018 edition

Suggested Software/Learning Websites:

<https://www.constitution.org/cons/india/const.html>

<http://www.legislative.gov.in/constitution-of-india>

<https://www.sci.gov.in/constitution>

<https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

S. No.	NPTEL ID	NPTEL Course Name	Instructor	Host Institute
1	12910600	CONSTITUTION OF INDIA AND ENVIRONMENTAL GOVERNANCE: ADMINISTRATIVE AND ADJUDICATORY PROCESS	PROF. SAIRAM BHAT, PROF. M. K. RAMESH	NATIONAL LAW SCHOOL OF INDIA UNIVERSITY

Alternative NPTEL/SWAYAM Course

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2		H	M		
CO3	M	H	H		
CO4	L		M	H	M
CO5				M	H

CSSNxxx: Data and Visual Analytics in AI Lab

(1 credit – 15 Hours)

Experiments

Understand the meaning of big data and its application.

Using NOSQL to get data from unstructured database.

Explore differed open source technologies available for big data.

Project involving yarn, Pig, grant etc.

Suggested Readings

The Visual Display of Quantitative Information by E. Tufte, Graphics Press, 2nd Edition, 2001

Beginner's Guide for Data Analysis using R Programming, Jeeva Jose, Khanna Publishing 2019.

Data Visualization Handbook by J. Koponen, J. Hildén, CRC Press, 2019

The Book of Trees: Visualizing Branches of Knowledge by M. Lima, Princeton Architectural Press, 2014

Handbook of Graph Drawing and Visualization by R. Tamassia, CRC Press, 2013

Interactive Data Visualization for the Web by S. Murray O'Reilly Press, 2nd Edition, 2017

Mapping of COs to Syllabus

Course Outcomes	Exp I	Exp II	Exp III	Exp IV
CO1	M			
CO2	H	H		
CO3		H	H	M
CO4			M	H

CSSNxxx: NATURAL LANGUAGE PROCESSING LAB

(1 credit – 15 Hours)

Course Outcomes

List the functions provided by NLTK for natural language processing. (Knowledge)

Explain of the various NLTK functions and corpora available for natural language processing. (Understanding)

Implement NLTK programs for part of speech tagging, syntax analysis, semantic analysis etc. (Applying)

Analyze the structure and meaning of given text. (Analyzing)

Evaluate the performance of classifiers used for text classification. (Evaluating)

Combine different NLTK functions to build applications for natural language processing and understanding. (Creating)

Module I (4 Hours)

Natural Language Toolkit (NLTK): Installation and getting started; Accessing text corpora; Ngrams; Conditional Frequency Distribution; Regular expressions for detecting word patterns; Regular expressions for tokenizing text

Module II (3 Hours)

Using a tagger; Tagged corpora; Automatic tagging, Ngram tagging;

Module III (4 Hours)

Classify text; supervised classification; Naive Bayes classifiers; Information extraction; Chunking; Named entity recognition; Relation extraction

Module IV (4 Hours)

Parsing with context free grammars; Dependency grammar; Grammar development; Grammatical features; Processing feature structures; Natural language understanding; Propositional logic; First order logic

Suggested Readings

Steven Bird, Ewan Klein, Edward Loper, Natural Language Processing with Python, O'Reilly Media.
Jacob Perkins, Python Text Processing with NLTK 2.0 Cookbook, O'Reilly Media.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	M		
CO2		H	H	
CO3		M		H
CO4			L	H
CO5		L	H	
CO6	L		H	H

CSPxxxx: ADVANCED MACHINE LEARNING LAB

(1 credit – 15 Hours)

Course Objectives

To introduce advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. To design and implement various machine learning algorithms in a range of real-world applications.

Course Outcomes

Understand advanced concepts and methods of machine learning and to develop an understanding of the role of machine learning in massive scale automation. (Understanding)
Apply various machine learning algorithms in a range of real-world applications. (Applying)
Integrate and apply their expertise to produce solutions for real-world problems. (Applying and Creating)
Interpret and Analyze results with reasoning using different ML techniques. (Analyzing)

Implementation of following machine learning algorithms in various projects using Python:

1. Classification and regression algorithms.
2. K-Means Clustering.
3. Artificial Neural Network (with back-propagation).
4. Decision Trees.
5. Random Forest.

Suggested Readings

Tom Mitchell, Machine Learning, McGraw Hill, 1997.
 Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.
 Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021
 Ethem Apaydin, Introduction to Machine Learning, 2e. The MIT Press, 2010.
 Kevin P. Murphy, Machine Learning: a Probabilistic Perspective, The MIT Press, 2012.
<https://www.coursera.org/learn/bayesian-methods-in-machine-learning?specialization=aml>

Mapping of COs to Syllabus

Course Outcomes	Exp I	Exp II	Exp III	Exp IV	Exp V
CO1	M	L			
CO2		H	L		
CO3	H	H	H	M	M
CO4	L			H	H

SEMESTER VI
CSxxxxxx: INDUSTRY/RESEARCH LAB INTERNSHIP
(16 credits – 490 Hours)
Course Outcomes

Demonstrate knowledge of professional and ethical responsibilities in AI/ML, focusing on data privacy, bias, and societal impact during the internship. (Understanding)
 Assess the effectiveness, efficiency, and impact of AI/ML solutions from the internship, considering accuracy, performance, scalability, and ethics. (Evaluating)
 Apply AI/ML concepts and techniques from coursework to solve practical problems in an industry or research setting during the internship. (Applying)
 Evaluate technical and business requirements of internship projects, identify challenges, and propose AI/ML solutions. (Analyzing)
 Design and implement innovative AI/ML models and systems to address specific internship tasks, showcasing creativity and technical skill. (Creating)

CSxxxxxx: MAJOR PROJECT
(10 credits – 150 Hours)
Course Outcomes

Explain how to execute a project, emphasizing the significance of various phases in system design, workflow, and time estimation with a research perspective. (Understanding)
 Develop a system and demonstrate the process of conducting research for real-time applications. (Applying)
 Assess the feasibility of a project considering factors such as time, effort, and budget. (Analyzing)
 Evaluate a project's effectiveness based on criteria like efficiency, applicability, robustness, user-friendliness, and socioeconomic impact. (Evaluating)
 Create applications by systematically planning and designing each phase of a project. (Creating)

Professional Elective Courses - 1
CSxxxxxx: Solve Business Problems with AI
(3 credits- 45 Hours)
Course Objectives

The students will be able to relate with the practical uses of AI in day-to-day businesses. They will be able to understand the cautions need to be observed while working with AI. They will also be able to apply AI to boost business productivity.

Course Outcomes

Analyze practical uses of AI in day-to-day businesses. (Analyze)
 Understand the cautions need to be observed while working with AI. (Understand)
 Apply AI to boost business productivity. (Apply)
 Use various cloud platforms. (Apply)
 Understand data privacy. (Understand)

Module I: Introduction (6 hours)

AI for businesses, optimizing business processes, Minimizing costs, AI solutions: Deep Q-learning, Action selection policies

Module II: Apply AI and ML to business problems (13 hours)

Solve Business Problems with AI and Machine Learning Course Introduction, Identify Data-Driven Emerging Technologies Module Introduction, The Data Hierarchy, Big Data, Data Mining, Applied AI and ML in Business, Appropriate Business Problems, Challenges of AI/ML, Machine Learning Model, Machine Learning Workflow, Concept Drift and Transfer Learning, Problem Formulation, Differences Between Traditional Programming and Machine Learning, Differences Between Supervised and Unsupervised Learning, Randomness and Uncertainty, Machine Learning Outcomes

Module III: How to choose the right tool? (8 hours)

importance of choosing the right tools, Hardware requirements: Parallel processors, GPUs, GPU platforms; Cloud Platforms: cloud hosting services: Amazon Web Services, Microsoft Azure, Google TPUs; Open-source AI tools, Proprietary AI tools

Module IV: Data privacy and Ethical Practices (13 hours)

Introduction, Data Protection, Data Privacy Laws, Privacy by Design, Data Privacy Principles at Odds with Machine Learning, Compliance with Data Privacy Laws and Standards, Data Sharing and Privacy, The Big Data Challenge, Preconceived Notions, The Black Box Challenge, Bias, Prejudice, and Discrimination, Ethics in NLP, Use of Data for Unintended Purposes, Intellectual Property, Humanitarian Principles, Asilomar AI Principles

Module V: Case Studies (5 hours)

Real world case study

Suggested Readings

A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Book Publishing.
 Artificial Intelligence in Practice by Bernard Marr, Matt Ward, O'Reilly, 2019.
 Artificial Intelligence and Machine Learning for Business: A No-Nonsense Guide to Data- Driven Technologies by Steven Finlay, Relativistic publishers, 2017.
<https://www.coursera.org/learn/solve-problems-ai-machine-learning>

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	M	M	H
CO2		M	M	H	
CO3	H	H	M		H
CO4	L		H	H	
CO5		L	L	H	M

Professional Elective Courses - 2**CSxxxxxx: AI in Gaming
(3 credits- 45 Hours)****Course Objectives**

The students should be able to understand and use AI techniques for generating efficient, intelligent behavior in games. Additional attention is to be given to AI algorithms for improving game play experience.

Course Outcomes

Understand and identify tasks that can be tackled using AI techniques. (Remember, Understand)
 Apply appropriate AI technique for the problem under investigation. (Apply)
 Create efficient and robust AI algorithms for game tasks. (Create)
 Apply learning mechanisms to gaming problems. (Apply)

Module I: Introduction (8 Hours)

Introduction to Game AI, kind of AI used in game development, model of game AI, AI engine structure..

Module II: Movement Algorithms and Steering Behaviour (9 Hours)

Kinematic movement algorithms, problems related to the steering behaviour of objects and Solutions.

Coordinated Movement and Motor Control: This unit discusses the concepts related to coordinated movements and motor control.

Module III: Pathfinding (8 Hours)

Basic Path finding Algorithms in game development, Path finding for complex solutions

Module IV: Decision-Making and Uncertainty (10 Hours)

Decision trees and state machines for game development, models for implementing knowledge uncertainty, such as fuzzy logic and Markov systems

Module V: Introduction to Learning Mechanisms (10 Hours)

Board game theory and discusses the implementation of some key algorithms, such as minimax and negamax, Random Number Generation and Minimaxing, algorithms for implementing action prediction, decision learning and reinforcement learning.

Suggested Readings

<https://www.athabascau.ca/syllabi/comp/comp452.php>

<https://www.udemy.com/course/artificial-intelligence-for-simple-games/>

Artificial Intelligence for Games, Ian Millington and John Funge, CRC Press; 2nd edition, 2009.

Artificial Intelligence and Games, Georgios N. Yannakakis and Julian Togelius, Springer International Publishing, 2018.

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Artificial Intelligence: Search Methods For Problem Solving	Prof. Deepak Khemani	IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M		H	
CO2		H	M	H	H
CO3	H	H		H	M
CO4	L			M	H

CSxxxxxx: AI in Healthcare
(3 credits- 45 Hours)
Course Objectives

The students should be able to understand how AI is transforming the practice of medicine. The students should learn the practical experience in applying machine learning to concrete problems in medicine.

Course Outcomes

Understand and apply on tree-based machine learning to estimate patient survival rates. (Understand, Apply)
 Analyze convolutional neural network image classification and segmentation models to make diagnoses of lung and brain disorders. (Analyze)
 Apply natural language processing to extract information from unstructured medical data. (Apply)
 Understand different types of prognosis models related to different diseases. (Understand)

Module I: Introduction (8 Hours)

Introduction to Game AI, kind of AI used in game development, model of game AI, AI engine structure.

Module I: Disease detection with computer vision (8 hours)

Medical Image Diagnosis, Eye Disease and Cancer Diagnosis, Building and Training a Model for Medical Diagnosis, Training, prediction, and loss, Image Classification and Class Imbalance, Generating More Samples, Model Testing

Module II: Evaluating models (11 hours)

Sensitivity, Specificity, and Evaluation Metrics, Accuracy in terms of conditional probability, Confusion matrix, ROC curve and Threshold

Image segmentation on MRI images: Medical Image Segmentation, MRI Data and Image Registration, Segmentation, 2D U-Net and 3D U-Net Data augmentation and loss function for segmentation, Different Populations and Diagnostic Technology, External validation

Module III: Linear prognostic models (11 hours)

Medical Prognosis, Atrial fibrillation, Liver Disease Mortality, Risk of heart disease, Evaluating Prognostic Models, Concordant Pairs, Risk Ties, Permissible Pairs.

Prognosis with Tree-based models:

Decision trees for prognosis, fix overfitting, Different distributions, Missing Data example, Imputation.

Module IV: Survival Models and Time (8 hours)

Survival Model, Survival function, collecting time data, Estimating the survival function.

Build a risk model using linear and tree-based models:

Hazard Functions, Relative risk, Individual vs. baseline hazard, Survival Trees, Nelson Aalen estimator.

Module V: Medical Treatment Effect Estimation (7hours)

Analyze data from a randomized control trial, Average treatment effect, Conditional average treatment effect, T-Learner, S-Learner, C-for-benefit.

Suggested Readings

<https://www.coursera.org/learn/ai-for-medical-diagnosis>

<https://www.coursera.org/learn/ai-for-medical-prognosis#syllabus>

<https://www.coursera.org/learn/ai-for-medical-treatment#syllabus>

Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again, Eric Topol, Basic Books, 1st edition 2019.

Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, ArjunPanesar, Apress, 1st ed. Edition, 2019.

Artificial Intelligence in Healthcare, 2020, ISBN 978-0-12-818438-7, Elsevier Inc.

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1		M	H	H	M
CO2	H	H	L		
CO3	L	L	L	L	L
CO4		M	H	H	M

CSxxxxxx: AI in Finance

(3 credits- 45 Hours)

Course Objectives

The students should be able to understand the evolution of AI-driven online wealth management platforms, robo-advisors, and learn how they work and why they're successful.

Course Outcomes

Understand the strengths and weaknesses of human financial advisors and investors. (Understand)

Understand the business model of robo/AI-advisors. (Understand)

Understand how InsurTech is redefining the insurance industry using AI techniques. (Understand, Analyze)

Understand stock selection and asset management related to financial world. (Understand, Analyze)

Module I: Introduction (9 hours)

Fintech Innovations: Series Map and Learning Goals, Introduction to InsurTech, Investment &

Market Size of the InsurTech Industry, Real Estate Tech, Residential Real Estate Tech

Startups, Commercial Real Estate Tech

Module II: Robo Advising (11 hours)

Expected Returns, Standard Deviations, and Correlation, Building an Efficient Portfolio, Diversified Investments, Exchange Traded Funds, Robo-Advisors, Pure Advisors vs Robo-Advisors, Customer support using robo advisors.

Module III: Stock Selection & Asset Management (12 hours)

Fundamental Analysis: The Passive Benchmark, Manager Performance, Stock Selection Screening: Discovering Signals and Data Issue, Neural Networks, Smart Beta, Wealth Management: Automated Portfolio Optimization, Portfolio Rebalancing Recommendations

Module IV: Compliance and Fraud Detection (8 hours)

Behavioural Profiling Analytics in Fraud Detection, Distinguishing Specialized from Generic Behaviour Analytics,

Module V: Case Studies (5 hours)

Fetch.ai, platforms or apps using AI for financial aspects.

Suggested Readings

<https://www.coursera.org/learn/invest-tech#syllabus>

<https://www.coursera.org/learn/wharton-ai-application-insurtech-real-estate-technology#syllabus>

<https://www.coursera.org/learn/innovation-strategy-fintech>

<https://my.cfte.education/courses/AI-in-Finance-Specialisation>

Artificial Intelligence in Finance, Yves Hilpisch, O'Reilly Media, Inc., 2020.

Machine Learning for Finance: Principles and Practice for Financial Insiders, JannesKlaas, Packt Publishing Limited, 2019.

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	L	H	M	L	
CO2		H	M		M
CO3	H			L	M
CO4		M	H	L	

SEMESTER VII**CSXXX: SOFT COMPUTING**

(3 credits-45 hours)

Course Objective:

Students should be able to understand soft computing concepts and techniques and foster their abilities in designing and implementing soft computing-based solutions for real-world problems.

Course Outcomes:

Understand, Identify and describe soft computing techniques and their roles in building intelligent machines. (Remembering)

Apply a soft computing methodology for a particular problem. (Understanding)

Analyze and compare solutions by various soft computing approaches for a given problem. (Analyze)

Apply genetic algorithms to combinatorial optimization problems and develop solutions. (Applying)

Evaluate and compare solutions by various soft computing approaches for a given problem. (Evaluating)

Module 1 (8 hours)

Introduction to neural networks: Structure and working of Biological Neural Network, Fundamentals of Artificial Neural Networks & Applications, Characteristics of Artificial Neural Networks, History of neural network research, characteristics of neural networks terminology.

Module 2 (12 hours)

Neural networks models and Learning Methods: Models of neuron McCulloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture, Multilayer Neural Networks, Learning Methods, Backpropagation, Counter propagation, ART, BAM, Associative memories.

Module 3 (10 hours)

Introduction of Fuzzy logic and Neuro Fuzzy Systems: Introduction, Fuzzy sets, Fuzzy model, Fuzzy rule generation Fuzzy inference system, Defuzzification, Architecture of a Neuro-Fuzzy system and its applications.

Module 4 (10 hours)

Machine Learning: Supervised learning: Primitive algorithms, Generative algorithms, Support Vector Machine, Ensemble methods. Unsupervised learning: K-means, Principal component analysis, Independent component analysis. Reinforcement learning and control.

Module 5 (5 hours)

Applications: Applications of GA & GP, Hybrid systems.

Suggested Readings:

1. Neuro fuzzy and soft computing by Jang, Pearson Education, 1996
2. Learning and Soft Computing by Kecman, Pearson Education, 2001
3. Fuzzy Sets and Fuzzy Logic - Klir and Yuan, PHI, 1995
4. Neural Network in computer Intelligence by Fu, TMH, 2003
5. Bio-Inspired Artificial Intelligence – Dario Floreano, PHI, 2008
6. Soft Computing – Ikvinderpal Singh, Khanna Book Publishing 2015.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Introduction to Soft Computing	Prof. Debasis Samanta	IIT Kharagpur
2.	Fuzzy Logic and Neural Networks	Prof. Dilip Kumar Pratihar	IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			L
CO2	H	H	M	M	M
CO3	M	H	H	H	
CO4			M	H	H
CO5	L			M	

CSXXX: Machine Learning for Data Science**(3 credits-45 hours)****Course Objective:**

The students will be able to derive practical solutions using predictive analytics. They will also understand the importance of various algorithms in Data Science.

Course Outcomes:

Understand the importance of various algorithms in Data Science. (Understanding)
 Apply practical solutions using predictive analytics. (Applying)
 Create competitive advantage from both structured and unstructured data. (Creating)
 Predict outcomes with supervised machine learning techniques. (Analysing)
 Unearth patterns in customer behavior with unsupervised techniques. (Evaluating)

Module 1(8 hours)

Introduction: Algorithms and Machine Learning, Introduction to algorithms, Tools to analyze algorithms, Algorithmic techniques: Divide and Conquer, examples, Randomization, Applications

Module 2(10 hours)

Algorithms: Graphs, maps, Map searching, Application of algorithms: stable marriages example, Dictionaries and hashing, search trees, Dynamic programming.

Module 3 (10 hours)

Application to Personal Genomics: Linear Programming, NP completeness, Introduction to personal Genomics, Massive Raw data in Genomics, Data science on Personal Genomes, Interconnectedness on Personal Genomes, Case studies

Module 4(8 hours)

Machine Learning: Introduction, Classification, Linear Classification, Ensemble Classifiers, Model Selection, Cross Validation, Holdout

Module 5 (9 hours)

Machine Learning Applications: Probabilistic modelling, Topic modelling, Probabilistic Inference, Application: prediction of preterm birth, Data description and preparation, Relationship between machine learning and statistics

Suggested Readings:

Introduction to Machine Learning, Jeeva Jose, Khanna Book Publishing House.
 Machine Learning, Rajiv Chopra, Khanna Book Publishing House.

Data Science and Machine Learning: Mathematical and Statistical Methods Machine Learning & Pattern Recognition, by Dirk P. Kroese, Zdravko Botev, Thomas Taimre, Radislav Vaisman, Chapman & Hall/Crc, 2019.

Hands-On Data Science and Python Machine Learning, Frank Kane, Packt Publishers, 2017.

<https://www.edx.org/course/machine-learning-for-data-science-and-analytics>

Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Introduction to Machine Learning	Prof. Sudeshna Sarkar	IIT Kharagpur
2.	Introduction to Data Analytics	Prof. Nandan Sudarsanam Prof. B. Ravindran	IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			L
CO2	H	H	M	M	
CO3	M		H		M
CO4			M	M	H
CO5	L			H	

CSXXX: Bioinformatics
(3 credits - 45 hours)

Course Objective:

The students should be able to understand the scope of Bioinformatics. They should know about popular bioinformatics databases and sequence alignment algorithms.

Course outcomes:

Understand the various challenges and applications of bioinformatics. (Understanding)

Analyze various biological sequence databases. (Analysing)

Apply predictive methods on DNA and protein sequences. (Applying)

Perform sequence comparison and sequence alignment. (Evaluating)

Module 1 (8 hours)

Introduction: History, scope and important contributions, aims and tasks of Bioinformatics, applications of Bioinformatics, challenges and opportunities, introduction to NCBI data model, various file formats for biological sequences.

Module 2 (12 hours)

Biological Databases and Data Search Methods: Importance of databases, biological databases, primary sequence databases, composite sequence databases, secondary databases, nucleic acid sequence databases, protein sequence databases, structure databases, bibliographic databases, specialized genomic resources,

analysis packages. Methods for searching sequence databases like FASTA and BLAST algorithms, Statistical analysis and evaluation of BLAST results.

Module 3 (8 hours)

Sequence Comparison Methods: Methods for comparison of two sequences, Needleman Wush and Smith Waterman algorithms. Analysis of computational complexities, merits and demerits of these algorithms, theory of scoring matrices and their use for sequence comparison.

Module 4 (8 hours)

Sequence Alignment Methods: Sequence analysis of biological data, significance of sequence alignment, pair wise sequence alignment methods, use of scoring matrices and gap penalties in sequence alignments, multiple sequence alignment methods, tools and applications of multiple sequence alignment.

Module 5 (9 hours)

Predictive Methods Using DNA and Protein Sequences: Gene prediction strategies, protein prediction strategies, molecular visualization tools, phylogenetic analysis: concept of trees, phylogenetic trees and multiple alignments.

Suggested Readings:

Andreas D Baxeavanis& B F Francis, "Bioinformatics-A practical guide to analysis of Genes and Proteins", John Wiley, 2010
 T K Attwood, D J Parry-Smith, "Introduction to Bioinformatics", Pearson Education, 2005
 Neil C. Jones, Pavel A. Pevzner, "An introduction to Bioinformatics Algorithms", MIT Press, 2005
 Gary Benson Roderic, "Algorithms in Bioinformatics", Springer, 2004
 Foundations of Bioinformatics, ManojDarbari, Khanna Book Publishing Co., 2013

Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Bio-Informatics: Algorithms And Applications	Prof. Michael Gromiha	IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H			
CO2	M	H			
CO3			L		H
CO4			H	H	L

CSXX: Pattern Recognition & Visual Recognition

(3 credits - 45 hours)

Course Objective:

To help students understand basic mathematical and statistical techniques commonly used in pattern recognition. To introduce students to a variety of pattern recognition algorithms.

Course Outcomes

Understand basic mathematical and statistical techniques commonly used in pattern recognition. (Understanding)

Apply a variety of pattern recognition algorithms. (Applying)

Analyse and apply various pre-processing algorithms. (Analysing)

Evaluate various algorithms for image classification. (Evaluating)

Module 1 (8 hours)

Introduction and mathematical Preliminaries: Principles of pattern recognition: Uses, mathematics, Classification and Bayesian rules, Clustering vs classification, Basics of linear algebra and vector spaces, Eigen values and eigen vectors, Rank of matrix and SVD.

Module 2 (12 hours)

Pattern Recognition basics: Bayesian decision theory, Classifiers, Discriminant functions, Decision surfaces, Parameter estimation methods, Hidden Markov models, dimension reduction methods, Fisher discriminant analysis, Principal component analysis, non-parametric techniques for density estimation, non-metric methods for pattern classification, unsupervised learning, algorithms for clustering: K-means, Hierarchical and other methods

Module 3 (8 hours)

Feature Selection and extraction: Problem statement and uses, Branch and bound algorithm, Sequential forward and backward selection, Cauchy Schwartz inequality, Feature selection criteria function: Probabilistic separability based and Interclass distance based, Feature Extraction: principles

Module 4 (9 hours)

Visual Recognition: Human visual recognition system, Recognition methods: Low-level modelling (e.g. features), Mid-level abstraction (e.g. segmentation), High-level reasoning (e.g. scene understanding); Detection/Segmentation methods; Context and scenes, Importance and saliency, Large-scale search and recognition, Egocentric vision, systems, Human-in-the-loop interactive systems, 3D scene understanding.

Module 5 (8 hours)

Recent advancements in Pattern Recognition: Comparison between performance of classifiers, Basics of statistics, covariance and their properties, Data condensation, feature clustering, Data visualization, Probability density estimation, Visualization and Aggregation, FCM and soft-computing techniques, Examples of real-life datasets.

Suggested Readings:

Pattern Recognition and Machine Learning by Christopher M. Bishop, Springer, 2006.

Pattern Classification by Richard O. Duda, Peter E. Hart, David G. Stork, Wiley, 1973.

<https://nptel.ac.in/courses/106/106/106106046/>

Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Pattern Recognition and Application	Prof. P.K Biswas	IIT Kharagpur
2.	Pattern Recognition	Prof. C.A. Murthy	IIT Madras

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO1	H		H		
CO2	M	H		H	
CO3			M	M	H
CO4		M			M

CSXXX: Genome Sequencing**(3 credits-45 hours)**

Course Objective:

The students should be able to understand the basic biology of modern genomics and the experimental tools those can be used to measure it.

Course outcomes: After completion of course, students would be able to:

Understand how data from next-generation sequencing experiments are generated and analyzed. (Understanding)

Understand Galaxy framework and apply for different types of analysis. (Applying)

Analyze RNA sequences using Galaxy framework. (Analysing)

Evaluate antibiotic sequence using genomic assembly tools. (Evaluate)

Module 1 (8 hours)

Introduction: Genomics, Genomic Data Science, Molecular Biology Structures, From Genes to Phenotypes, Polymerase Chain Reaction, Next Generation Sequencing, Applications of Sequencing, The String Reconstruction Problem, String Reconstruction as a Hamiltonian Path Problem, String Reconstruction as a Eulerian Path Problem.

Module 2 (12 hours)

Genomic data science with galaxy: Challenges of Reproducibility, Introduction to the Galaxy Platform, Genomic Intervals, Workflows, Sequence Data Quality Control, ChIP-Sequence Analysis with MACS, RNA-seq Analysis: Mapping, RNA Sequence Analysis: Assembly Quantitation, and Differential Expression.

Module 3 (8 hours)

Sequencing Antibiotics: Discovery of Antibiotics, How Do Bacteria Make Antibiotics, Sequencing Antibiotics by Shattering them into Pieces, A Brute Force Algorithm for Cyclopeptide Sequencing, Cyclopeptide Sequencing with Branch and Bound.

Module 4 (10 hours)

Ideal to Real Spectra for Antibiotics Sequencing: Adapting Sequencing for Spectra with Errors, from 20 to More than 100 Amino Acids, The Spectral Convolution, apply genome assembly tools to sequencing data from a dangerous pathogenic bacterium.

Module 5 (7 hours)

Proteomics: Protein structure, proteomics, and protein-protein interaction networks.

Suggested readings:

<https://www.coursera.org/learn/genome-sequencing#syllabus>

<https://www.coursera.org/learn/galaxyproject?specialization=genomic-data-science#syllabus>

Bioinformatics with Python Cookbook, Packt Publishing, 2015

Python for Bioinformatics, Sebastian Bassi, Chapman and Hall/CRC.

Alternative NPTEL/SWAYAM Course (if any):

S. No.	Course Name	Instructor	Host Institute
1.	Introduction to Proteogenomics	Prof. SanjeevaSrivastava	IIT Bombay
2.	Bio-Informatics: Algorithms And Applications	Prof. Michael Gromiha	IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	
CO1	H	M			
CO2	L	H			
CO3		H	L		H
CO4			H	H	L

CSXXX: Machine Learning with Python
(3 Credits - 45 hours)

Course Objective:

The students will be able to handle various datatypes and datasets in python. They will also be able to implement various machine learning model sin python.

Course Outcomes

Understand python and be able to handle various datasets in python.(Remembering, Understanding)

Understand basic machine learning algorithms.(Applying)

Apply different classification and clustering algorithms for problem solving.(Anaylsing)

Create basic machine learning algorithms in python.(Creating)

Module 1 (8 hours)

Introduction to Python: Data Types, Operators, Expression, Indexing & Slicing, Strings, Conditionals, Functions, Control Flow, Nested Loops, Sets & Dictionaries

Module 2 (12 hours)

Introduction to Machine Learning: Machine Learning Vs Statistical Modelling, Supervised vs Unsupervised Learning, Supervised Learning Classification, Unsupervised Learning, Reinforcement Learning, Applications, Python libraries suitable for Machine Learning: Pandas, Numpy, Scikit-learn, visualization libraries: matplotlib etc.

Module 3 (8 hours)

Regression: Simple Linear Regression, Multiple Linear Regression, Non-linear Regression, Model Evaluation in Regression Models, Evaluation Metrics in Regression Models

Module 4 (8 hours)

Classification: Introduction to Classification, K-Nearest Neighbour, Decision Trees, Logistic Regression, Support Vector Machines, Logistic regression vs Linear regression, Evaluation Metrics in Classification

Module 5 (9 hours)

Unsupervised Learning: Intro to Clustering, K-Means Clustering, Hierarchical Clustering, Density-Based Clustering, Content-based recommender systems, Collaborative Filtering

Laboratory/ Practicals:

Implementation of following machine learning algorithms in various projects using Python:

Classification and regression algorithms.

Artificial Neural Network (with back-propagation).

Mathematical computing with Python packages like: numpy, Mat-plotLib, pandas Tensor Flow, Keras

Implement basic ML models like SVM, KNN, K-Means, Logistic Regression, Linear Regression

Suggested Readings:

Hands-On Machine Learning with Scikit-Learn and TensorFlow 2e: Concepts, Tools, and Techniques to Build Intelligent Systems, Aurelien Geron, O'Reilly, 2017

Python Machine Learning - Third Edition, Sebastian Raschka, Vahid Mirjalili, Packt Publishers, 2019

Introduction to Machine Learning with Python: A Guide for Data Scientists 1st Edition by Andreas C. Müller, Sarah Guido, O'Reilly, 2016

<https://www.coursera.org/learn/machine-learning-with-python>

<https://www.edx.org/course/machine-learning-with-python-a-practical-introduct>

Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Introduction to Machine Learning	Prof. Balaraman Ravindran	IIT Madras
2.	Machine Learning	Prof. Carl Gustaf Jansson	KTH, The Royal Institute of Technology

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2		H		M	
CO3		M		H	
CO4			M	H	L

CSXXX: AI for Everyone
(3 credits- 45 hours)

Course Objective:

The students should be able to understand what is AI, its applications and use cases and how it is transforming our lives.

Course outcomes:

Understand the basic concepts of AI and machine learning. (Remembering, understanding)

Understand the working of self-driving systems. (Applying)

Understand how to build different AI projects. (Evaluating and creating)

Apply AI techniques to any application domain. (Analysing)

Module 1: (10 hours)

Introduction: Machine Learning, What is data, The terminology of AI, What makes an AI company, What machine learning can and cannot do, Non-technical explanation of deep learning, basics of neural networks, Examples of AI, Application domains of AI.

Module 2: (10 hours)

Building AI projects: Workflow of a machine learning project, Workflow of a data science project, how to use data, How to choose an AI project, Working with an AI team, How to process and visualize data, Technical tools for AI teams, use of python in AI related projects.

Module 3: (8 hours)

Building AI in Your Company: Case study: Smart speaker, Case study: Self-driving car, Example roles of an AI team, AI pitfalls to avoid, Survey of major AI application areas

Module 4: (8 hours)

AI and Society: A realistic view of AI, Discrimination / Bias, Adversarial attacks on AI, Adverse uses of AI, AI and developing economies, AI and jobs

Module 5: (9 hours)

AI case studies related to a specific domain.

Laboratory/ Practicals:

Numerical type questions on CNN-

Parameters tuning

Convolution function

Different types of filters

Fuzzy Logic and Neural Networks

Implement self-driving vehicle algorithm.

Alternative NPTEL/SWAYAM Course (if any):

S. No.	NPTEL Course Name	Instructor	Host Institute
1	Artificial Intelligence	Prof. Sudeshna Sarkar	IIT Kharagpur
2	An Introduction to Artificial Intelligence	Prof. Mausam	IIT Delhi

Suggested References:

<https://www.coursera.org/learn/ai-for-everyone#syllabus>

<https://www.edx.org/course/artificial-intelligence-for-everyone>

Artificial Intelligence: A Modern Approach, by Stuart Russell, Peter Norvig, Prentice Hall, 2010

Artificial Intelligence: The Basics by Kevin Warwick, Routledge, 2011

Artificial Intelligence for Humans by Jeff Heaton, CreateSpace Independent Publishing, 2015

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	
CO1	L	H			
CO2	L	M			
CO3		M	M	H	
CO4		M	M	M	H

CSXXX: SOFT COMPUTING LAB (1 Credit-15 hours)

Course Objective:

Students should be able to understand soft computing concepts and techniques and foster their abilities in designing and implementing soft computing-based solutions for real-world problems.

Course Outcomes:

Understand, Identify and describe soft computing techniques and their roles in building intelligent machines. (Remembering)

Apply a soft computing methodology for a particular problem. (Understanding)

Analyze and compare solutions by various soft computing approaches for a given problem. (Analyze)

Apply genetic algorithms to combinatorial optimization problems and develop solutions. (Applying)

Evaluate and compare solutions by various soft computing approaches for a given problem. (Evaluating)

Practical sessions: Setting up Python for Machine Learning and AI.

Experiments with TensorFlow for Neural Networks.

Experiments with scikit-fuzzy for Fuzzy Logic.

Implementing Fuzzy Logic in Python.

Implementing Artificial Neural Networks in Python.

Implementing Genetic Algorithms in Python.

Mapping of COs to Syllabus

Course Outcomes	I	II	III	IV	V	VI
CO1	H	M				
CO2			H	H		H
CO3		H				
CO4					H	H
CO5				H		
CO6	L			H		H

CSXXX: Machine Learning for Data Science Lab (1 credit-15 hours)

Course Outcomes

Apply Clustering algorithms to solve any clustering problem. (Applying)
 Analyse the performance of various classification algorithms. (Analysing)
 Select appropriate models for solving a specific problem. (Evaluating)
 Design neural network-based classifiers to classify real world data. (Creating)

List of Experiments

Write a program to implement Linear Regression. Use an appropriate dataset to illustrate the working of linear regression.
 Write a program to implement Decision Tree. Illustrate the classification of sample data using an appropriate dataset.
 Write a program to demonstrate the classification of sample data using KNN algorithm.
 Write a program to implement Bayes Classifier for the classification of sample data.
 Write a program to implement logistic regression for the classification of sample data.
 Write a program to implement Support Vector Machine. Illustrate the classification of sample data using an appropriate dataset.
 Write a program to demonstrate the classification of sample data using Random Forest algorithm.
 Performance analysis of various classification methods using standard matrices applied on confusion matrix.
 Write a program to implement K-Means Clustering Algorithm.
 Write a program to implement a classifier using MLP. Use appropriate dataset to demonstrate the process of classification.
 Write a program to implement a sample CNN. Use appropriate dataset to test the performance of the classifier.
 Implement transfer learning using state of art CNN models. Use appropriate dataset to test the performances of such models.
 Case Studies in Data Science: Eve, the Pharmaceutical Robot Scientist: Data Science for Drug Discovery
 Case Studies in Data Science: Data science for sports analytics
 Case Studies in Data Science: Data science for sensor data (Introduction to challenge)

Mapping of Course Outcomes to Syllabus

Course outcomes	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV
CO1	H	H	H	H	H	H	H		H	H					
CO2											H	M			
CO3								H				H			
CO4													H	H	H

CSxxxxxx: Bioinformatics lab**(1 credit - 15 hours)****Course Objective:**

The students should be able to understand the scope of Bioinformatics. They should know about popular bioinformatics databases and sequence alignment algorithms.

Course outcomes:

Understand the various challenges and applications of bioinformatics. (Understanding)
 Analyze various biological sequence databases. (Analysing)
 Apply predictive methods on DNA and protein sequences. (Applying)
 Perform sequence comparison and sequence alignment. (Evaluating)

List of Experiments:

Hands-on with Nucleic acid databases (NCBI, DDBJ, EMBL), Protein databases (Primary, Composite and Secondary).

Hands-on with Specialized Genome databases (SGD, TIGR, ACeDB), Structure databases (CATH, SCOP, PDBsum).

Hands-on with methods for searching sequence databases.

Hands-on with sequence comparison and sequence alignment methods.

Hands-on with predictive methods.

Mapping of Course Outcomes to Syllabus

Course outcomes	I	II	III	IV	V
CO1	M	M	L		
CO2	H	H	H		
CO3					H
CO4		L		H	

CSXXX: Pattern Recognition & Visual Recognition Lab

(1 credit-15 hours)

Course Outcome

Implement various tools such as maximum likelihood algorithm, Bayes classifier, linear regression, deep learning algorithm, linear discriminant algorithm, unsupervised learning. (remembering, Applying)

Design classifier using perceptron rule, feed forward back-propagation and delta rule, SVM. (Creating)

List of Experiments

Basics of Data Extraction.

Basics of Feature extraction.

Basics of Image classification.

Implement maximum likelihood algorithm.

Implement Bayes classifier.

Implement linear regression.

Design a classifier using perceptron rule.

Design a classifier using feed-forward back-propagation and delta rule algorithms.

Implement deep learning algorithm.

Implement linear discriminant algorithm.

Design a two class classifier using SVM.

Design a multiclass classifier using SVM.

Perform unsupervised learning.

Mapping of Course Outcomes to Syllabus

Course outcomes	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
CO1	H	H	H	H	H	H			H	H			H
CO2							H	H			H	H	

CSXXX: Genome Sequencing Lab

(1 credit-15 hours)

Course Objective:

The students should be able to understand the basic biology of modern genomics and the experimental tools those can be used to measure it.

Course outcomes: After completion of course, students would be able to:

Understand how data from next-generation sequencing experiments are generated and analyzed. (Understanding)

Understand the Galaxy framework and apply for different types of analysis. (Applying)

Analyze RNA sequences using Galaxy framework. (Analysing)

Evaluate antibiotic sequence using genomic assembly tools. (Evaluate)

List of experiments:

Write a program for sequence similarity search.

Write a program to count non-DNA bases in a sequence using Python.

Given a protein sequence, determine if it contains this highly redundant protein domain motif.

Hands on with RNA sequence Analysis.

Hands on with antibiotic sequence.

Mapping of Course Outcomes to Syllabus

Course outcomes	I	II	III	IV	V
CO1			L	M	M
CO2		M		H	
CO3				H	L
CO4	M	M			H

CSXXX: Capstone Project (Phase – I)

(6 Credits- 90 Hours)

Course Outcomes

Recall and identify the phases of the AI and ML project development lifecycle, including data collection, pre-processing, model selection, training, evaluation, and deployment. (Remembering)

Explain the significance of each phase in the AI and ML project lifecycle. Articulate how each phase contributes to the overall success of the project, from problem definition and data gathering to model evaluation and deployment. (Understanding)

Implement AI/ML systems using appropriate programming languages and frameworks. Develop a research plan for applying AI/ML techniques to solve real-world problems, considering scalability, efficiency, and ethical implications. (Applying)

Analyze and compare the feasibility of AI/ML projects in terms of time, effort, cost, and technical complexity. Assess risks and constraints associated with different project approaches and propose mitigating strategies. (Analyze)

Evaluate AI/ML projects based on criteria such as efficiency, applicability, robustness, user-friendliness, and socio-economic impact. Critically assess the success and limitations of implemented solutions and propose enhancements or alternatives. (Evaluating)

Design AI/ML applications by systematically examining and scientifically designing each phase of the project lifecycle. Integrate theoretical knowledge with practical implementation strategies to develop innovative and effective solutions. (Creating)

SEMESTER VIII

PE007: IMAGE AND VIDEO PROCESSING

(3 credits-45 Hours)

Course Objectives

The students will be able to work with images and videos in several ways. These methods can be used as pre-processing steps for complex models.

Course Outcomes

Understand images and videos representation in a detailed manner.
 Apply ML techniques for image processing in different scenarios.
 Apply various object detection and image segmentation algorithms.
 Apply various image restoration techniques and algorithms.

Module I: Image representation and analysis

Introduction to computer Vision, Numerical representation of images, Image augmentation, enhancement, processing, color transforms, geometric transforms, feature recognition and extraction

Module II: Image Segmentation

Object detection, breaking image into parts, finding contours and edges of various objects in image, Background subtraction for video.

Module III: Object Motion and tracking

Tracking a single point over time, motion models to define object movement over time, analyze videos as sequences of individual image frames, methods to track a set of features over time, matching features from image frame to other, tracking a moving car using optical flow

Module IV: Robotic localization

Bayesian statistics to locate a robot in space, sensor measurements to safely navigate an environment, Gaussian uncertainty, histogram filter for robot localization in python.

Module V: Image Restoration

Degradation model, noise models, estimation of degradation function by modeling, restoration using Wiener filters and Inverse filters

Suggested Readings/Textbooks

Audio Video Systems, Bali & Bali, Khanna Book Publishing 2020.
 Handbook of Image and Video Processing by Alan C. Bovik, Academic Press, 2000.
 Python 3 Image Processing, AshwinPajankar, BPB Publication, 2019.
 Coursera Link: <https://www.coursera.org/learn/image-processing>

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Digital Image Processing	Prof. P.K. Biswas	IIT Kharagpur
2.	Image Signal Processing	Prof. A.N. Rajagopalan	IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		M	H	H	H
CO3	L	H			
CO4	L				H

PELAB007: IMAGE AND VIDEO PROCESSING LAB

(1 credit-15 Hours)

Course Objectives

The students will be able to work with images and videos in several ways. These methods can be used as pre-processing steps for complex models.

Course Outcomes

Understand images and videos representation in a detailed manner.
 Apply ML techniques for image processing in different scenarios.
 Apply various object detection and image segmentation algorithms.
 Apply various image restoration techniques and algorithms.

Laboratory Exercises

Various forms of image representation
 Apply various image segmentation algorithms
 Apply object motion and tracking
 Apply object localization
 Apply image restoration

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		M	H	H	H
CO3	L	H			
CO4	L				H

PE008: DEEP LEARNING FOR COMPUTER VISION (3 credits-45 Hours)

Course Objectives

To help students understand advanced deep learning models for handling images. This course also helps students to generate synthetic datasets with the help of GANs.

Course Outcomes

Understand basic Computer Vision concepts.
 Apply complex deep learning models to real-life problems and datasets
 Create synthetic datasets with the help of GANs.
 Use of transfer learning for image classification.
 Use of LSTM for image captioning.

Module I: Convolutional Neural Networks

Introduction to Computer Vision, CNN architecture, Convolution function, CNN layers: Convolution, pooling and fully connected layers, activation functions, batch normalization, parameters and hyperparameters

Module II: Advanced CNN

Advances in CNN architecture, region-based CNN, faster CNN, standard CNN architectures: VGG, ResNet, Xception YOLO etc., transfer learning, Efficient CNN architecture: SqueezeNet

Module III: Recurrent Neural Network

RNN architecture, how RNN learns from ordered data sequences, RNN for sequential text generation, memory incorporation into deep learning models, applications of RNNs

Module IV: Attention Mechanisms and Image Captioning

how attention allows models to focus on a specific piece of input data, where attention is useful in natural language and computer vision applications, Combine CNN and RNN to build a complex captioning model, LSTM for caption generation.

Module V: Generative Adversarial Networks (GANs)

Introduction, Discriminator, Generator, Activation, Common activation functions for GANs, BCE loss, Conditional GANs, Controllable generation, real life GANs

Suggested Readings/Textbooks

Programming Computer Vision with Python: Techniques and Libraries for Imaging and Retrieving Information by Jan Erik Solem, O'Reilly, 2012

Deep Learning, Rajiv Chopra, Khanna Book Publishing, Delhi.

Hands-On Computer Vision with TensorFlow 2: Leverage deep learning to create powerful image processing apps with TensorFlow by Benjamin Planche, Eliot Andres, Packt Publishers, 2019

Learning Generative Adversarial Networks: Next-generation deep learning simplified by Kuntal Ganguly, Packt, 2017

Coursera Link: <https://www.coursera.org/learn/deep-learning-in-computer-vision>

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Deep Learning for Computer Vision	Prof. Vineeth N Balasubramanian	IIT Hyderabad

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	M	H	H		
CO3	L				H
CO4	L	H			
CO5	L			H	

PELAB008: DEEP LEARNING FOR COMPUTER VISION LAB

(1 credits-15 Hours)

Course Objectives

The students will be able to work with images and videos in several ways. These methods can be used as pre-processing steps for complex models.

Course Outcomes

Understand images and videos representation in a detailed manner.

Apply ML techniques for image processing in different scenarios.

Apply various object detection and image segmentation algorithms.

Apply various image restoration techniques and algorithms.

Laboratory Exercises

Apply basic CNN for image classification

Apply transfer learning with the help of advanced CNN for image classification

Apply Recurrent Neural Networks

LSTM for image captioning

Use of GANs for generating synthetic datasets

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	M	H	H		

CO3	L				H
CO4	L	H			
CO5	L			H	

PE012: ALGORITHMS FOR DNA SEQUENCING**(3 credits-45 Hours)****Course Objectives**

The students should be able to understand computational methods, algorithms and data structures for analyzing DNA sequencing data.

Course Outcomes

Understand DNA sequences, genomics, and how DNA sequencing is used.

Apply python to implement key algorithms and data structures to analyze real genomes and DNA sequencing datasets.

Understand human population genomics.

Analyze genome sequence of different species.

Module I: DNA sequencing, strings and matching

DNA sequencing past and present, Genomes as strings, reads as substrings, String definitions and Python examples, How DNA gets copied, Sequencing reads in FASTQ format, Sequencers give pieces to genomic puzzles, Read alignment and why it's hard, Naive exact matching

Module II: Pre-processing, indexing and approximate matching

Boyer-Moore basics, Diversion: Repetitive elements, Pre-processing, Indexing and the k-mer index, ordered structures for indexing, hash tables for indexing, Variations on k-mer indexes, Genome indexes used in research, Approximate matching, Hamming and edit distance, Pigeonhole principle.

Module III: Edit distance, assembly, overlaps

Solving the edit distance problem, using dynamic programming for edit distance, a new solution to approximate matching, Meet the family: global and local alignment, read alignment in the field, Assembly: working from scratch, First and second laws of assembly, Overlap graphs.

Module IV: Algorithms for assembly

The shortest common superstring problem, Greedy shortest common superstring, Third law of assembly: repeats are bad, De Bruijn graphs and Eulerian walks, When Eulerian walks go wrong,

Module V: Assemblers in practice

Assemble a genome from small pieces of DNA, comparing genomes of different species, gene finding, gene regulation, Cancer Sequencing, Fragment Assembly, Human Population Genomics

Suggested Readings/Textbooks

Coursera Link: <https://www.coursera.org/specializations/genomic-data-science>

Python for Bioinformatics, Sebastian Bassi, Chapman and Hall/CRC.

Bioinformatics with Python Cookbook, Packt Publishing, 2015

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Bioinformatics: Algorithms And Applications	Prof. Michael Gromiha	IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	L	H	H	H	

CO3	L			M	H
CO4	L			M	H

PELAB012: ALGORITHMS FOR DNA SEQUENCING LAB**(1 credits-15 Hours)****Course Objectives**

The students should be able to understand computational methods, algorithms and data structures for analyzing DNA sequencing data.

Course Outcomes

Understand DNA sequences, genomics, and how DNA sequencing is used.

Apply python to implement key algorithms and data structures to analyze real genomes and DNA sequencing datasets.

Understand human population genomics.

Analyze genome sequence of different species.

Laboratory Exercises

Convert a given sequence of DNA into its Protein equivalent.

De-Coding a Human DNA Sequence using Python.

Implement DNA alignment using Python.

Implement assembly algorithms for DNA.

Write a program for comparing genomes of different species.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	L	H	H	H	
CO3	L			M	H
CO4	L			M	H

PE013: COMPUTATIONAL NEUROSCIENCE**(3 credits-45 Hours)****Course Objectives**

The students should be able to explore the computational principles governing various aspects of vision, sensory-motor control, learning, and memory. They should learn representation of information by spiking neurons, processing of information in neural networks, and algorithms for adaptation and learning.

Course Outcomes

Understand how the brain processes information.

Understand the mathematical and computational models used in neuroscience.

Analyze different neural encoding models using python.

Apply supervised learning to neuron classifiers.

Module I: Introduction & Basic Neurobiology

Computational Neuroscience: Descriptive Models, Computational Neuroscience: Mechanistic and Interpretive Models, The Electrical Personality of Neurons, Making Connections: Synapses, Time to Network: Brain Areas and their Function.

Module II: Neural Encoding Models

Neural Encoding: Simple Models, Feature Selection, Variability, Vectors and Functions, Convolutions and Linear Systems, Change of Basis and PCA.

Module III: Extracting Information from Neurons & Neural coding

Neural Decoding and Signal Detection Theory, Population Coding and Bayesian Estimation, Reading Minds: Stimulus Reconstruction, Information and Entropy, Calculating Information in Spike Trains, Coding Principles.

Module IV: Computing in Carbon and Computing with Networks

Modeling Neurons, Spikes, Simplified Model Neurons, A Forest of Dendrites, modeling Connections Between Neurons, Introduction to Network Models, The Fascinating World of Recurrent Networks.

Module 5: Plasticity in the Brain & Learning

Synaptic Plasticity, Hebb's Rule, and Statistical Learning, Introduction to Unsupervised Learning, Sparse Coding and Predictive Coding

Learning from Supervision and Rewards

Neurons as Classifiers and Supervised Learning, Reinforcement Learning: Predicting Rewards, Reinforcement Learning: Time for Action

Suggested Readings/Textbooks

Coursera Link: <https://www.coursera.org/learn/computational-neuroscience#syllabus>

Edx Link: <https://www.edx.org/course/computational-neuroscience-neuronal-dynamics-of-co>

Fundamentals of Computational Neuroscience, Thomas Trappenberg, OUP Oxford; 2nd edition, 2009.

An Introductory Course in Computational Neuroscience, Paul Miller, The MIT Press; 1st edition, 2018.

Alternative NPTEL/SWAYAM Course

S. No.	NPTEL Course Name	Instructor	Host Institute
1.	Introduction to Computational Neuroscience – Web course	Dr. V SrinivasaChakravarthy	IIT Madras
2.	Demystifying the Brain	Prof. SrinivasChakravarthy	IIT Madras

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	L	H			
CO3	L	M	H	H	
CO4					H

PELAB013: COMPUTATIONAL NEUROSCIENCE LAB

(1 credits-15 Hours)

Course Objectives

The students should be able to explore the computational principles governing various aspects of vision, sensory-motor control, learning, and memory. They should learn representation of information by spiking neurons, processing of information in neural networks, and algorithms for adaptation and learning.

Course Outcomes

Understand how the brain processes information.

Understand the mathematical and computational models used in neuroscience.

Analyze different neural encoding models using python.

Apply supervised learning to neuron classifiers.

Laboratory Exercises

Implement Neural encoding methods using Python.

Implement information extraction from neurons using Bayesian estimation.

Implement synaptic plasticity using Artificial Neural Networks (ANN).

Implement Neuron classification using Supervised learning algorithms.

Implement Neuron classification using Reinforcement learning algorithms.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2	L	H			
CO3	L	M	H	H	
CO4					H

Course Structure of Minor Engineering in AIML

S. No.	Course Code	Title	L	T	P	Credits	Semester
1	To be assigned	Introduction to AI & Machine Learning	3	0	0	3	3
2	To be assigned	Introduction to AI & Machine Learning Lab	0	0	2	1	3
3	To be assigned	Introduction to Data Analytics	3	0	0	3	4
4	To be assigned	Introduction to Data Analytics Lab	0	0	2	1	4
5	To be assigned	Deep Learning and Neural Networks	3	0	0	3	5
6	To be assigned	Deep Learning and Neural Network Lab	0	0	2	1	5
7	To be assigned	Special Techniques in Artificial Intelligence	3	0	0	3	6
8	To be assigned	Applications of Artificial Intelligence	3	0	0	3	7
Total Credits						18	

Introduction to AI & Machine Learning**Credit: 3, Hours: 45****Course Objective:**

To review and strengthen important mathematical concepts required for AI & ML.

Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state-of-the-art Machine Learning algorithms.

Course Outcomes: After completion of the course, students would be able to:

Design and implement machine learning solutions to classification, regression, and clustering problems.

Evaluate and interpret the results of the different ML techniques.

Design and implement various machine learning algorithms in a range of Real-world

Course Contents: [Total Theory Duration: 45Hours]**Module 1:**(12 Hours)

Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.

Module 2:(10Hours)

Idea of Machine learning from data, Classification of problem –Regression and Classification, Supervised and Unsupervised learning.

Module 3:(10 Hours)

Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Descent for Linear Regression, Gradient Descent in practice.

Module 4:(8Hours)

Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.

Module 5:(5 Hours)

Discussion on clustering algorithms and use-cases centered around clustering and classification.

CO-Module Mapping Table

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	H	L	H	
CO 2	L	L	L	L	H
CO 3				H	H

Text Books/References:

Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011.

Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.

M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Publishing House, Delhi.

Jeeva Jose, Introduction to Machine Learning, Khanna Publishing House, Delhi.

Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.

Tom Mitchell, Machine Learning, McGraw Hill, 2017.

Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.

T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.

Corresponding Online Resources:

Artificial Intelligence, https://swayam.gov.in/nd2_cec20_cs10/preview.

Introduction to AI & Machine Learning Lab

Credit: 1, Hours: 15

List of Experiments:

Implementation of logical rules in Python.

Using any data, apply the concept of: (a) Linear regression (b) Gradient descent (c) Logistic regression

To add the missing value in any data set.

Perform and plot underfitting and overfitting in a data set.

Implementation of clustering and classification algorithms.

DEPARTMENT OF CIVIL ENGINEERING
BACHELOR OF TECHNOLOGY (BTECH) – CIVIL ENGINEERING
***COURSE STRUCTURE (NEP BATCH 2024 onwards)**

*"Undergraduate Degree Course Structure Based on AICTE Model Curriculum 2024 "

Semester I (First year)								
Type	Type of Course/Category	Course Code	Course Name	L	T	P	Credits	Page No
3 WEEKS COMPULSORY UNIVERSAL HUMAN VALUES I (UHV-I): STUDENT INDUCTION PROGRAM (BTUH0001)								
Theory	Basic Science	CHCY118T	Chemistry I	3	1	0	4	
	Basic Science	MAMT113T	Mathematics I	3	1	0	4	
	Engineering Science	EEEL100T	Basic Electrical Engineering	2	1	0	3	
	Basic Science	BOBE113T	Biology for Engineers	3	0	0	3	
Lab	Basic Science	CHCY119L	Chemistry Lab	0	0	2	1	
	Engineering Science	EEEL101L	Basic Electrical Engineering Lab	0	0	2	1	
	Engineering Science	MNWM100L	Workshop/Manufacturing Practices	1	0	2	2	
	Engineering Science	MNDI101L	Design Thinking and Idea Lab	1	0	2	2	
TOTAL CREDITS				13	3	16	20	

Semester II (First year)								
Type	Type of Course/Category	Course Code	Course Name	L	T	P	Credits	Page No
Theory	Basic Science	PSEP109T	Engineering Physics	3	1	0	4	
	Basic Science	MAMT114T	Mathematics II	3	1	0	4	
	Engineering Science	CSPS100T	Programming for Problem Solving	3	0	0	3	
	Humanities and social science	EGTW107T	English for Technical Writing	2	0	0	2	
Lab	Engineering Science	CVGD100T	Engineering Graphics and Design	1	0	4	3	
	Basic Science	PSEP110L	Engineering Physics Lab	0	0	2	1	
	Engineering Science	CSPS101L	Programming for Problem Solving Lab	0	0	4	2	
	Humanities and social science	EGOP108L	Oral Communication Practice Lab	0	0	2	1	
Theory	Humanities and Social Science	BTUH0002	Universal Human Values (UHV II)	2	1	0	3	
Theory & Lab	Mandatory -Non-credit Audit Course	BTSY0003	Sports and Yoga or NSS/NCC	1	0	4	0	
TOTAL CREDITS				15	3	16	23	

Exit Options for Civil Engineering

Semester I and II - UG certificate (40 credits to be obtained in 1st and 2nd semester)
(Additional Credits required = 6 to 8 Credits)

CVMI187T: Materials in Civil Engineering (3-0-0 = 3 Credits)

CVIT188T: Introduction to Construction Techniques & Material Testing (2-0-0=2 Credits)

CVSW189T: Survey work (1-0-0: 1 Credit)

CVIT190P: Introduction to Construction Techniques & Material Testing Lab (0-0-2:1 credit)

CVSW191P: Survey work Lab (0-0-2:1 credit)

Semester III (Second year)								
Type	Type of Course/Category	Course Code	Course Name	L	T	P	Credits	Page No
Theory	Engineering Science	CVMS204T	Mechanics of Solids	3	0	0	3	992
	Basic Science	CVMC205T	Mathematics to Civil Engineering-1	3		0	3	993
	Engineering Science	CVCE206T	Civil Engineering Materials and Concrete Technology	3	0	0	3	
	Professional Core	CVFM207T	Fluid Mechanics	3	0	0	3	995
	Humanities and Social Science	ECIK201T	IKS II - Indian and Indigenous Knowledge System	2	0	0	2	
Lab	Professional Core Course	CVBP201P	Building Planning and Computer- aided Civil Engineering drawing-Lab	0	2	2	3	1050
	Professional Core Course	CVCE202P	Civil Engineering Materials and Concrete Technology – Lab	0	0	2	1	1052
	Professional Core Course	CVFM203P	Fluid mechanics Lab	0	0	2	1	1052
	Skill Enhancement course	CVIA208T	Internship Activity	0	0	2	1	
TOTAL CREDITS				14	2	8	20	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

Semester IV (Second year)								
Type	Type of Course/Category	Course Code	Course Name	L	T	P	Credits	Page No
Theory	Professional Core	CVTE221T	Transportation Engineering	3	0	0	3	996
	Professional Core	CVSA222T	Surveying and Geomatics	3	0	0	3	997
	Professional Core	CVGE223T	Geotechnical Engineering	3	0	0	3	998
	Professional Core	CVHE224T	Hydraulic Engineering	3	0	0	3	1000
	Professional Core	CVSA225T	Structural Analysis	3	1	0	4	1001
	Professional Core	CVCE226T	Construction Engineering & Management	3	0	0	3	1003
Lab	Professional Core	CVTE227P	Transportation Engineering Lab	0	0	2	1	1053
	Professional Core	CVSA228P	Surveying and Geomatics Lab	0	0	2	1	1054
	Professional Core	CVGE229P	Geotechnical Engineering Lab	0	0	2	1	1055

	Professional Core	CVHE230P	Hydraulic Engineering Lab	0	0	2	1	1056
	Professional Core	CVSM231P	Solid Mechanics and Structural Analysis Lab	0	0	2	1	1056
Theory	Mandatory –Non-credit Audit Course	CVCE232T	Civil Engineering - Societal & Global Impact	3	0	0	0	P/NP
	Mandatory Course/IC		Constitution of India	0	0	0	0	P/NP
TOTAL CREDITS				21	1	8	24	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

- Micro project/ skill based training course (to be checked in NEP documents)

Exit Options for Civil Engineering

Semester III and IV - UG Diploma (44 credits to be obtained in 3rd and 4th semester)

(Additional Credits required = 6 to 8 Credits)

CVFO233T : Fundamentals of Structural Design (2-0-0= 2Credits)

CVQS234P :Quantity Survey and Estimation (0-1-4 = 3 Credits)

CVSC235T :Sustainable Construction and Lean Construction (3 – 0 -0 = 3 credits)

CVEI236T :Environmental Impact Assessment (0-1-2= 2 Credits)

CVIT237P : Introduction to Building Information Modeling (BIM)(0-1-4 =3 Credits)

Semester V (Third year)								
Type	Type of Course/Category	Course Code	Course Name	L	T	P	Credits	Page No
Theory	Professional Core	CVSD338T	Structural Design –I	3	0	0	3	1004
	Professional Core	CVEE339T	Environmental Engineering	3	0	0	3	1006
	Professional Core	CVEE340T	Engineering Economics, Estimation & Costing	3	1	0	4	1008
	Professional Core	CVHW341T	Hydrology & Water Resources Engineering	3	0	0	3	1010
	Professional Elective course -1	CVSA342T	1. Structural Analysis -I	3	0	0	3	1011
		CVRA343T	2. Railway & Airport Engineering					1012
		CVER344T	3. Earth retaining structure					1014
		CVOC345T	4. Open Channel Flow					1015
	Open Elective course	CVCM346T	Multidisciplinary Open Electives Courses -1	3	0	0	3	1039
			Concrete Materials					
Lab	Professional Core	CVSD347P	Structural Design -I Lab	0	0	2	1	1057
	Professional Core	CVEE348P	Environmental Engineering Lab	0	0	2	1	1058
Theory	Mandatory –Non-credit Audit Course	CVPP349T	Professional Practice, Law & Ethics	3	0	0	P/NP	1044
			Service Learning - Theory	2	0	0	P/NP	

		CVIN392P	Internship	0	0	8	4	
TOTAL CREDITS				23	2	12	25	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

Semester VI (Third year)								
Type	Type of Course/Cate-gory	Course Code	Course Name	L	T	P	Credits	Page No
The-ory	Professional Core	CVSD351T	Structural Design –II	2	1	0	3	1016
	Professional Core	CVIT352T	Intelligent Transportation Systems	3	0	0	3	1017
	Professional Core	CVSA353T	Sustainable and Green construction	4	0	0	4	1018
	Professional Elective Course-2	CVAS354T	1. Advanced Structural Analysis	3	1	0	4	1019
		CVRE355T	2. River Engineering					1020
	Professional Elective Course-3	CVFE356T	1. Foundation Engineer-ing	4	0	0	4	1021
		CVSH357T	2. Surface Hydrology					1023
	Multidisciplinary Open Electives Courses -2	CVSC358T	Sustainable construction methods	3	0	0	3	1039
Lab	Professional Core	CVSD359P	Structural Design -II-Lab	0	0	2	1	1059
The-ory	Mandatory –Non- credit Audit Course	EEIS321T	Instrumentation & Sensor Technologies for Civil En-gineering Applications	2	0	0	0	
	Internship to be changed as (core La-boratory course)	CVSC361P	Survey Camp	0	0	2	1	
			Service Learning-Field Work (Mandatory Course)	0	0	4	P/NP	
TOTAL CREDITS				21	2	8	23	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

Exit Options for Civil Engineering**Semester V and VI – B.E. Vocational (44 credits to be obtained in 5th and 6th semester)****(Additional Credits required = 6 to 8 Credits)**

CVAC363T : Advance Concrete Technology. (2-0-0) = 2 Credits)

CVAA364T : Air and Noise pollution control engineering (3-0-0 = 3 credits)

CVIA365T : Introduction and Application of AI, ML and IOT for Civil Engineering (3-0-0 = 3 Credits)

CVC366T : Construction Management and Safety (3-0-0) - 3 Credits)

CVAC367P:Advanced Concrete Technology Lab (0-0-2 = 1 Credits)

Semester VII (Fourth year)								
Type	Type of Course/Category	Course Code	Course Name	L	T	P	Credits	Page No
Theory	Professional Core	CVRA468T	Robotics and Automation	2	0	0	2	1024

	Professional Elective course -4	CVGI469T	1. Ground Improvement techniques	3	0	0	3	1025
		CVTE470T	2. Traffic Engineering & Management					1026
		CVSD471T	3. Structural Dynamics					1027
	Multidisciplinary Open Electives Course - 3	CVRR472T	Repair & Rehabilitation of Structures.	3	0	0	3	1040
Practical	Internship	CVIN473P	Industrial Training	0	0	12	6	1061
	PROJECT	CVMP474P	Minor Project	0	0	2	1 (Changed to 2)	1061
Theory	Mandatory –Non-credit Audit Course	CVDP475T	Disaster Preparedness & Planning	3	0	0	0	1047
TOTAL CREDITS				11	0	14	15	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

Semester VIII (Fourth year)								
Type	Type of Course/Category	Course Code	Course Name	L	T	P	Credits	Page No
Theory	Program Elective Course -5	CVEQ476T	1. Earth quake Engineering	3	1	0	4	1028
		CVDO477T	2. Design of hydraulic Structures					1029
		CVRW478T	3. Rain water harvesting					1030
	Program Elective Course -6	CVBE479T	1. Bridge Engineering	3	1	0	4	1031
		CVUT480T	2. Urban Transportation Planning					1032
		CVGW481T	3. Ground water Engineering					1033
	Program Elective Course -7	CVEO482T	1. Elements of Geoinformatics	3	0	0	3	1035
		CVEG483T	2. Environmental Geotechnology					1036
		CVPS484T	3. Pre stressed concrete					1038
	Multidisciplinary Open Electives Courses - 4	CVIT485T	Introduction to Finite Element Analysis	3	0	0	3	1042
	Project	CVPR486P	Project	0	0	8	4	1062
	TOTAL CREDITS			12	2	8	18	
Minor/Honours/Value Added Courses (Optional)				3	0	0	3	

TOTAL CREDITS – 168

B.TECH (MINOR / HONOURS / RESEARCH) ADDITIONAL 18 CREDITS

List of Courses for Honours and Minors Minor courses offered from Civil Engineering Department

List of Courses for Honours and Minors**Minor courses offered from Civil Engineering Department**

Sl. No	Course Name		Credits	Archive URL	
1	Basic Construction Materials		3	https://archive.nptel.ac.in/courses/105/106/105106206/	
2	Geographic Information System		3	https://archive.nptel.ac.in/courses/105/107/105107206/	
3	Geomorphology		3	https://archive.nptel.ac.in/courses/105/107/105107200/	
4	Maintenance and Repair of Concrete Structures		3	https://archive.nptel.ac.in/courses/105/106/105106202/	
5	Remote Sensing-Principles and Applications		3	https://archive.nptel.ac.in/courses/105/101/105101206/	
6	Strategies for Sustainable Design		3	https://archive.nptel.ac.in/courses/124/106/124106157/	
8	Introduction to Civil Engineering Profession		2	https://archive.nptel.ac.in/courses/105/106/105106201/	
9	Architectural Conservation and Historic Preservation		2	https://archive.nptel.ac.in/courses/124/105/124105003/	
10	Safety in Construction		2	https://archive.nptel.ac.in/courses/105/102/105102206/	
11	Natural Hazards		2	https://archive.nptel.ac.in/courses/105/104/105104183/	
12	CVMS204T	Mechanics of Solids	3-0-0	3	
13	CVFM207T	Fluid Mechanics	3-0-0	3	
14	CVCE206T	Civil Engineering Materials and Concrete Technology	3-0-0	3	
14	CVSE0058	Structural Engineering	2-1-0	3	
15	CVSA222T	Surveying & Geomatics	3-0-0	3	
16	CVCE226T	Construction Engineering & Management	2-1-0	3	
17	CVVE340T	Engineering Economics, Estimation & Costing	2-2-0	4	
18	CVVE339T	Environmental Engineering	3-0-0	3	

List of courses offered for Honours in Civil Engineering**Domain 1. Environmental Engineering**

Sl. No.	Course Name	Credits	Link
1	Plastic Waste Management	2	https://nptel.ac.in/courses/105/105/105105184/
2	Electronic Waste Management	1	https://nptel.ac.in/courses/105/105/105105169/
3	Applied Environmental Microbiology	3	https://nptel.ac.in/courses/105/107/105107173/

4	Water and Wastewater Treatment	3	https://nptel.ac.in/courses/105/105/105105178/
5	Water Supply Engineering	3	https://nptel.ac.in/courses/105/105/105105201/
6	Environmental Remediation	3	https://nptel.ac.in/courses/105/107/105107181/
7	Environmental Chemistry and Microbiology	3	https://nptel.ac.in/courses/102/105/102105087/
8	Applied Environmental Microbiology	3	https://nptel.ac.in/courses/105/107/105107173/
9	Integrated Waste Management for a Smart City	3	https://onlinecourses.nptel.ac.in/noc21_ce46/preview -3 rd semester students
10	Wastewater Treatment and Recycling	3	https://onlinecourses.nptel.ac.in/noc21_ce49/preview -5 th Sem students

Domain 2. Construction Technology

Sl. No.	Course Name	Credits	Link
1	Land Scape Architecture and Site Planning-Basic Fundamentals	2	https://nptel.ac.in/courses/124/105/124105001/
2	Maintenance and Repair of Concrete Structures	3	https://nptel.ac.in/courses/105/106/105106202/
3	Basic Construction Materials	3	https://onlinecourses.nptel.ac.in/noc21_ce10/preview
4	Safety in Construction	2	https://nptel.ac.in/courses/105/102/105102206/
5	Development and Application of Special Concrete	3	https://nptel.ac.in/courses/105/104/105104206/
6	Principles of Construction Management	2	https://nptel.ac.in/courses/105/104/105104161/
7	Construction Methods and Equipment Management	2	https://nptel.ac.in/courses/105/103/105103206/
8	Concrete Technology	3	https://nptel.ac.in/courses/105/102/105102012/ https://nptel.ac.in/courses/105/104/105104030/ https://nptel.ac.in/courses/105/106/105106176/
9	Project Planning & Control	3	https://onlinecourses.nptel.ac.in/noc21_ce50/preview
10	Hydration, Porosity & Strength of Cementitious Materials - for 3 rd semester	3	https://onlinecourses.nptel.ac.in/noc21_ce66/preview
11	Elastic Stability of Structures	3	https://onlinecourses.nptel.ac.in/noc22_ce91/preview
12	Plates and shells	3	https://onlinecourses.nptel.ac.in/noc22_ce80/preview

LIST of VALUE-ADDED COURSES offered by the DEPARTMENT

1. Computer Aided Drafting
2. Building Modeling and Analysis using STAAD-Pro

3. Training on Modeling and Analysis using ABACUS
4. Detailing and Drafting of Concrete Reinforcement
5. Soil modelling with the finite element program PLAXIS 2D (INTRODUCED in AUTUMN 2023)

DEPARTMENT OF CIVIL ENGINEERING

VISION

To be a recognized leader in Civil Engineering education and learning experiences providing state of the art education guided by innovative research and consultancy, inclusive technology and managerial skills for industry as well as societal needs towards sustainable development.

MISSION

To make the department a center of excellence in Civil Engineering education which equips students with a strong conceptual foundation coupled with practical insight to meet the global industrial and environmental challenges.

To produce spiritually inspired socially committed and intellectually competent professionals of high caliber and strong ethical principles to serve the society and nation through teamwork and societal leadership.

To establish the department as a recognized center of research for developing sustainable solutions to engineering problems by providing knowledge base and consultancy services to the community.

PROGRAM EDUCATIONAL OBJECTIVES (PEOS)

1. To equip the students with necessary technical skills and professional expertise that make them competent for immediate employment or to pursue postgraduate studies in Civil Engineering disciplines.
2. To produce graduates who are spiritually motivated for life-long learning and morally committed for successful careers as civil engineers, managers, administrators, educators, engineering consultants and entrepreneurs.
3. To enhance students' abilities to identify and take up project and research topics which would be highly useful for the society considering the present environmental and industrial needs of the country.
4. To make the students able to communicate their innovative ideas to be effective in collaboration with other civil engineering teams that will make them achieve leadership positions to solve different challenges of civil engineering problems.
5. To develop a sense of understanding of the multidisciplinary approach and an ability to relate engineering issues to the broader context of individuals and society for sustainable development.

DETAILED SYLLABUS (Theory Courses)

CVMI187T :Materials in Civil Engineering

3 Credits - 3L:0T:0P

Objectives:

The course aims to provide students with a deep understanding of the properties, behaviors, and applications of various construction materials used in civil engineering projects. It equips students with the knowledge to select appropriate materials and design solutions that ensure durability, sustainability, and cost-effectiveness in civil engineering practices.

Course outcomes

CO1. Explain the properties and requirements of all building materials. (Understanding)

CO2. Identify various components of buildings and their functions. (understanding)

CO3. Judge the quality of building materials (Evaluate)

Syllabus:

Module I:10 Hours

Role of materials in construction; Aggregate: Classification, Physical and mechanical properties, soundness, alkali-aggregate reaction, thermal properties of aggregate Bricks and Masonry Blocks: Types, properties and field and laboratory tests to evaluate quality Lime: classification, properties Cement: types, Portland cement: chemical composition of raw material, bogue compounds, hydration of cement, role of water in hydration, testing of cements, fly ash: properties and use in manufacturing of bricks and cement. Building stone: classifications, properties and structural requirements; Masonry- Materials, Walls, Resistance, Functional Performances, Defects and Durability,

Module II :15 Hours

Mortar: Types and tests on mortars. Concrete: Production, mix proportions and grades of concrete, fresh, mechanical and durability properties of concrete, factors affecting properties of concrete, tests on concrete, admixtures, Special concrete: light weight concrete, high density concrete, vacuum concrete, shotcrete, steel fiber reinforced concrete, polymer concrete, Ferro cement, high performance concrete, self-compacting concrete.

Module III: 15 Hours

Wood and Wood products: Introduction to wood macrostructure, sap wood and heart wood, defects and decay of timber, seasoning and preservation of timber, fire resisting treatment, introduction to wood products- veneers, plywoods, fibre board, particle board, block board, batten boards. Metals: Steel: Important properties and uses of Iron (Cast iron, wrought iron and steel), Important tests on steel rebar, aluminum and copper. Glass: types and uses, gypsum: source, properties, uses; plastic: properties and uses, paint: types, distemper, varnish, Adhesive: Types, Bitumen: types, properties and tests.

Suggested readings:

- 1.E resource: <https://www.classcentral.com/classroom/youtube-civil-building-materials-and-construction-47666>
2. Building Materials and Construction, Jena and Sahu, Mc. Graw Hill.
3. Materials for Civil and Construction Engineers, Mamlouk and Zaniewski, Pearson
4. Building Materials and Building Construction, by P C Verghese

Course Mapping

	CO I	CO II	CO III
Module I	H	H	H
Module II	H	H	H
Module III	H	H	H

CVIT188T :Introduction to Construction Techniques & Material Testing

2 Credits: 2L: 0T:0P

Objectives:

Objectives of the course is to make students aware of the various construction techniques, practices and the equipment needed for different types of construction projects.

Course Outcomes:

After successful completion of the course, students will be able to:

CO1. Explain various construction procedures for sub to super structure (Understanding)

CO2. Identify and recommend suitable equipment needed for construction of various types of structures from foundation to super structure (Understanding)

CO3. Testing of Various Construction materials (Applying)

Syllabus:

Module I: [6 Hours]

Construction Techniques: Structural systems- Load bearing structures-Framed structure- Load bearing mechanism-Floor system- development of construction techniques-High rise building technology- seismic effect- Environmental Impact Materials.

Green building-materials used – construction methods-Natural Buildings- passive buildings-Intelligent building / smart buildings-Building automation- Energy efficient building for various zones. Case Studies

Module II: [8 Hours]

Construction Practices: Specifications -Details and sequence of activities and construction coordination-Site clearance-marking- earthwork, masonry, stone masonry-bonds in masonry- concrete- hollow block masonry-

flooring- damp proof course-construction joints-building foundations- Basements -Scaffolding- Dethuttering forms-Fabrication and erection of steel trusses -weather and water proof roof finishes-Acoustic and Fire protection

Module III: [6 hours]

Sub Structure Construction: Techniques of box jacking , pipe jacking- Under water construction of diaphragm walls and basement – Tunnelling techniques-Piling Techniques-Well and Caisson-Sinking Cofferdams-Cable Anchoring and grouting-driving diaphragm walls -sheet piles – shoring for deep cuttings-well points- Dewatering-standby plant equipment for underground open excavation.

Module IV: [5 hours]

Superstructure Construction: Launching girders- bridge deck- Offshore Platform-Material handling- erecting light weight components of tall structures-Support structures for heavy equipment and Conveyors.

Module V: [5 Hours]

Construction Equipment: Selection of Equipment for earthwork-Earth moving operations-types of earthwork equipment-equipment for foundations and pile driving-equipment for compaction, batching- mixing and concreting, Equipment for material handling, erection of structures -Types of cranes , equipment for dredging, trenching and tunnelling.

Course Mapping

	CO I	CO II	CO III	CO IV
Module I	H			
Module II	H			
Module III	H			
Module IV	H			
Module V	H			

CVSW189T: Survey work

1 credits:1L:0T:0P

Course Objectives:

The course aims to equip students with the skills and knowledge necessary for conducting accurate and efficient land surveys, including the use of modern surveying instruments and techniques. It focuses on providing practical experience and understanding of data collection, analysis, and interpretation to support various civil engineering and construction projects.

After successful completion of this lab course Students will be able to :

CO1. Demonstrate ability to use surveying equipment and techniques to collect data for civil engineering projects. (Understanding)

CO2. Develop effective strategies and plans for executing civil engineering field studies and surveying. (Applying)

CO3. Apply mathematical principles analyse data collected during field activities for problem solving in civil engineering projects. (Applying)

Syllabus:

Module I: [5 Hours]

Surveying: - Introduction, History and principles of chain survey, Instruments Classification, accuracy, types, Main divisions (plane & geodetic), Chaining, , Compass survey, Plane table survey.

Module II [5 Hours]

Levelling: -Auto level, dumpy Level, Tilting Level, Principle of levelling Types, component/part and function, Datum Focussing and parallax, Deduction of levels / Reduced Level, Types of levelling, Application to chain and Levelling Instrument to Building construction.

Module III: [5 Hours]

Contouring: Definition, Characteristics, Methods, Interpolation of Contour, Contour gradient, Uses of Contour plan and Map. Introduction to Theodolite survey and Total station.

CVSW191P: Survey work Lab

List of Practical

Chain Surveying- Open Traverse and Closed Traverse
Plotting
Compass Surveying
Levelling
Preparation of contour maps
Theodolite Surveying

CVMS204T: Mechanics of Solids

B.Tech-CVE 3

3 credits- (3L: 0T :0P)

Course Objectives

The objective of this Course is to introduce continuum mechanics and material modelling of engineering materials based on first energy principles: deformation and strain; momentum balance, stress and stress states; elasticity and elasticity bounds; plasticity and yield design.

Course Outcomes:

On completion of the course, the student will be able to:

CO1: Apply the principles of equilibrium, superposition, and compatibility to estimate the stress-strain behaviour of linear elastic solids under axial and torsional loading. (Understanding)

CO2: Analyse stresses at inclined planes and construct Mohr's circle to predict the principal and maximum shear planes and apply the theories of failure (Applying)

CO3: Construct shear force and bending moment diagrams, to estimate the deflection and stress distribution in beams of various cross sections (Applying)

CO4: Determine longitudinal and circumferential stresses in thin and thick cylinders subjected to internal and external pressures (Applying)

Syllabus

Module1:[7 Hours]

Simple Stresses and Strains- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law – stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic moduli and the relationship between them – Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience – Gradual, sudden, impact and shock loadings – simple applications.

Module 2:[8 Hours]

Compound Stresses and Strains- Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two-dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain. Relationship between elastic constants.

Module 3:[10 Hours]

Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams. BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

Module 4: [5 Hours]

Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: $M/I = f/y = E/R$ - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections – Design of simple beam sections.

Module 5: [5 Hours]

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

Module 6: [6 Hours]

Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

Module 7: [4 Hours]

Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close-coiled-helical springs. Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

Text/Reference Books:

1. D.S. Bedi, "Strength of Materials", Khanna Book Publishing Co.
2. AICTE Prescribed Textbook: Physics (Introduction to Mechanics), Bhattacharya, A.B., Khanna Book Publishing Co., 2023.
3. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA.
4. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
5. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004
6. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
7. Laboratory Manual of Testing Materials - William Kendrick Hall
8. Mechanics of Materials - Ferdinand P. Beer, E. Russel Johnston Jr., John T. DEwolf – TMH 2002.
9. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
10. MOOCs Link: https://onlinecourses.nptel.ac.in/noc22_ce46/preview

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	H	M	L	
Module II	M	H		
Module III			H	
Module IV		H		
Module V				H
Module VI				H
Module VII				H

CVCE206T :CIVIL ENGINEERING MATERIALS AND CONCRETE TECHNOLOGY

B.Tech-CVE 3

3 Credits (3L:0T:0P)

Objective:

The main goal of this course is to provide students with all information concerning principle, evaluation, as well as practical application of civil engineering materials.

To acquaint the students for exploring the materials, its properties, intrinsic nature and its application in preparing cement concrete.

To understand the influence of various factors effecting the strength and durability of Concrete.

To illustrate the concrete mix design process based on properties of material as per various national and international standards.

To understand the basic behavior of concrete or other engineering materials under application of various loading conditions and surrounding environment.

Exposure to a variety of established engineering materials.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

Examine the properties of basic building materials like, stones, bricks, cement and concrete. (Understanding)

Design concrete mixes using principles and methods of mix design. (Creating)

Articulate the applications of special concrete and other engineering materials. (Applying)

Syllabus:

Module I (10 hours)

Building stone: classifications, properties and structural requirements; Stone Masonry: General principles, classification of stone masonry and their relative merits and demerits.

Bricks: Types, properties and field and laboratory tests to evaluate quality; Brick Masonry: types of bonds, relative merits and demerits of English, Single Flemish and Double Flemish bond.

Module II (10 hours)

Concrete and its Ingredients: Introduction and historical background of concrete; Cement: manufacturing process, chemical composition, Heat of hydration and Structure of hydrated cement, Physical tests of cement, Supplementary cementitious material; Aggregate: Categorization of aggregate and its Properties, Grading and Testing of Aggregates; Admixtures: Review of Types and Classification, Chemical Composition, Effects on Properties of Concretes; Water: General requirements and impurities in water.

Module III (10 hours)

Fresh and Hardened Concrete: Fresh concrete: Properties of fresh concrete, Workability tests as per IS standards, factors affecting workability, Segregation & Bleeding, Slump loss, Retempering, Mixing, transporting, Placing, Compaction and Curing of concrete; Hardened concrete: Various tests on Hardened concrete; Destructive test: Compressive, Flexure, Tensile and Bond tests. Introduction to Non-Destructive and semi-destructive testing using Rebound Hammer, Ultrasonic pulse velocity and core cutting tests.

Module IV (10 hours)

Mix design, Durability & Permeability of Concrete: Principles of concrete mix design, parameters and factors influencing mix design, Indian Standard methods of mix design, Acceptability criteria, Variability of results, , Factors affecting durability, Types of Cracking & causes; Alkali-aggregate reaction, Degradation by freeze & thaw, Sulphate attack, Durability under sea-water.

Module V (5 hours)

Other Engineering Materials: Special concrete, Ceramics, and Refractories, Bitumen and asphaltic materials, Timbers, Glass and Plastics; Steel: Types of Steel, Properties of Rolled section and Bars; Paints and Varnishes, Acoustical material and geo-textiles, rubber and asbestos, laminates and adhesives, Composite materials and FRP.

Suggested Readings

Concrete Technology by A.M. Neville, Pearson Publication.

Concrete Technology by M.L. Gambhir, Tata McGraw Hill Publication

New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman & Hall, 1983.

Building Construction by B.C. Punmia; Ashok Kumar Jain; Arun Kumar Jain, Laxmi Publications.

COURSE MAPPING:

	CO1	CO2	CO3
Module I	H		
Module II	H		
Module III	M		
Module IV		H	
Module V			H

CVFM207T :FLUID MECHANICS**B.Tech-CVE 3****3 Credits: (3L: 0T:0P)****Objectives**

- To introduce the concepts of fluid mechanics useful in Civil Engineering applications.
- To understand the properties of fluids and fluid statics.
- To derive the equation of conservation of mass and its application
- To solve kinematic problems such as finding particle paths and stream lines
- To use important concepts like continuity equation and Bernoulli's equation and apply the same to solve fluid flow problems
- To understand the various flow measuring devices.

Course/ Learning Outcomes

At the end of this course students will be able to:

- CO1.** Define the basic terms used in fluid mechanics. (*remember*)
CO2. Explain the broad principles of fluid statics, kinematics and dynamics. (*understand*)
CO3. Classify different types of fluid flow. (*understand*)
CO4. Solve problems using the continuity, momentum and energy principles. (*apply*)
CO5. Test various scenarios using dimensional analysis. (*analyze*)

Module I (5 hours)

Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; vapor pressure, boiling point, cavitation; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Module II (11 hours)

Fluid Statics - Fluid Pressure: Pressure at a point, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U-Tube Differential Manometer, Micromanometers. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Module III (11 hours)

Fluid Kinematics- Classification of fluid flow: steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one-, two- and three-dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates.

Module IV (13 hours)

Fluid Dynamics- Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced.

Module V (5 hours)

Dimensional Analysis and Dynamic Similitude – Rayleigh's method; Buckingham's π -Theorem; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number.

References:

1. Singh, S., "Fluid Mechanics", Khanna Book Publishing Co., New Delhi.
2. Modi, P.M., and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House.
3. Subramanya, K., "Theory and Applications of Fluid Mechanics", Tata McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H	M		M	
Module II		H		M	
Module III	L	H	H	M	
Module IV		H		H	
Module V			M		H

CVTE221T : Transportation Engineering

B TECH -CVE 4

3 Credits: 3L:0T:0P -

Objective: *This course introduces Transportation Engineering, a core civil engineering practice in the field with prime focus on the highway engineering sector. On completion a student should be competent enough for planning and designing of different types of roads with necessary quality control in road construction and maintenance.*

On completion of the course, the students will be able to:

CO1: Carry out surveys involved in planning and highway alignment (Applying)

CO2: Design the geometric elements of highways and expressways (Creating)

CO3: Carry out traffic studies and implement traffic regulation and control measures and intersection design (Applying)

CO4: Characterize pavement materials and design flexible and rigid pavements as per IRC (Understanding)

Syllabus

Module 1: (5 Hours)

Highway development and planning-Classification of roads, road development in India, Current Road projects in India; highway alignment and project preparation.

Module 2:(10 Hours)

Geometric design of highways:- Introduction; highway cross section elements; sight distance, design of horizontal alignment; design of vertical alignment; design of intersections, problems.

Module 3:(10 Hours)

Accessibility to Differently Abled Publics

Design of Access Routes & Walkways (Elements of walkways, Tactile Navigation Systems, BRT Systems, Pedestrian streets and other related aspects), Accessible Streets and Mobility Environments (Street Elements for Accessibility, dimensions and codes material, TGSIs), Inclusive Public Transportation System

Module 4:(5 Hours)

Traffic engineering & control- Traffic Characteristics, traffic engineering studies, traffic flow and capacity, traffic regulation and control; design of road intersections; design of parking facilities; highway lighting; problems

Module 5:(5 Hours)

Pavement materials- Materials used in Highway Construction- Soils, Stone aggregates, bituminous binders, bituminous paving mixes; Portland cement and cement concrete: desirable properties, tests, requirements for different types of pavements. Problems

Module 6:(10 Hours)

Design of pavements- Introduction; flexible pavements, factors affecting design and performance; stresses in flexible pavements; design of flexible pavements as per IRC; rigid pavements- components and functions; factors affecting design and performance of CC pavements; stresses in rigid pavements; design of concrete pavements as per IRC; problems

Suggested Readings:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Revised 10th Edition, Nem Chand & Bros, 2017
2. Kadiyalai, L.R., 'Transportation Engineering', Khanna Book Publishing Co., New Delhi (ISBN: 978-9382-609-858)
3. Partha Chakraborty, 'Principles Of Transportation Engineering, PHI Learning,
4. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and Traffic Analysis', 4th Edition, John Wiley
5. Srinivasa Kumar, R, Textbook of Highway Engineering, Universities Press, 2011.

6. Paul H. Wright and Karen K. Dixon, Highway Engineering, 7 th Edition, Wiley Student Edition, 2009.133

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	H	L		
Module II		H		
Module III		H		
Module IV	M	L	H	
Module V				H
Module VI		H		

CVSA222T:SURVEYING AND GEOMATICS

3 credits- (L:T:P:3:0:0)

Objectives: Objectives of this course is to introduce the students to various types of surveying and to prepare them to work with survey observations and perform calculations.

COURSE/LEARNING OUTCOMES

On completion of the course the students will be able to:

CO1. Classify different types of surveying and their applicability. (Understanding)

CO2. Recognize the importance and uses of remote sensing and other modern techniques in various civil engineering works. (Understanding)

CO3. Execute traverse calculations; determine latitudes, departures, and coordinates of control points and balancing errors in a traverse. Use appropriate software for calculations and mapping. (Applying)

CO4. Operate the techniques, skills, and applicable tools of the discipline for application in engineering and surveying activities. (creating)

Detailed Syllabus

Module I: Introduction to Surveying (15 hours):

Principles, Linear, angular and graphical methods, Survey stations, Survey lines use.

Chain Surveying: Definition, advantages, and disadvantages, Advantages of chain surveying, Disadvantages of chain surveying, Equipment required for chaining, Process of chain surveying, Chain survey stations, Line Types in Chain Survey, Ranging, Offsets in chain survey, Correction for Chain and Tape Measurement.

Compass Surveying: Definition, Priorities for compass surveying, Methods of Angle Measurement, Definitions used in Angular Measurements, Principle of Compass Surveying, Types of Bearing, Types of Compasses (Angular Measurement Equipment), Fore Bearing and Back Bearing, Local attraction, Elimination of Local Attraction in Compass Surveying.

Levelling Survey: Levelling and Objectives of Levelling, Terms Related to Levelling, Applications of Levelling in Surveying, Types of Levels Used in Levelling, Basic Components of a Dumpy Level, Temporary and permanent Adjustment of Levelling, Types of Levelling in Surveying, Curvature and Refraction Correction, Errors in Levelling, Methods of Calculation of Reduced Level, Difficulties faced in levelling.

Theodolite Survey: Uses and types of theodolite, parts of theodolite, Temporary Adjustment of a Theodolite, Measurement of Horizontal Angles, Measurement of Vertical Angles, Measurement of Deflection Angle, Measurement of Magnetic Bearing of a Line, Theodolite Traverse Survey Calculation, Trigonometric Surveying: Measurement of Height and Distance.

Contouring: Contour Line and Contour Interval, Characteristics of a Contour, Methods of Contour Surveying, Interpolation of Contours, Uses of Contour Lines/Maps.

Plane Table Surveying: Objectives and principles of plane table survey, Equipment Used in Plane Table Survey, Temporary Adjustments of the Plane Table, Methods of Plane Table Surveying, Advantages and Disadvantages of Plane Table Surveying, Errors in Plane Table Surveying.

Computation of Area and Volume: Trapezoidal method, Simpson's rule, Area of regular shapes, Computation of Volume.

Module II: Triangulation and Trilateration (7 Hours):

Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - methods -triangulation – network- Signals. Baseline - choices - instruments and accessories - extension of

base lines – corrections - Satellite station - reduction to centre - Intervisibility of height and distances – Trigonometric leveling - Axis single corrections.

Module III: Curves (7 hours)

Elements of simple and compound curves – Method of setting out– Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve - Vertical curves

Module IV: Modern Field Survey Systems (7 Hours):

Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.

Module V: Photogrammetry Surveying (6 Hours):

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.

Module VI: Remote Sensing (3 Hours):

Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing.

Suggested Readings:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	H		H	
Module II	H		L	
Module III	H			
Module IV				H
Module V		H		M
Module VI		M		H

CVGE223T : Geotechnical Engineering

(3 credits – 45 hours) (3L:0T:0P)

Objectives

This course aims to impart a solid foundation in the principles of Soil Mechanics, equipping students with a comprehensive understanding of the subject. It provides in-depth knowledge about the fundamental properties of soils, including basic, index and engineering properties, enabling students to analyze and apply this information effectively in practical engineering scenarios.

COURSE / LEARNING OUTCOMES

At the end of the course students will be able to

CO1. Classify the soils. (Understanding)

CO2. Determine seepage, stresses under various loading conditions and compaction characteristics. (Applying)

CO3. Analyze the compressibility of soils. (Analyzing)

CO4. Evaluate soil strength under various drainage conditions. (Evaluating)

CO5. Design and assess the stability of embankment slopes. (Creating)

Module I: 8 Hours

Basic Concepts: Types of soils, their formation and deposition, Definitions: soil mechanics, soil engineering, rock mechanics, geotechnical engineering. Scope of soil engineering. Comparison and difference between soil and rock, Soil as three-phase system.

Index Properties: Plasticity Characteristics of Soil - Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Classification of Soils-Introduction of soil classification: particle size classification, textural classification, unified soil classification system, Indian standard soil classification system. Identification: field identification of soils, general characteristics of soil in different groups.

Module II: 8 Hours

Permeability of Soil: Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis- Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.

Effective Stress Principle: Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

Module III: 8 Hours

Stresses in soils: Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Influence factors, Isobars, Boussinesq's equation, Newmark's Influence Chart. Contact pressure under rigid and flexible area, computation of displacements from elastic theory.

Compaction of Soil: Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.

Module IV: 8 Hours

Consolidation of Soil: Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, final settlement of soil deposits, computation of consolidation settlement and secondary consolidation

Module V: 8 Hours

Shear Strength: Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters. unconfined compression test, vane shear test.

Module VI: 5 Hours

Stability of Slopes: Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

Suggested Readings:

1. Soil Mechanics by Craig R.F., Chapman & Hall
2. Elements of Land/ Soil Pollution by O.P. Gupta, Khanna Book Publishing.
3. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
4. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall, NJ
5. Principles of Geotechnical Engineering, by Braja M. Das, Cengage Learning

6. Principles of Foundation Engineering, by Braja M. Das, Cengage Learning
7. Essentials of Soil Mechanics and Foundations: Basic Geotechnics by David F. McCarthy
8. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, and Gholamreza Mesri.
9. Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering (Civil and Environmental Engineering) by V.N.S. Murthy

Mapping of COs to Syllabus

Course outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H				
Module II	M				
Module III		H			
Module IV		M	H		
Module V				H	
Module VI					H

CVHE224T :HYDRAULIC ENGINEERING**B TECH CVE 4****(3 Credits) (3L: 0T:0P)****Objectives**

- To relate the theory and practice of problems in hydraulic engineering.
- To introduce the concepts of laminar and turbulent pipe flows.
- To understand the various losses in pipe flows.
- To investigate the formation of boundary layer over flat plates.
- To comprehend the physics of open channel flows.
- To distinguish uniform open channel flows from non-uniform open channel flows.

Course/ Learning Outcomes**At the end of this course students will be able to:****CO1.** Differentiate between laminar and turbulent pipe flow theories. (analyze)**CO2.** Solve pipe flow problems for branching pipes and pipe network. (apply)**CO3.** Recognize and solve the boundary layer problems. (understand, apply)**CO4.** Test their knowledge of fluid mechanics to address the uniform flow problems in open channels. (analyze)**CO5.** Investigate the problems of gradually and rapidly varied flows in open channels under steady state conditions. (create)**Module I (10 hours)****Laminar Flow** - Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity.**Turbulent Flow**- Reynolds experiment, Transition from laminar to turbulent flow. Definition of turbulence, scale and intensity, Causes of turbulence, instability, mechanism of turbulence and effect of turbulent flow in pipes. Reynolds stresses, semiempirical theories of turbulence, Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram.**Module II (7 hours)**

Loss of head through pipes, Darcy-Wiesbatch equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel, flow through laterals, flows in dead end pipes, siphon, power transmission through pipes, nozzles. Analysis of pipe networks: Hardy Cross method, water hammer in pipes and control measures, branching of pipes, three reservoir problem.

Module III (10 hours)

Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

Module IV (8 hours)

Introduction to Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section.

Uniform Flow: Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Factors affecting Manning's Roughness Coefficient "n. Most economical section of channel. Computation of Uniform flow, Normal depth.

Module V (10 hours)

Non-Uniform Open Channel Flow- Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Gradually Varied Flow-Dynamic Equation of Gradually Varied Flow, Classification of channel bottom slopes, Classification of surface profile, Characteristics of surface profile. Computation of water surface profile. Hydraulic Jump- Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Froude Model Law.

Suggested Readings:

1. Singh, S., "Fluid Mechanics", Khanna Book Publishing Co., New Delhi.
2. Modi, P.M., and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House.
3. Subramanya, K., "Theory and Applications of Fluid Mechanics", Tata McGraw Hill.
4. Subramanya, K., "Flow in Open Channels", Tata McGraw Hill.
5. Chow, V.T., "Open Channel Hydraulics", Tata McGraw Hill.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H	M			
Module II	M	H			
Module III			H		
Module IV				H	M
Module V				M	H

CVSA225T :STRUCTURAL ANALYSIS**4 Credits (3L:1T:0P)**

(4 Credits- 60 Hours)

Objectives:

The objective of this course is to equip students with the fundamental principles and analytical techniques necessary for understanding and analyzing various structures. The course aims to develop proficiency in using theorems of elasticity, deflection methods, influence line analysis, stability and buckling theories, and both flexibility and stiffness methods. Through a combination of theoretical learning and practical applications, students will gain the skills needed to solve complex structural engineering problems and design robust structures.

Course/Learning Outcomes:

At the end of the course, students will be able to:

CO1: Apply principles of virtual work and strain energy to elastic structures. (Apply)

CO2: Determine deformations in beams and frames using various analytical methods. (Evaluate)

CO3: Analyze determinate and indeterminate structure using various approaches. (Analyze)

CO4: Evaluate stability of columns and struts using Euler's and Rankine's theories. (Evaluate)

Syllabus:

Module I: (12 hours)

General theorems: Theorems relating to elastic structures, principle of virtual work, strain energy in elastic structures, complementary energy, Castigliano's theorems, Maxwell-Betti's reciprocal theorem.

Deflection of statically determinate structures: Deflection of determinate beams by double integration (Macaulay's) method, moment area and conjugate beam methods, principle of virtual work (unit load method) and Castigliano theorems, Deflection of determinate pin jointed trusses and rigid jointed frames by principle of virtual work (unit load method), Strain Energy and Castigliano theorems.

Module II: (13 hours)

Approximate Analysis of Multi-Storied Frames: Approximate Analysis of Multi-Storied frames subjected to Vertical Loads, Method of Substitute Frames; Analysis of Building Frames subjected to Horizontal Loads, Portal Method and Cantilever Method.

Elastic arches: Normal thrust, shear force and bending moment for parabolic and segmental three hinged arches. Influence lines for normal thrust, shear force and bending moment for three hinged parabolic arch.

Module III: (15 hours)

Suspension bridges: Suspension cable with three hinged stiffening girder.

Column and Struts: Struts subjected to axial loads, concept of buckling. Euler's buckling theory of struts with different boundary conditions. Rankine's buckling theory for columns. Struts subjected to eccentric and lateral loads and struts with initial curvature.

Module IV: (20 hours)

Analysis of indeterminate structures by flexibility method: Flexibility coefficients and their use in the formulation of compatibility equations. Application of Castigliano's theorem of least work to propped cantilevers, fixed beams, continuous beams, simple pin jointed frames including effect of lack of fit of members, simple rigid jointed frames and two hinged arches.

Analysis of indeterminate structures by stiffness method: Stiffness coefficients and their use for formulation of equilibrium equation, direct stiffness method, slope deflection method, moment distribution method, applications of these methods to indeterminate beams, simple rigid jointed frames and rigid jointed frames with inclined members, including the effect of settlement/rotation of supports.

Suggested Readings:

1. Ramamrutham S. and Narayanan R. "Theory of Structures", 8th edition (2014), Dhanpat Rai Publishing Company.
2. Punmia B. C., Jain A. K. and Jain A. K. "Strength of Materials and Theory of Structures", 11th edition (2016), Laxmi Publications.
3. Timoshenko S. P. and Gere J. M. "Theory of Elastic Stability", 2nd edition (1961), McGraw-Hill.
4. Hibbeler R. C. "Structural Analysis", 9th edition (2014), Pearson Education.
5. Ghali A., Neville A. M. and Brown T. G. "Structural Analysis: A Unified Classical and Matrix Approach", 7th edition (2009), CRC Press.

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	H	H		
Module II	M	M	H	
Module III			M	H

Module IV		H	H	M

CVCE226T :Construction Engineering and Management**B TECH -CVE IV****(3 credits – 45 hours) (3L:0T:0P)****Objectives**

The aim of the course is to familiarise students with the causes and quantification of earthquakes and to familiarise them with the effects of earthquakes and the design criteria required for the design of various geotechnical structures.

COURSE / LEARNING OUTCOMES

At the end of the course students will be able to

1. Interpret project organization for executing construction projects. (Understanding)
2. Apply knowledge and skills of modern construction practices and techniques. (Applying)
3. Analyze the learning and understand techniques for Project planning, scheduling and Execution Control. (Analyzing)
4. Organize and monitor the construction projects with respect to time and cost. (Creating)

Module I: 2 Hours

Basics of Construction- Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution.

Module II: 10 Hours

Construction project planning- Stages of project planning: pre-tender planning, preconstruction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

Module III: 8 Hours

Construction Methods basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

Module IV: 4 Hours

Construction Equipment basics: Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

Module V: 5 Hours

Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction.

Module VI: 4 Hours

Project Monitoring & Control- Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost

overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

Module VII: 4 Hours

Contracts Management basics: Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods

Module VIII: 8 Hours

Construction Costs: Make-up of construction costs; Classification of costs, timecost trade-off in construction projects, compression and decompression.

Suggested Readings:

1. Sharma, S.C. & Deodhar S.V., Construction Engineering and Management, Khanna Book Publishing Co., 2022.
2. Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
3. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
4. Chudley, R., Construction Technology, ELBS Publishers, 2007.
5. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
6. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
7. Rajoria, K.B., Case Studies in Construction Project Management, Khanna Publishing House, 2023.
8. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
9. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4
Module I	H			
Module II	H			
Module III		H	M	
Module IV		H	M	
Module V			H	
Module VI			H	
Module VII			M	
Module VIII				H

CVSD338T: Structural Design –I

B Tech -Civil V

3 Credits - 45 hours- 3L:0T:0P

Course Objectives: The objective of this course is to familiarize the students with all fundamental concepts of reinforced cement concrete design. RCC has been the predominant structural entity in the present day civil engineering constructions. The main goal of this course is to provide students with all information concerning different principles, ways of analyzing, as well as structural designing and detailing of RCC elements. The knowledge acquired will lay a good foundation for analysis and design of various civil engineering structures/systems in a reliable manner.

COURSE/LEARNING OUTCOMES

After completion of the course students will be able to:

CO1: Explain the design philosophies of reinforced concrete structures related to the Working Stress Method. (Understanding)

CO2: Explain the design philosophies of reinforced concrete structures related to the Limit State Method. (Understanding)

CO3: Analyze and design reinforced concrete beams, columns and slabs (Analyzing, creating)

CO4: Analyze and design reinforced concrete foundation systems and staircases (Analyzing, Creating)

CO5: Interpret the basics of pre-stressed concrete design methodology (Understanding)

Module I:[8 Hours]

Working stress method and ultimate load method of design, Reinforced Concrete Fundamentals (working Stress Method): Concept of reinforced concrete, stress strain characteristics of concrete and steel reinforcement, elastic theory, singly reinforced, balanced section, under reinforced section and over reinforced section.

Module II: [8 Hours]

Limit state method of design, Concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to limit states of collapse in flexure, direct compression, shear and limit states of serviceability in deflection and cracking

Module III: [8 Hours]

Design of singly and doubly reinforced rectangular and T sections for flexure, Design of members in shear and bond, Design of beam subjected to bending and torsion, Design of columns for Axial Load, Uni-axial bending moment and Bi-axial bending moment as per IS Code method.

Module IV:[8 Hours]

Design of one-way and two-way slabs, Design of Isolated square and rectangular footings subjected to axial load and moments, Design of combined foundations

Module V[5 Hours]

Design of Doglegged, Open well type staircases. Design of Flat slab and Post tensioned slab

Module VI: [8 Hous]

Pre-stressed concrete, Basic principles of pre-stressed concrete: materials used and their properties, methods and

systems of pre-stressing. Losses in pre-stress, analysis of various types of sections subjected to pre-stress and external loads. Prestressed and post tensioned members, Different types of Prestressed sections, Box-Section, Girder

CO Mapping

SI No	CO1	CO2	CO3	CO4	CO5
Module I	H				
Module II		H			
Module III			H		
Module IV			H	H	
Module V				H	
Module VI					H

Text Books

Jain and Jaikrishna, Plain and Reinforced Concrete, Vol. I, Nemchand Brothers.(ISBN- 8185240086/978-8185240084).

Shrikhandt Vanakudre, Prestressed Concrete (Materials, Analysis and Design), Khanna Publishing House, (ISBN: 9789386173317)

V. L. Shah and Karve, Limit State Design - Reinforced Concrete Structures Publications. (ISBN- 9788190371711/8190371711).

N. Krishna Raju, Pre-stressed Concrete, Tata McGraw Hill. (ISBN- 9789387886209/9387886204).

Recommended Reading

- P. Dayaratnam, Design of Reinforced Concrete Structures, Oxford & IBH. (ISBN- 9789386479785/9386479788).
- T.Y. Lin, Design of Prestressed Concrete Structures, John Wiley and Sons Inc., 2010. (ISBN153 AICTE Model Curriculum for Undergraduate degree in Civil Engineering (Engineering & Technology) 9788126528035/978-8126528035).
- P.D. Arthur and V. Ramkrishnan, Ultimate Strength Design for Structural Concrete, Wheeler & Co. Pvt Ltd. (ISBN- 0273403230, 978-0273403234).
- B.P. Hughes, Limit State Theory for Reinforced Concrete Design, Pitman. (ISBN- 0273010239, 978-0273010234).
- IS456 (2000), Plain and Reinforced Concrete.
- IS 875 (1987), Part I- Design Loads (Other than earthquake) for Buildings and Structures (Dead Loads).
- IS 875 (1987), Part II- Design Loads (Other than earthquake) for Buildings and Structures (Imposed Loads).
- IS 875 (2015), Part III- Design Loads (Other than earthquake) for Buildings and Structures (Wind Loads).
- IS 875 (1987), Part IV- Design Loads (Other than earthquake) for Buildings and Structures (Snow Loads).

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H				
Module II		H			
Module III			H		
Module IV			H	H	
Module V				H	
Module VI					H

CVEE339T: ENVIRONMENTAL ENGINEERING**(3 credits-45 hours) (L-T-P:3-0-0)**

Objectives: Starting with an introductory lesson on environment vis-a-vis pollution of its components, this course basically deals with various issues related to water supply to community as well as waste water treatment and disposal which constitutes a prime area of practice for civil engineers. Through this course students will get familiarize with land pollution, noise pollution and air pollution.

COURSE/LEARNING OUTCOMES

After successfully studying this course, students will be able to:

- CO1:** Relate the impact of humans on environment and environment on humans(understand)
- CO2:** Summarize the principles and operation of water, waste water, solid waste and air pollution treatment systems and the required appurtenances and accessories.(Understand)
- CO3:** Plan strategies to control, reduce and monitor pollution and select the most appropriate technique for the treatment of water, wastewater solid waste and contaminated air.(Applying)
- CO4:** Adapt with basic environmental legislation.(Applying)

Module I: 15 hours

Water: -Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Various valves used in W/S systems-

Water Treatment: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced

treatments like adsorption, ion exchange, membrane processes

Module II: 10 Hours

Sewage- Domestic and Stormwater, Quantity of Sewage, Sewage flow variations. Conveyance of sewage- Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water- Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, National River cleaning plans, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

Module III: 5 Hours

Air - Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution- Occupational hazards, Urban air pollution automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations

Module IV: 2 Hours

Noise- Basic concept, measurement and various control methods.

Module V: 8 Hours

Solid waste management-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on the environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods- Integrated solid waste management. Hazardous waste: Types and nature of hazardous waste as per the HW Schedules of regulating authorities.

Module VI: 3 Hours

Building Plumbing-Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Pressure reducing valves, Break pressure tanks, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used.

Module VII: 2 Hours

Government authorities and their roles in water supply, sewerage disposal. Solid waste management and monitoring/control of environmental pollution.

Text/Reference Books:

1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
2. Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. *Environmental Engineering*, Mc-Graw Hill International Editions, New York 1985.
4. MetCalf and Eddy. *Wastewater Engineering, Treatment, Disposal and Reuse*, Tata McGraw-Hill, New Delhi.
5. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
6. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999
7. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
8. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development.

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	L	H	M	
Module II		H	M	
Module III		H	M	
Module IV		H	M	
Module V	H	H	M	L

Module VI		H		
Module VII				H

CVEE340T: Engineering Economics, Estimation & Costing**B Tech CVE -V****4 Credits : 3L:1T:0P**

Objectives: *This subject will introduce the students to the basics of estimation of quantity and cost of civil engineering projects including the methods of tendering and contracting. It also deals with the valuation of properties.*

Course Outcomes:**On completion of the course, the students will be able to :**

CO1: Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses (Understand)

CO2: Perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives. (Apply)

CO3: Carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.

CO4: Understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.(Apply)

CO5: Quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure. (Apply)

CO6: Understand how competitive bidding works and how to submit a competitive bid proposal.(Understand)

Module 1: (6 Hours)

Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes.

Module 2: (6 Hours)

Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve.

Module 3: 6 Hours

Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method.

Module 4: (5 Hours)

Indian economy - Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private.Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors.

Module 5: (15 Hours)

Estimation / Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding

equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying

Module 6: (6 Hours)

Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.

Module 7: (6 Hours)

Rate analysis-Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.

Module 8: (8 Hours)

Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management

Module 9: (2 Hour)

Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

Term Work Assignments may include:

1. Deriving an approximate estimate for a multistoried building by approximate methods.
2. Detailed estimate, Cost of finishes, MEP works for the following with the required material survey for the same:
 - a. Ground plus three storied RCC Framed structure building with blockwork walls
 - b. bridge with minimum 2 spans
 - c. factory building
 - d. road work
 - e. cross drainage work
 - f. Ground plus three storied building with load-bearing walls
3. Preparation of valuation report in standard Government form.
4. Assignments on rate analysis, specifications and simple estimates.
5. Detailed estimate of minor structure.
6. Preparation of Bar bending schedule.

Text/Reference Books:

1. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House
2. Mankiw Gregory N. (2002), *Principles of Economics*, Thompson Asia
3. V. Mote, S. Paul, G. Gupta(2004), *Managerial Economics*, Tata McGraw Hill
4. Misra, S.K. and Puri (2009), *Indian Economy*, Himalaya
5. Pareek Saroj (2003), *Textbook of Business Economics*, Sunrise Publishers
6. M Chakravarty, Estimating, Costing Specifications & Valuation
7. Joy P K, Handbook of Construction Management, Macmillan
8. B.S. Patil, Building & Engineering Contracts
9. Relevant Indian Standard Specifications.
10. World Bank Approved Contract Documents.
11. FIDIC Contract Conditions.
12. Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration
13. Typical PWD Rate Analysis documents.159
14. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations,2016
15. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I		M	H	
Module II	H			
Module III			H	
Module IV	H			
Module V		M		H
Module VI		H	H	M
Module VII			H	M

CVHW341T: Hydrology & Water Resources Engineering**B Tech CVE-V***(3 Credits-45 hours) (2L:1T:0P)*

Objectives: *This course is intended to make the students exposed to the key features of hydrological science including precipitation, data analysis, rainfall-runoff analysis, ground water hydrology, hydrographs, flood routing, hydrological design, risk analysis and uncertainty. It also familiarizes the students with important aspects of irrigation and dams & spillways.*

COURSE /LEARNING OUTCOMES

After the completion of the course, the students will be able to

CO1: Identify hydrological cycle components and measurement tools for precipitation. Analyze average precipitation depth and various abstractions like infiltration and evaporation. (Understand)

CO2: Understand hyetographs and hydrographs, and compute runoff. Evaluate well yield in saturated or unsaturated aquifers. (Apply)

CO3: Analyze the water requirements of crops, understand the various types of soil water, design regime channels, understand canal losses, canal lining and water logging. (Understand, Analyze)

CO4: Classify dam types, understand site selection and design of gravity and earth dams, analyze seepage, reservoir storage, yield, regulation, and sedimentation, and discuss spillway components. (Understand)

Module I: (3 hours)

Introduction - hydrologic cycle, water-budget equation, history of hydrology, World water balance, applications in engineering, sources of data.

Module II: (4 hours)

Precipitation - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth area- duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.

Module III: (6 hours)

Abstractions from precipitation - evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.

Module IV: (6 hours)

Runoff - runoff volume, SCS-CN method of estimating runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India, environmental flows.

Module V: (6 hours)

Ground-water and well hydrology - forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.

Module VI: (6 hours)

a) Water withdrawals and uses – water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta;

b) Quality of irrigation water; Soil-water relationships, root zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; Methods of applying water to the fields: surface, sub-surface, sprinkler and trickle / drip irrigation.

Module VII: (6 hours)

Distribution systems - canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Canal outlets: non-modular, semi-modular and modular outlets. Water logging: causes, effects and remedial measures. Lining of canals, types of lining. Drainage of irrigated lands: necessity, methods.

Module VIII: (8 hours)

a) Dams and spillways - embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams.

b) Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.

Suggested Readings

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
3. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc-Graw Hill.
4. G L Asawa, Irrigation Engineering, Wiley Eastern
5. L W Mays, Water Resources Engineering, Wiley.
6. J D Zimmerman, Irrigation, John Wiley & Sons
7. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford.

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	H			
Module II			H	
Module III			M	
Module IV		H		
Module V				H
Module VI				H
Module VII			H	M
Module VIII			L	M

Professional Elective course-1**CVSA342T: Structural Analysis-I (PEC-01)****B Tech CVE-V**

(3 Credits-45 hours) (2L:1T:0P)

Objectives: This course aims to equip students with the fundamental and advanced principles of structural analysis. It emphasizes understanding the behavior of structures under various loading conditions, applying classical and numerical methods, and using matrix approaches to analyze indeterminate structures. Students will gain skills in influence line construction, truss analysis, and the use of stiffness and flexibility matrices in structural systems.

Course Outcomes

At the end of the course, the student will be able to:

CO1 – Understand structural response under moving loads (Understand)

CO2 – Apply classical and numerical methods for structural analysis (Apply)

CO3 – Analyze indeterminate structures using matrix methods (Analyze)

Syllabus:

Module I: Moving Loads and Influence Lines: (16 hours)

Moving loads and Influence lines for statically determinate structures, Influence lines for cantilever beam, simply supported beam, overhanging beam and pin-jointed trusses, Criteria for maximum shear force and bending moment under moving loads for simply supported beams, Absolute maximum bending moment, Influence line diagrams for horizontal tension in the cable, shear force and bending moment at any section of the stiffening girder (Suspension bridge).

Module II: Classical and Numerical Methods: (13 hours)

Numerical analysis of plane trusses, grids and frames, Kani's method, Introduction to the finite element method for plane stress and plane strain

Module III: Matrix Methods in Structural Analysis: (16 hours)

Matrix Analysis of Framed Structures, Flexibility and Stiffness Matrices and their derivation and application, Local and global stiffness matrices, Relationship between flexibility and stiffness matrix

Suggested Readings:

Hibbeler, Russell C., and Kiang-Hwee Tan. *Structural analysis*. Harlow, United Kingdom: Pearson Prentice Hall, 2006.

Reddy, C. S. *Basic structural analysis*. (2011).

Kassimali, Aslam, G. V. Ramana, and Germán Rojas Orozco. *Structural analysis*. Stamford, CT: Cengage Learning, 2015.

Menon, Devdas. *Advanced structural analysis*. Alpha Science International, 2009.

Chandrupatla, Tirupathi, Tirupathi R. Chandrupatla, and Ashok Belegundu. *Introduction to finite elements in engineering*. Cambridge University Press, 2021.

Kassimali, Aslam. *Matrix analysis of structures*. Vol. 2. Cengage Learning, 2012.

Weaver, William, and James M. Gere. *Matrix analysis framed structures*. Springer science & business media, 2012.

Ramamrutham, S., and R. Narayan. *Theory of Structures*. Dhanpat Rai Pub Company, 2008.

Mapping of COs to Syllabus

	CO1	CO2	CO3
Module I	H		
Module II		H	
Module III		L	H

2.CVRA343T: Railway and Airport Engineering

B Tech CVE V

(3 credits – 45 hours) (3L:0T:0P)

Objective: This course aims to provide a comprehensive understanding of Railway and Airport Engineering. It covers the design, construction, and maintenance of railway tracks and airports, including track alignment, rail components, geometric design, signalling, and track maintenance. Additionally, it addresses airport planning, site selection, runway and taxiway design, air traffic management, and airport terminal functions, preparing students for the engineering challenges in rail and air transportation systems.

COURSE/LEARNING OUTCOMES

On completion of the course, the students will be able to:

CO1: Describe the fundamental concepts of railway track design, including track gauges, alignment, and the components of railway tracks such as rails, sleepers, and ballast. (Understand)

CO2: Apply engineering principles to the geometric design of railway tracks, including curves, super-elevation, points, and crossings, and analyze the impact of tractive resistance and power on railway performance. (Apply, Analyze)

CO3: Develop maintenance and rehabilitation strategies for railway tracks, incorporating modern methods of track maintenance, track drainage, and the renewal of track components to ensure operational efficiency and safety. (create)

CO4: Analyze and design airport infrastructure, including runway and taxiway capacity, airport drainage, terminal aprons, and air traffic management systems, to accommodate air travel demand and enhance airport operations. (Create)

Module I: (12 Hours)

Fundamentals of Railway Engineering: Introduction to Railway Engineering: Overview of railway systems, Importance of railway engineering, Railway Track, Gauge and Alignment: Types of tracks, gauges, Principles of track alignment

Engineering Surveys and Construction of New Lines: Survey methods and tools, Steps in constructing new railway lines

Track Components and Stresses: Rails, sleepers, and ballast; Subgrade and formation; Track fittings and fastenings

Creep of Rails and Geometric Design: Causes and effects of rail creep; Geometric design of tracks, including curves and super-elevation

Module II: (12 Hours)

Advanced Railway Track Design :Points, Crossings, and Track Junctions: Design and construction of points and crossings; Simple track layouts and junctions

Rail Joints and Welding of Rails: Types of rail joints, Welding techniques and benefits

Track Maintenance and Drainage: Regular track maintenance practices, Importance and methods of track drainage

Modern Methods of Track Maintenance: Advanced technologies in track maintenance, Case studies of modern maintenance methods

Tractive Resistance and Power: Factors affecting tractive resistance, Calculation of tractive power

Module III: (11 Hours)

Railway Stations, Yards, and Signaling :Railway Stations and Yards: Design and layout of railway stations, Functions and types of railway yards

Railway Tunnelling: Methods and challenges of railway tunnelling

Signalling and Interlocking: Basics of railway signalling, Interlocking systems for safe railway operations

High-Speed Trains and Maintenance: Design and operation of high-speed trains, Maintenance practices specific to high-speed rail

Module IV: (10 Hours)

Airport Engineering Introduction to Airport Planning and Design: Overview of airport engineering, Aircraft characteristics and performance

Airport Planning and Air Travel Demand Forecasting: Techniques for forecasting air travel demand, Criteria for airport site selection

Geometric Design of the Airfield: Runway and taxiway design, Capacity and delay determination

Airport Terminals and Facilities: Design of passenger and cargo terminals, Airport drainage

Air Traffic Management and Navigational Aids: Ground-based and satellite-based navigational systems, Air traffic control and surveillance facilities, Airfield lighting systems

Suggested Readings

1. S.P. Arora, S.C. Saxena, A Textbook of Railway Engineering, Dhanpat Rai Publications
2. S. Chandra and M.M. Agarwal, Railway Engineering, University Press, New Delhi
3. S.C. Rangwala, Principles of Railway Engineering, Charotar Publishing House Pvt. Ltd.
4. P H Wright, S Mumayiz, N J Ashford, "Airport Engineering: Planning, Design, and Development of 21st Century Airports" Wiley Publication

Mapping of COs to Syllabus

	CO 1	CO 2	CO 3	CO 4
Module I	H		M	
Module II		H	L	
Module III	M		H	
Module IV				H

3. CVER0131: Earth Retaining Structures**B Tech CVE V****(3 credits – 45 hours) (3L:0T:0P)****Objectives**

The objective of this course is to prepare students to analyze and design various types of earth retaining structures.

COURSE / LEARNING OUTCOMES

At the end of the course students will be able to

CO1: Understand various theories in Earth Pressure. (Understanding)

CO2: Explore the Stability of retaining structure. (Applying)

CO3: Analyze the sheet pile walls. (Analyzing)

CO4: Explain aspects related to the design of bulkheads, tunnels, conduits, and braced excavations. (Creating)

Module I: 5 Hours

Earth Pressure: Rankine and Coulomb theories, active, passive and pressure at rest; concentrated surcharge above the back fill, earth pressure due to uniform surcharge, earth pressure of stratified backfills, saturated and partially saturated backfill.

Module II: 10 Hours

Retaining walls: Proportioning of retaining walls, stability of retaining walls, mechanically stabilized retaining walls/reinforced earth retaining walls.

Module III: 15 Hours

Sheet Pile wall: free earth system, fixed earth system.

Module IV: 15 Hours

Bulkheads: bulkheads with free and fixed earth supports, equivalent beam method, Anchorage of bulkheads and resistance of anchor walls, spacing between bulkheads and anchor walls, resistance of anchor plates.

Module V: 15 Hours

Tunnel and Conduit: Stress distribution around tunnels, Types of conduits, Load on projecting conduits; Arching and Open Cuts: Arching in soils.

Module VI: 15 Hours

Braced excavations: Earth pressure against bracings in cuts, Heave of the bottom of cut in soft clays.

Suggested Readings:

1. Das, Braja M., "Principles of Foundation Engineering", PWS Publishing. 1998
2. Bowles. J.E., Foundation Analysis and Design, Tata McGraw-Hill International Edition, 5th Edn, 1997.

Mapping of COs to Syllabus

Course out-comes	CO1	CO2	CO3	CO4
Module I	H			
Module II		H		
Module III			H	
Module IV				H

Module V				H
Module VI				H

4.CVOC 345T: Open Channel Flow**B Tech CVE V****(3 credits) (3L:0T:0P)****Objectives**

The course provides a comprehensive understanding of the principles and dynamics of unsteady flows in open channels, emphasizing their importance and applications in engineering. the course will equip students with the knowledge and skills to apply various numerical methods for solving shallow water flow equations, focusing on the finite-Difference, Finite Element, and Finite Volume methods. It will also enable students to conduct detailed analyses and modeling of dambreak flows, flood routing, and surface irrigation systems, incorporating advanced techniques and real-world case studies.

Course Outcomes

After completing this course, students will be able to:

Develop the ability to predict unsteady flow behavior in diverse open channel scenarios. (Analysing)

Implement Finite-Difference, Finite Element, and Finite Volume methods to solve complex shallow water flow equations. (Applying)

Perform comprehensive flood routing analyses in various channel configurations and model surface irrigation flows. (Applying)

Syllabus:**Module 1: (5 hours)**

Introduction to Unsteady Open Channel Flow: Fundamentals of unsteady flow in open channels; Basic concepts of flow continuity, momentum, and energy equations

Module 2: (5 hours)

Shallow Water Flow Equations: Derivation of 1-D shallow water flow equations; Considerations for non-hydrostatic pressure distribution.

Module 3: (10 hours)

Numerical Methods for Flow Analysis: Introduction to numerical methods for solving differential equations; Finite-Difference Method (FDM); Finite Element Method (FEM); Stability and accuracy considerations in numerical methods.

Module 4: (12 hours)

Shock Capturing Techniques: Introduction to shock capturing methods; Finite Volume Method (FVM) for 1-D and 2-D flow equations; Implementation of shock capturing techniques; Case studies on shock capturing in practical scenarios.

Module 5: (8 hours)

Dambreak Flow Analysis: Physical phenomena of dambreak flows; Mathematical modeling of dambreak scenarios; Real-world applications and case studies.

Module 6: (5 hours)

Flood Routing Techniques: Flood routing in large channel networks; Flood routing in compound channels; Flood routing in channels with flood plains; Comparative analysis of different flood routing methods.

Suggested Readings

Chaudhry, M. H. (2008). Open-channel flow (Vol. 523). New York: Springer.

Subramanya, K. (1984). Flow in Open Channels . McGraw-Hill.

Chow, V. T. (1959). Open-channel Hydraulics. McGraw-Hill

COURSE MAPPING:

	CO1	CO2	CO3
Module I	M		
Module II	L	L	
Module III	M	L	

Module IV		M	
Module V		M	
Module VI			H

CVSD351T: Structural Design -II**B Tech CVE -VI****3 Credits -3L:0T:0P****Course Objectives**

The objective of the course is to teach the students methods and their application to design of steel structures.

Course Outcomes:

After completion of course, students will be able to,

CO1: Apply the limit state design philosophy for analysis and design of structural steel connections(Apply)

CO2: Apply the limit state design philosophy for analysis and design of structural steel components. (Apply)

CO3: Analyze and design structural steel roofing and flooring systems.(Create)

Module-I (12 hours)

Bolted and welded connections: **Introduction** to steel structures, principle of limit state design, riveted connection, design of bolted and welded connections, concept of net sectional area, tension member and connection with gusset plate, load carrying capacity, axially and eccentrically loaded joints, simple connection of bracket plates to columns, beam to beam and beam to column connections, design of framed, unstiffened and stiffened seat connections.

Module-II: (12 hours)

Flooring system: **Concept** of floor system with secondary beams, main beams and columns, design of simply supported beams using rolled steel sections, laterally restrained and unrestrained beams, plastic method of design, determination of collapse load of steel beams.

Module-III (12 hours):

Columns and bases: Members in compression, slenderness ratio and critical load, design of columns under axial loads using single or multiple rolled steel sections, design of lacing, battens, columns subjected to axial load and bending, design of slab and Gusseted base.

Module-IV (9 hours)

Roofing system :Imposed loads on flat and sloping roofs and floors, wind loads on sloping roofs and vertical cladding including effect of degree permeability and wind drag, analysis of pin-jointed trusses under various loading cases, computation of design forces in members, design of members, purlin and detailing of connections and supports.

Structural Design-II tutorial Class:

- Analysis and Design of roof truss system.
- Design of columns and columns bases.
- Design of structural steel flooring system.
- Design of bolted and welded connections.
- Study of Structural detail of construction drawings and checking adequacy and compliance with codes.

Suggested Readings:

- S.K. Duggal, Limit State Design of Steel Structures, Tata McGraw Hill Education Private Limited, 2017. (ISBN: 9789351343493/9351343499).
- S.S. Bhavikatti, Design of Steel Structures, I.K. International Publishing House Limited, 2017. (ISBN: 9789385909559/938590955X).
- V.L. Shah and V. Gore, Limit State Design of Steel Structures IS:800-2007, Structures Publication, 2012. (ISBN: 8190371754).
- N. Subramanian, Design of Steel Structures, Oxford University Press, 2011.
- IS 800 (2007), General Construction in Steel- Code of Practice, Ced 7: Structural Engineering and Structural Section, Published by Bureau of Indian Standard, New Delhi.
- IS 875- Part 3 (2017): Wind Loads, Indian Standard Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures, Published by Bureau of Indian Standard Manak Bhavan, New Delhi.

Mapping of Course outcomes to Syllabus

Module No.	CO1	CO2	CO3
I	M	H	
II		H	H
III		H	H
IV			H

CVIT352T: INTELLIGENT TRANSPORTATION SYSTEMS**B Tech CVE-VI****(3 credits) (3L:0T:0P)**

Objective: The course is designed to provide an introduction to Intelligent Transportation Systems (ITS). It explores ITS data collection techniques, the role of telecommunications, and various functional areas like Advanced Traffic Management Systems (ATMS) and Advanced Public Transportation Systems (APTS). The course also addresses ITS user needs, automated highway systems, and global ITS implementations, emphasising both developed and developing countries.

COURSE/LEARNING OUTCOMES

On completion of the course, the students will be able to:

CO1: Explain the fundamental concepts, historical background, and benefits of Intelligent Transportation Systems (ITS), including data collection techniques and the importance of telecommunications within ITS.(Understand)

CO2: Apply ITS data collection methods such as AVL, AVI, GIS, and video data collection to real-world scenarios, and analyze their effectiveness in improving traffic and transportation management.(Apply)

CO3: Design and evaluate ITS functional areas, including ATMS, ATIS, CVO, AVCS, APTS, and ARTS, by integrating advanced technologies and user needs to enhance transportation efficiency and safety.(Apply)

CO4: Compare and contrast ITS implementations in developed and developing countries, assessing their challenges and benefits, and propose adaptable ITS solutions suitable for varying infrastructural contexts. (Analyze)

Detailed Syllabus:**Module I: Introduction to ITS and Data Collection Techniques (12 Hours)**

Definition and Objectives of ITS: Introduction to ITS, Identification of ITS objectives

Historical Background and Benefits of ITS: Evolution of ITS, Benefits of ITS in modern transportation

ITS Data Collection Techniques: Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), Video data collection

Module II: Telecommunications in ITS and Traffic Management (10 Hours)

Role of Telecommunications in ITS: Importance of telecommunications in ITS, Information management

Traffic Management Centres (TMC): Functions and operations of TMC

Vehicle – Roadside Communication and Positioning Systems: Vehicle positioning systems, Communication between vehicles and roadside infrastructure

Module III: ITS Functional Areas (13 Hours)

Advanced Traffic Management Systems (ATMS): Components and benefits of ATMS

Advanced Traveler Information Systems (ATIS): Providing real-time information to travellers

Commercial Vehicle Operations (CVO): Enhancing efficiency in commercial vehicle operations

Advanced Vehicle Control Systems (AVCS): Vehicle control technologies

Advanced Public Transportation Systems (APTS): Improving public transportation through ITS

Advanced Rural Transportation Systems (ARTS): ITS applications in rural areas

Module IV: ITS User Needs, Services, and Global Implementations (10 Hours)

ITS User Needs and Services: Travel and traffic management, Public transportation management, Electronic payment systems, Commercial vehicle operations, Emergency management, Advanced vehicle safety systems, Information management

Automated Highway Systems and Vehicle Platoons: Concept of automated highway systems, Vehicles in platoons

Global ITS Programs: Overview of ITS implementations in developed countries, ITS in developing countries, Case studies and comparative analysis

Suggested Readings

Robert L. Gordon, "Intelligent Transportation Systems: Functional Design for Efficient Traffic Management", Springer Nature Publication.

M A Chowdhury and A W Sadek, "Fundamentals of Intelligent Transportation Systems Planning" Artech House Publication

B S Kerner, "Introduction to Modern Traffic Flow Theory and Control", Springer Berlin, Heidelberg Publication.

S.K. Khanna and C.E.G. Justo, "Highway Engineering", Nem Chand and Bros, Roorkee.

Mapping of COs to Syllabus

	CO 1	CO 2	CO 3	CO 4
Module I	H	L		
Module II		H	L	L
Module III	M	M	H	
Module IV		L	M	H

CVSA353T: SUSTAINABLE AND GREEN CONSTRUCTION

B Tech CVE -VI

(4 Credits) (4L:0T:0P)

Objectives:

The objective of this course is to provide students with a comprehensive understanding of sustainable construction principles and practices. Students will learn about the historical context and principles of sustainable development, environmental science, and ecology. Students will explore the economic, ethical, and social dimensions of sustainable construction, preparing them to integrate sustainable practices in their professional careers and contribute to environmentally responsible and socially conscious building projects.

Course/Learning Outcomes:

At the end of the course, students will be able to:

CO1: Apply principles of sustainable development and their application in construction. (Apply)

CO2: Evaluate energy-efficient and water management strategies in building projects. (Evaluate)

CO3: Analyze sustainable building materials, technologies, and waste management practices. (Analyze)

CO4: Assess the economic, ethical, and social impacts of sustainable construction. (Evaluate)

Syllabus:

Module I: (16 hours)

Introduction to sustainable Development: Definition and principles of sustainable development, Historical context and evolution of sustainability, Global and local challenges related to sustainability.

Environment Science and Ecology: Fundamentals of ecology, Biodiversity and conservation, Climate change and its impacts, Environmental pollution and waste management.

Sustainable construction Material and Technology: Green building materials and technologies, Life cycle assessment of materials, Resource efficiency and waste reduction in construction, Low-impact construction methods

Energy Efficiency in Buildings: Principles of energy-efficient design, Renewable energy integration in building design, Energy-efficient HVAC systems, Building energy modeling and simulation.

Module II: (14 hours)

Water Management in Construction: Sustainable water use in construction processes, Rainwater harvesting and greywater recycling, Water-efficient construction practices, Strategies for mitigating water pollution on construction sites.

Sustainable Site Planning: Site selection and evaluation for sustainable construction, green space planning and landscaping, and Sustainable storm water management,

Sustainable Building Design: Principles of green building design, Passive design strategies for energy efficiency, Daylighting and natural ventilation, Integration of sustainable technologies in design.

Module III: (15 hours)

Construction and Demolition Waste Management: Waste reduction and recycling in construction, Responsible demolition practices, Circular economy concepts in construction.

Building Certifications and Standards: LEED (Leadership in Energy and Environmental Design) certification, BREEAM (Building Research Establishment Environmental Assessment Method), other regional and international green building certifications.

Environmental Regulations and Policy: Building codes and regulations for sustainable construction - Environmental impact assessments - Government policies promoting green construction.

Module IV: (15 hours)

Economics of Sustainable Construction: Cost-benefit analysis for green building projects - Financial incentives for sustainable construction - Business models for green technologies in construction.

Project Management for Sustainable Construction: Sustainable project planning and execution - Stakeholder engagement and communication - Monitoring and evaluating sustainability performance

Ethics and Social Responsibility in Construction: Ethical considerations in sustainable construction - Social impacts of green construction projects - Community engagement and stakeholder involvement.

Suggested Readings:

1. Anil Kumar De and Arnab Kumar De. "Environmental Studies", 3rd edition (2012), New Age International Publishers.
2. Reddy Venkata C. S. "Sustainable Building Technologies", 1st edition (2019), BSP Books Pvt. Ltd.
3. Kibert C. "Sustainable Construction: Green Building Design and Delivery", 4th edition (2016), John Wiley and Sons.
4. Charles J. Kibert. "Sustainable Construction: Green Building Design and Delivery", 3rd edition (2012), John Wiley & Sons.
5. Edward Allen and Joseph Iano. "Fundamentals of Building Construction: Materials and Methods", 6th edition (2013), John Wiley & Sons.

Mapping of COs to Syllabus:

	CO1	CO2	CO3	CO4
Module I	H	M	H	
Module II	M	H		L
Module III	L		H	M
Module IV		M	L	H

Program Elective Course 2**1.CVAS354T: ADVANCED STRUCTURAL ANALYSIS****B Tech CVE -VI****(4 Credits) (3L:1T:0P)****Objectives:**

The objective of this course is to provide students with a thorough understanding of the principles and applications of elasticity, model analysis, and the finite element method in structural analysis. Students will gain foundational knowledge and develop skills in analyzing and solving complex structural problems using classical and modern computational techniques.

Course/Learning Outcomes:

At the end of the course, students will be able to:

CO1: Apply equilibrium and compatibility equations to elasticity problems. (Apply)

CO2: Examine model analysis to measure structural forces and deformations. (Analyze)

CO3: Adapt FEM for stress-strain analysis in structural domains. (Create)

CO4: Apply fundamental principles of elasticity and structural analysis for structural simulations. (Apply)

Syllabus:

Module I: Elasticity (13 hours)

Introduction, Components of strain and strain, Hooke's law, Plane stress and plane strain, Equations of equilibrium and compatibility, Boundary conditions,

Module II: Two-Dimensional Problems and Beam Bending (16 hours)

Two dimensional problems in rectangular and polar coordinates, Bending of simple and cantilever beams, Boundary Value Problems in Polar Coordinates, Material Non-Linearity in Beam Bending.

Module III: Model Analysis in Structural Engineering (16 hours)

Structural similitude, Direct and indirect model analysis, Model material and model making, Measurement for forces and deformations.

Module IV: Introduction to Finite element method for structural analysis (15 hours)

Review of principle of virtual work, Ritz method, Discretization of domain, Basic element shape, Discretization process, Application of finite element method to one and two- dimensional plane stress strain elements.

Suggested Readings:

1. D. Menon. "Advanced Structural Analysis", 1st edition (1905), Narosa.
2. A. K. Jain. "Advanced Structural Analysis", 3rd edition (2015), Nem Chand & Bros.
3. R. P. Rethaliya. "Advance Structural Analysis", 1st edition (2020), Atul Prakashan.
4. H. G. Harris and G. Sabnis. "Structural Modeling and Experimental Techniques", 2nd edition (1999), CRC Press.
5. A. P. Boresi, K. Chong and J. D. Lee. "Elasticity in Engineering Mechanics", 1st edition (2008), Butterworth-Heinemann Ltd.

Mapping of COs to Syllabus:

	CO1	CO2	CO3	CO4
Module I	H		M	
Module II	H			M
Module III	L	H		H
Module IV		L	H	M

2. CVRE355T: River Engineering

B.Tech-CVE VI

(4 credits) (L-T-P: 3-1-0)

Objectives

This course provides an in-depth understanding of river behaviour, essential for practising hydraulic and water resources engineers. It covers the principles of river morphology, sediment transport mechanics, and river dynamics. Students will learn to measure various river parameters, use physical and mathematical models to predict river behaviour, and design river training and flood protection structures. The course also addresses the practical aspects of river protection, training works, and restoration.

Course Outcomes

After completing this course, students will be able to:

CO1. Develop skills in measuring and analysing river parameters such as stage, discharge, and sediment load. (Understand)

CO2. Predict river behaviour using knowledge of river morphology and sediment transport mechanics. (Analysing)

CO3. Implement effective river training and flood protection structures. (Applying)

CO4. Solve practical problems in river engineering using mathematical and physical models. (Applying)

Syllabus:**Module 1: (5 hours)**

River Morphology: Fundamentals of river behaviour and morphology; Understanding bars, bends, and meanders; Analysis of thalweg, braiding, and bifurcations.

Module 2: (15 hours)

Sediment Transport Mechanics: Bed forms and bed load transport; Mechanics of suspended sediment transport

Critical shear stress and sediment transport equations.

Module 3: (10 hours)

Aggradation and Degradation: Processes of aggradation and degradation in rivers; Local scour at bridge piers and other hydraulic structures; Case studies on aggradation and degradation impacts.

Module 4: (5 hours)

Measurements in Rivers: Techniques for stage measurements and channel geometry; Discharge measurements and sediment samplers; Methods for measuring suspended and bed load sediment.

Module 5: (10 hours)

Physical and Mathematical River Models: Introduction to fixed and movable bed models; Sectional and distorted models; Mathematical models for predicting aggradation, degradation, and local scour.

Module 6: (15 hours)

River Protection and Training Works: Design and implementation of revetments, dikes, gabions, and spurs; Bank protective measures and bed control structures; River training and flood protection structures; Diversion and cofferdams, river regulation systems; Techniques for dredging, disposal, and river restoration.

Suggested Readings

1. Julien, P.Y. (2002). River Mechanics. Cambridge University Press.
2. Subramanya, K. (1984). Flow in Open Channels . McGraw-Hill.
3. Wu, W. (2007). Computational River Dynamics. Taylor & Francis.

COURSE MAPPING:

	CO1	CO2	CO3	CO4
Module I	H	M		
Module II	M	H		
Module III			H	
Module IV			M	H
Module V			H	L

Professional Elective Course-3**1. CVFE356T: Foundation Engineering**

4 credits- (4L:0T:0P)

Course Objective:

After Successful completion of the course students will be able to:

1. Decide the type of foundations to be recommended for construction of different engineering structures
2. Design different types of foundations

Course Outcomes:

CO1: Identify a suitable foundation system for a structure, methods of soil exploration, (Understand)

CO2: Estimate Lateral earth pressure and retaining wall, Bearing capacity and settlement of shallow foundation, Analyze and design shallow foundations, and pile foundations. (Apply, Analyze)

CO3: Evaluate the importance of raft foundation, analyze and design of well foundation. (Evaluate)

CO4: Examine and discuss various machine foundations, Analyze and design Sheet piles and cofferdams, foundation on problematic soil. (Analyze)

Syllabus:

Module I: (3 Hour)

Introduction: Foundation Engineering, Importance and Purpose, Classification and general requirement, Factors influencing the choice of a foundation, Selection of the type

Module II: (10 Hours)

Soil Exploration: Introduction, Methods of exploration, Planning the exploration programme, Method of boring, Soil sampling and soil samplers, Vertical and lateral extent of borings, Field tests like Penetration test (Standard Penetration Test, Static Cone Penetration Test, Dynamic Cone Penetration Test) Pressure meter tests, dilatometer test and field Vane shear test. Groundwater observations, Borehole logs, Site investigation reports

Module III: (12 Hours)

Lateral Earth Pressure Theories and Retaining Walls [10 Hours]: Introduction, Effect of wall movement on Earth pressure, Earth pressure at Rest, Classical Earth Pressure Theories, Rankine's theory, Coulomb's theory, Yielding of wall of limited height, Graphical solution for coulomb's earth pressure, Trial wedge method for earth pressure, proportioning of retaining walls, Stability of retaining walls

Module IV : (3 Hours)

Flexible Retaining Structures and Cofferdams: Introduction, Cantilever sheet pile wall, Anchored wall, Cofferdams

Module V : (12 Hours)

Bearing Capacity and Settlement of Shallow Foundations [6 Hours]: Introduction, Basic Definitions and their relationship, Principle modes of soil failure, Bearing capacity by classical Earth pressure theory of Rankine, Pauker and Bell's bearing capacity theory of failure, Prandtl's theory of failure, Terzaghi's method of determining bearing capacity of soil, Effect of water table on bearing capacity, Extension of Terzaghi's bearing capacity theory, Recent bearing capacity theories, Bearing capacity from In-situ tests (Plate load test), Types of settlement and their relationships. Allowable settlement and allowable bearing pressure, Steps involved in the proportion of footings

Module VI : (4 Hours)

Mat Foundations: Introduction, Common types of mat foundation, bearing capacity and settlement of mat foundations Compensated foundation, Analysis of mat foundation

Module: VII: (6 Hours)

Pile Foundations: Introduction, Types and uses of piles, Construction of piles, Selection of pile type, Types of foundations to suit subsoil conditions, Pile driving formulae, Static pile load formulae, Load test on piles, Dynamics pile formulae, Pile capacity from in-situ tests. Group action of piles, Negative skin friction, laterally load piles, Piles subjected to uplift loads

Module VIII: (10 Hours)

Well Foundations : Introduction, Types of wells or caissons, Components of a well foundation, Shapes of wells, Depth of a well foundation, Forces acting on well foundation, Lateral stability of well foundation, Construction and sinking of a well, Foundations on problematic soils: Foundations for collapsible and expansive soil

Suggested Readings:

"Foundation Analysis and Design" Joseph E. Bowels. McGraw-Hill International Editions, Fifth Edition, 1997

"Principles of Foundation Engineering" Braja M. Das, Fifth Edition, 2003. Thomson/Brookscole

"Basic and Applied soil mechanics" Gopal Ranjan and ASR Rao, Second Edition New Age International Publishers, 2000

"Soil mechanics and Foundation Engineering" K. R. Arora Standard Publisher Distribution 1997

"A Text Book of Soil Mechanics and Foundation Engineering in SI units" V.N.S. Murthy UBS Publishers Distributors Ltd. Fourth Edition 1993.

"A Text Book of Foundation Engineering", Dr. R.K. Poudel and R. Neupane, 1st Edition, 2006.

"Pile Foundation Analysis and Design" H.G. Poulos and E.H. Davis, John Wiley and Sons, 1980

Course mapping:

	CO1	CO2	CO3	CO4
Module I	H	L		
Module II	H		M	
Module III		H		
Module IV		M		H
Module V	L	H		
Module VI			H	
Module VII			H	
Module VIII			H	3

2.CVSH357T: Surface Hydrology**B Tech CVE -VI****4 Credits - 4L: 0 T: 0P**

COURSE OBJECTIVES: The Course will introduce the overall concept of surface water hydrology for understanding how the measurements and estimation of surface water is done. This course will help in comprehending the various hydrograph parameters and thereby applying the various methods of flood estimation as well as flood routing.

COURSE OUTCOME: At the end of the course, students will be able to:

CO1: Understand the hydrologic cycle and its components (Understand)

CO2: Understand the runoff estimation methods and their measurement techniques (Understand)

CO3: Understand the hydrograph generation and the parameters (Understand)

CO4: Estimate the flood magnitude and flood routing (Evaluate)

Syllabus :**Module I: [15 hours]**

Introduction to hydrologic system and hydrologic budget, fundamental laws of hydrology; atmospheric water vapor, introduction to hydrologic Inputs like precipitation and its forms, snowfall and rainfall; measurement techniques and space-time characteristics, hydrologic data sources (10 hours)

Module II: [15 hours]

Introduction to Hydrologic Abstractions like infiltration, depression storage, evapotranspiration and its measurement techniques, space time characteristics and their modeling, introduction to stream flow measurement techniques, space-time characteristics, rating curves.

Module III:[15 hours]

Streamflow measurement: Stage measurement, Velocity measurement, Bed load measurement and suspended load measurement, Indirect methods, Stage-Discharge relationship Runoff: Runoff, interflow, ground-water flow, Runoff characteristics, SCS-CN Method, Estimating reservoir capacity

Module IV: [15 hours]

Flood Analysis: Rational method, Empirical Formulas, Flood Frequency Analysis, Regional Flood Frequency Analysis, Risk and Reliability, Flood Routing: Reservoir routing, Channel routing, Conceptual model.

Suggested Readings:

1. Chow, V. T., Maidment, D. R., Mays, L. W., Applied Hydrology, McGraw Hill, 1988.
2. Haan, C. T., Statistical Methods in Hydrology, Iowa State University Press, 1977.
3. Subramanya, K., Engineering Hydrology, Fifth Edition, McGraw-Hill, 2020.

Course Mapping

	CO I	CO II	CO III	CO IV
Module I	H			
Module II		H		
Module III			H	
Module IV				H

CVRA468T: Robotics and Automation**B Tech CVE -VII****2 Credits - 2L: 0 T: 0P****Course Objectives:**

This course aims to introduce students to the fundamental principles of robotics and automation and their emerging applications in civil engineering. It familiarizes learners with sensors, actuators, robot kinematics, dynamics, autonomous systems, and UAV technologies relevant to construction, structural, and geotechnical engineering. The course also explores the role of machine learning and artificial intelligence in predictive maintenance, site monitoring, and decision-making. In addition, it develops awareness of human–robot collaboration, safety considerations, and the legal and ethical frameworks governing the deployment of robotics and automation in civil engineering practice.

Course Outcomes:

CO1: Explain the fundamental concepts of robotics, automation, sensors, actuators, and their relevance to civil engineering applications. (Level: Understand)

CO2: Apply the principles of robot kinematics, dynamics, and autonomous systems to construction, structural, and geotechnical engineering tasks. (Level: Apply/Analyze)

CO3: Evaluate the role of robotics, UAVs, machine learning, and AI in structural health monitoring, site inspection, predictive maintenance, and disaster response. (Level: Analyze/Evaluate)

CO4: Discuss the legal, ethical, and safety considerations in deploying automated and collaborative robotic systems in civil engineering. (Level: Understand/Analyze)

Module I

Introduction to Robotics and Automation: Definition and basic principles of robotics and automation, Historical perspective and evolution, Applications in civil engineering

Module II

a. Fundamentals of Civil Engineering: Overview of civil engineering disciplines (structural, geotechnical, transportation, etc.), Basic principles of construction and infrastructure development .

b. Sensors and Actuators: Types of sensors used in civil engineering applications, Actuators and their role in automation, Integration of sensors and actuators in robotic systems

Module III

a. Robot Kinematics and Dynamics: Basics of robot motion and manipulation, Forward and inverse kinematics, Dynamics of robot motion

b. Robotics in Construction: Autonomous construction vehicles, Robotic construction equipment, Robotic assembly and fabrication in construction

Module IV

a. Automation in Structural Engineering: Automated inspection and maintenance of structures, Robotic construction of buildings and bridges, Structural health monitoring using automation

b. Unmanned Aerial Vehicles (UAVs) in Civil Engineering:

Aerial surveying and mapping, UAVs for site inspection and monitoring, Applications in geotechnical engineering and slope stability analysis

Module V

Automation in Geotechnical Engineering: Automated soil sampling and testing, Autonomous drilling and excavation in geotechnical applications, Robotics in tunneling and underground construction

Module VI

a. Human-Robot Collaboration: Collaborative robots (cobots) in civil engineering, Safety considerations in human-robot interaction, Case studies of successful human-robot collaboration in construction

b. Robotics in Disaster Response and Recovery: Use of robots in disaster-stricken areas, Search and rescue robotics, Automated infrastructure inspection after disasters

Module VII

Machine Learning and Artificial Intelligence in Civil Engineering: Introduction to machine learning and AI, Applications in predictive maintenance, AI-driven decision-making in civil engineering projects

Module VIII

Legal and Ethical Considerations: Regulations and standards for robotics in civil engineering, Ethical considerations in the use of automation, Liability and safety standards

Suggested Textbooks:

- 1 Sabrie Soloman, Advanced Robotics, Khanna Book Publishing Co., 2023.
- 2 John J. Craig, Introduction to Robotics, Pearson Education Inc., Asia, 3rd Edition, 2005.
- 3 Asitava Ghoshal, Robotics: Fundamental concepts and analysis, Oxford University Press, 2006.
- 4 Dilip Kumar Pratihari, Fundamentals of Robotics, Narosa Publishing House, 2019. 183 AICTE Model Curriculum for Undergraduate degree in Civil Engineering (Engineering & Technology)
- 5 M.C. Trivedi, A Classical Approach to Artificial Intelligence, Khanna Book Publishing, 2023.
- 6 S. Mukherjee, Robotics Process Automation, Khanna Book Publishing, 2021.
- 7 Dr. Rajiv Chopra, Data Science with AI, ML, DL, Khanna Book Publishing, 2023

Course Mapping

	CO I	CO II	CO III	CO IV
Module I	H			
Module II	H			
Module III		H		
Module IV			H	
Module V		H		
Module VI			H	H
Module VII			H	
Module VIII				H

Program Elective Course – 4

1. CVGI469T: Ground Improvement Techniques

B Tech CVE-7

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objectives

This course aims to provide students with a comprehensive understanding of ground improvement techniques and their applications to various soil conditions and construction requirements. It covers mechanical, hydraulic, chemical and thermal modification methods as well as soil reinforcement with geosynthetics and promotes the ability to design and analyze stable and efficient reinforced soil structures.

COURSE / LEARNING OUTCOMES

At the end of the course students will be able to

1. Demonstrate the need and different situations requiring ground improvement. (Understanding)
2. Apply various modification techniques for ground improvement. (Applying)
3. Analyze and select appropriate soil reinforcement techniques for different scenarios. (Analyzing)
4. Design structures using soil reinforcement techniques. (Creating)

Module I: 5 Hours

Introduction: Need for Ground Improvement, Different types of problematic soils, Emerging trends in ground Improvement.

Module II: 8 Hours

Mechanical modification: Dynamic compaction, impact loading, compaction by blasting, vibro-compaction; pre-compression, stone columns; Hydraulic modification: dewatering systems, preloading and vertical drains, electro-kinetic dewatering.

Module III: 8 Hours

Chemical modification: Modification by admixtures, stabilization using industrial wastes, grouting.

Module IV: 8 Hours

Thermal modification: Ground freezing and thawing.

Module V: 8 Hours

Soil reinforcement: Reinforced earth, basic mechanism, type of reinforcements, selection of stabilisation/improvement of ground using Geotextiles, Geogrid, geomembranes, geocells, geonets, and soil nails.

Module VI: 8 Hours

Application of soil reinforcement: Shallow foundations on reinforced earth, design of reinforced earth retaining walls, reinforced earth embankments structures, wall with reinforced backfill, analysis and design of shallow foundations on reinforced earth, road designs with geosynthetics.

References

1. S. K. Gulhati and M. Datta, "Geotechnical Engineering", Tata McGraw Hill.
2. H.R. Hausmann, "Principles of Ground Modification", McGraw-Hill Book Company.
3. Purushothama Raj. P, "Ground Improvement Techniques", Firewall Media. Supplementary Readings
4. M. R. Hausmann, "Engineering Principles of Ground Modification", McGraw-Hill Pub, Co.
5. P. Nicholson, "Soil Improvement and Ground Modification Methods", Butterworth-Heinemann Ltd.
6. R. M. Koerner, "Designing with Geosynthetics", Prentice Hall Inc

Mapping of COs to Syllabus

Course outcomes	CO1	CO2	CO3	CO4
Module I	H			
Module II	L	H		
Module III	L	H		
Module IV	L	H		
Module V		M	H	
Module VI			M	H

2.CVTE470T: TRAFFIC ENGINEERING AND MANAGEMENT**B Tech CVE-VII**

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objective: This elective course is designed to familiarise the students with the concepts of traffic engineering by providing general concepts of planning, functional design, traffic operation and management of road transportation. Forecasting of traffic, probabilistic approach towards traffic flow theory, highway capacity and study of road accidents has been introduced in detail.

COURSE/LEARNING OUTCOMES

On completion of the course, the students will be able to:

CO1: Define the traffic components and assess the traffic characteristics and related problems.(Understand)

CO2: Develop a strong knowledge base of highway capacity, traffic planning and its management in any transportation area.(Understand)

CO3: Understand elements of highway safety and approaches to accident Studies.(Understand)

CO4: Analyse the design of traffic control devices, forecasting tools and their techniques in transportation interaction.(Analyse. Apply)

Module I: Traffic Forecast and Transportation Demand Management (12 hours)

Traffic Forecast: General travel forecasting principles, Different methods of traffic forecast - Mechanical and Analytical methods, Demand relationships, Methods for future projection; Design Hourly Volume for Varying Demand Conditions: Concept of Design vehicle units and Determination of PCU under mixed traffic conditions, Price-volume relationships, Demand functions. Determination of design hourly volume; Critical Hour concept

Module II: Highway Capacity and Level of Service (7 hours)

Highway Capacity: Factors affecting capacity, level of service; Capacity studies - Capacity of different highway facilities including unsignalised and signalised intersections. Problems in Mixed Traffic flow; Case studies

Module III: Accident Studies (8 hours)

Accident Analysis: Analysis of individual accidents and statistical data; Methods of representing accident rate; Factors influencing traffic accidents; influence of roadway and traffic conditions on traffic safety; accident coefficients; Driver strains due to roadway and traffic conditions.

Module IV: Traffic Flow Theory and Simulation (18 hours)

Traffic Flow Theory: Fundamental flow relationship and their applications, Traffic flow theories and applications; Shock waves; Queuing theory and applications; Probabilistic Aspects of Traffic Flow: Vehicle arrivals, distribution models, gaps and headway distribution models; gap acceptance merging parameters, delay models, applications; Simulation: Fundamental principle, application of simulation techniques in traffic engineering - formulation of simulation models, Case studies.

Suggested Readings

1. L.R. Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publication.
2. C.J. Khisty and B.K. Lall, "Transportation Engineering: An Introduction" Prentice Hall Publication
3. G.V. Rao, "Transportation Engineering", Tata McGraw Hill.
4. S.K. Khanna and C.E.G. Justo, "Highway Engineering", Nem Chand and Bros, Roorkee.

Mapping of COs to Syllabus

	CO 1	CO 2	CO 3	CO 4
Module I	H			L
Module II	L	H	L	
Module III		M	H	M
Module IV	M	L		H

3.CVSD471T: Structural Dynamics

B Tech CVE-7

3 Credits -45 hours (3L-0T-0P: 3credits)

Course Objectives

- To understand characteristics of dynamic system, types of excitation and principle of forming equation of motions.
- To find out the response of single degree freedom system under free and forced vibration
- To analyse millidegree freedom system and its application to shear building model
- To find out the dynamic response of continuous system

Course Outcome

CO1: Familiarization with the formulation of problems for dynamic analysis (Understand)

CO2: Development of equations of motions for SDF system and different approaches for solution (Create)

CO3: To be able to find the response of MDF and continuous systems using modal analysis (Apply)

CO4: To be familiar with different numerical methods to find out the dynamic response of a system (Understand)

Module I: (8 hours)

Introduction : Static and dynamic load, Dynamic loading in real life, Effect of dynamic load on structure, Nature of excitation, vibration terminology, Degrees of freedom, Characteristics of dynamic system-inertia, spring and damping force, Types of vibration-Free and forced vibration, Free body diagram, D'Alembert's principle

Module II: (15 hours)

Single Degree Freedom system: Equation of motion, energy method, natural frequency of SDF, viscous damping, undamped oscillation, underdamped and overdamped condition, free vibration response of Single Degree Freedom system for given initial condition, Idealized SDF system, logarithmic decrement. Forced vibration, response to harmonic excitation, support motion, vibration isolation, vibration measuring instruments, response to arbitrary excitation, Duhamel integral, Response spectra, response spectra for elastic and inelastic design.

Module III : (12 hours)

Multidegree freedom system : Two degrees of freedom system, natural frequencies and normal modes, forced vibration of multi degree freedom system, mode superposition technique, orthogonality condition of normal modes, Natural frequencies and normal modes of shear building, Base excitation in multistoried building, Equivalent static load at floor level due to earthquake excitation, IS 1893-2016 method.

Module IV: (10 hours)

Continuous system : Relation between discrete and continuous system, Axial vibration of rods, Bending vibrations of beams, boundary conditions and eigen value problems, mode shape functions and natural frequencies, orthogonality of mode shape functions, Rayleigh's approximate method.

Suggested Readings

Thompson, W. T , "Theory of Vibration with applications", CBS Publishers, New Delhi, 1990

Meriovitch, L "Elements of Vibration Analysis", Mc Graw Hill Book Co., New York, 1996

Chopra, A. K, "Dynamics of Structures: Theory and Applications to Earthquake Engineering" , Prentice Hall of India, New Delhi, 2001

Inman, D , "Engineering Vibration" Pearson, New Delhi, 2014

Paz, M and Kim , Y. H, "Structural Dynamics: Theory and Computation", Springer, 2018

Mapping of Course objectives to Syllabus

Module No.	CO1	CO2	CO3	CO4
I	L			
II		M	H	H
III	M	H	H	M
IV		M	H	H
V				H
VI	H			

Program Elective Course – 5**1. CVEQ476T: EARTHQUAKE ENGINEERING****BTech CVE-VIII**

(4 credits - 60 hours) (L-T-P: 3-1-0)

Objective: The main objective of this course is to illustrate the fundamentals of structural and soil dynamics to foresee the potential consequences of strong earthquakes on urban areas and civil infrastructure. The course deals with the problems and solutions in attaining efficient earthquake-resistant structures and facilities. This course will be a stepping stone towards designing, constructing and maintaining structures to perform at earthquake exposure up to the expectations and in compliance with building codes.

COURSE OUTCOMES

On completion of the course students will be able to:

CO1: Explain the basic elements of engineering seismology and theory of vibrations. (Understand)

CO2: Interpret the earthquake behavior of buildings and compare various vibration control measures, base isolation

Techniques (Understand)

CO3: Solve the equations of dynamic motions for SDOF and MDOF systems. (Apply)

CO4: Estimate the seismic performance of buildings with respect to site specific response and design spectra (Evaluate)

CO5: Illustrate the detailing requirements of buildings for earthquake resistant construction as per codal provisions (Understand)

Module I: Elements of seismology (8 Hours)

Causes of earthquake, geological faults, tectonic plate theory, elastic rebound, epicentre, hypocentre, primary, shear and Rayleigh waves, seismogram, magnitude and intensity of earthquakes, magnitude and intensity scales, spectral acceleration, information on some disastrous earthquakes

Module II: Theory of vibrations (12 Hours)

Concept of inertia and damping, types of damping, difference between static forces and dynamic excitation

Module III: Analysis of single and multi-degree of freedom systems (20 Hours)

SDOF idealization - equations of motion of SDOF system for mass as well as base excitation, free vibration of SDOF system, response to harmonic excitation, impulse and response to unit impulse, Duhamel integral, introduction to multiple degree of freedom systems, two degree of freedom system, normal modes of vibration, natural frequencies, mode shapes, decoupling of equations of motion, concept of mode superposition

Module IV: Design of earthquake resilient structures (20 Hours)

Response of structures to earthquake, response and design spectra, design earthquake, concept of peak ground acceleration, site specific response spectrum, effect of soil properties and damping, liquefaction of soils, importance of ductility, methods of introducing ductility into RC structures, design methodology, codal provisions and design as per the codes IS 1893, IS 13920 and IS 4326, base isolation techniques, vibration control measures, important points in mitigating effects of earthquake on structures

Suggested Readings:

Paz, M. (2004). Structural dynamics: Theory and computation. CBS Publishers.

Shrikhande, M., & Pankaj. (2006). Earthquake resistant design of structures. PHI Learning.

Hosur, V. (2012.). Earthquake-resistant design of building structures. Wiley and Sons.

Chopra, A. K. (2023). *Dynamics of structures: Theory and application to earthquake engineering*. Pearson Education Singapore Pte Ltd.

Rajasekaran, S. (2009). *Structural dynamics of earthquake engineering: Theory and application*. Woodhead Publishing Limited.

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4	CO5
Module I	H				
Module II	H	M			
Module III	M	H	H		
Module IV		H		H	H

2.CVDO477T: Design of Hydraulic Structures

B Tech CVE VIII

3 Credits : 3L: 0 T: 0P

COURSE OBJECTIVES: The objective of this course is to provide students with an advanced understanding of the analysis and design of various types of hydraulic structures.

COURSE OUTCOME: At the end of the course, students will be able to

CO1: Understand the hydraulic structures for water resources projects(Understand)

CO2: Analyse the construction and design principles of embankment and gravity dam(Analyze)

CO3: Analyse and solve problems on dam outlet works and terminal structures(Analyze. Apply)

CO4: Analyse and solve problems on dimensional analysis and design of physical models of hydraulic structures (Analyze, Apply)

Syllabus

Module I: (10 hours)

Introduction: Hydraulic structures for water resources projects.

Module II: (15 hours)

Introduction to embankment dams, its types, design considerations, seepage analysis and control, stability analysis, construction techniques, introduction to gravity dam, forces acting on and failure of a gravity dam, stress analysis, elementary profile, design of gravity dam, other functional features of a gravity dam.

Module III: (10 hours)

Introduction to dam outlet works, types of outlet structures, ogee spillway, chute spillway, siphon spillway, side channel spillway, labyrinth and piano key weir, introduction to terminal structure, hydraulic jump types, stilling basin, roller bucket, ski jump basin, baffled spillway, drop structure.

Module IV: Introduction to hydraulic modeling and its basic principles, dimensional analysis, design of physical models of hydraulic structures.

Suggested readings:

1. Peterka, A.J, "Hydraulic Design of Stilling Basins and Energy Dissipators", USBR Engineering Monographs No. 25". 1984
2. Design of Small Dams", Third Edition, Water Resources Technical Publication – US Bureau of Reclamation. 1987
3. Singh, B., and Varshney, R.S., "Embankment Dam and Engineering", Nem Chand and Brothers. 2004
4. Novak, P. and Nalluri, C., "Hydraulic Structures", Edition 4, Taylor & Francis. 2007
5. Creager, Justin and Hinds, "Engineering for Dams", Vol. I and II, John Wiley

Course Mapping

	CO I	CO II	CO III	CO IV
Module I	H			
Module II		H		
Module III			H	
Module IV				H

3. CVRW478T Rainwater harvesting

B Tech CVE VIII

3 Credits :3L: 0 T: 0P

Course Objectives

This course aims to equip civil engineering students with the knowledge and skills required to design, implement, and manage rainwater harvesting systems with the focus on integration of these systems into civil engineering projects. The course is framed with following objectives.

- To understand the various types and components of a rainwater harvesting system
- To develop technical skills in the design, installation, maintenance, and management of rainwater harvesting systems.
- To design and install a rainwater harvesting system for residential buildings.

Course Outcomes

CO1: Familiarization with various types and components of a rainwater harvesting system (Understand)

CO2: Understanding the suitability of various rainwater harvesting system (Understand)

CO3: Understanding the design principles of a rainwater harvesting system. (Understand)

CO4: Applying the design and installation procedure for residential buildings (Apply)

Module-I: (5 hours)

CONCEPT OF RAIN WATER HARVESTING: Introduction to types of groundwater recharge structures and factors affecting groundwater recharge structures. Design principles of groundwater recharge structures. Types of Rainwater Harvesting Systems: Rooftop rainwater harvesting, Surface runoff harvesting, Groundwater recharge techniques.

Module II: (10 hours)

COMPONENTS OF RAIN WATER HARVESTING SYSTEM: Collection surfaces and conveyance systems, Storage tanks, cisterns, and reservoirs. Filtration and purification technologies.

Module III: (15 hours)

DESIGN PRINCIPLES RAIN WATER HARVESTING SYSTEM: Site assessment and feasibility studies, system sizing and capacity calculations, structural and material considerations in design, incorporating rainwater harvesting in urban infrastructure, design considerations for residential, commercial, and industrial buildings.

Module IV: (15 hours)

Installation and Implementation OF RAIN WATER HARVESTING SYSTEM: Installation procedures and best practices, addressing common challenges during implementation, routine maintenance.

Suggested Reading:

1. Lancaster, B, "Rainwater Harvesting for Drylands and Beyond", Tucson, Arizona Rainsource Press, 2008
2. Laureano, P, "Water Conservation Techniques in Traditional Human Settlements", Copal Publishing Group, 2013.

Mapping of Course objectives to Syllabus

Module No.	CO1	CO2	CO3	CO4
I	M			
II		H		
III			H	
IV				H

Program Elective Course – 6**1. CVBE479T: BRIDGE ENGINEERING (L:T:P- 3:1:0)****B Tech CVE VIII****(4 Credits- 60 Hours)****Objectives:**

This course aims at knowledge development of principles of engineering mechanics, load transfer mechanisms, analysis methodologies, design principles, damage mechanics, failure mechanisms, and construction, inspection, maintenance, repair and retrofit strategies in the realm of bridge engineering.

Course/Learning Outcomes:

At the end of the course, students will be able to:

CO1: Explain the classification and design considerations for various types of bridges. (Evaluate)

CO2: Design concrete bridge elements including slabs, T-beams, and box girders using various IRC loading. (Create)

CO3: Design steel bridges such as plate girder and truss bridges using various IRC loading. (Create)

CO4: Analyze substructures including piers, abutments, and foundations with seismic considerations. (Analyze)

Syllabus:**Module I: General (13 hours)**

Classification of bridges, site selection, geometric and hydraulic design consideration, loading standards for highway and railway bridges, general design consideration; optimum spans.

Module II: Concrete bridges (14 hours)

Culverts; Slab, T-beam, box girder bridges, balanced cantilever bridge, cable stayed bridge, extrados bridges; arch bridge; Special requirements for Pre-stressed Concrete bridges.

Module III: Steel bridges (15 hours)

Plate Girder Bridge, truss bridge, suspension Cable Bridge, cable stayed bridge.

Module IV: Substructures (18 hours)

Design of piers and abutments, pile and well foundations, bearings and expansion joints, special wearing coats, seismic design considerations, Aerodynamic stability considerations, special durability measures, provisions for inspection and maintenance.

Suggested Readings:

1. Krishna Raju N. "Design of Bridges", 4th edition (2009), Oxford & IBH Publishing Co. Pvt. Ltd.
2. Vazirani V. N. and Ratwani, M. M. "Design of Concrete Bridges", 2nd edition (1999), Khanna Publishers.
3. J. A. L. Waddell. "Bridge Engineering", Revised edition (2010), Wiley.
4. D. J. Victor. "Essentials of Bridge Engineering", 6th edition (2017), Oxford University Press
5. E. J. Obrien, A. Dixon and E. Sheils. "Reinforced and Prestressed Concrete Design", 2nd edition (2012), CRC Press.

Mapping of COs to Syllabus:

	CO1	CO2	CO3	CO4
Module I	H	L		
Module II	M	H		M
Module III	M		H	M
Module IV		M	M	H

2. CVUT480T: URBAN TRANSPORTATION PLANNING**B Tech CVE VIII**

(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective: This course aims to provide a comprehensive understanding of urban transportation planning and modelling. It covers urban morphology, urbanisation, travel demand, and activity systems, and emphasises a systems approach to transportation planning. The course also addresses the preparation, evaluation, and implementation of transportation plans, incorporating policy and case studies for practical insights.

COURSE/LEARNING OUTCOMES

On completion of the course, the students will be able to:

CO1: Explain the fundamental concepts of urban morphology, urbanization, travel demand, and urban activity systems, including various approaches to urban transportation planning such as trip-based and activity-based methods. (Understand)

CO2: Apply urban transportation planning techniques to real-world scenarios, including inventory, model building, forecasting, and evaluation. Analyze trip generation, distribution, and modal split models to understand travel patterns and behavior. (Apply)

CO3: Develop and evaluate alternative urban transportation plans using various assignment methods, land use transportation models, and quick response techniques. Synthesize transportation solutions and assess their effectiveness in addressing urban transport problems. (Create)

CO4: Design and implement urban transportation projects, considering financing, monitoring, and policy aspects. Critically evaluate urban development planning policies and case studies to draw insights for practical application in urban transportation planning. (Create)

Module I: Fundamentals of Urban Transportation Planning (15 Hours)

Urban Morphology and Urbanization: Definition and components of urban morphology, Trends and impacts of urbanization on travel demand

Urban Activity Systems and Travel Patterns: Understanding urban activity systems, Analysis of travel patterns in urban areas

Systems Approach in Urban Transportation Planning: Overview of systems approach, Comparison of trip-based and activity-based approaches

Goals, Objectives, and Constraints in Urban Transportation Planning: Setting goals and objectives, Identifying constraints in transportation planning

Inventory, Model Building, Forecasting, and Evaluation: Steps in inventory and data collection, Model building techniques, Forecasting travel demand, Evaluation of transportation plans

Module II: Trip Generation and Distribution Models (15 Hours)

Study Area Delineation and Zoning: Defining the study area, Zoning principles and practices

UTP Survey and Trip Generation Models: Conducting UTP surveys, Classification of trips — productions and attractions, Trip rate analysis, Multiple regression models and category analysis

Trip Distribution Models: Growth factor models, Gravity model and opportunity models

Modal Split Models: Mode choice behavior, Trip end and trip interchange models, Probabilistic models, utility functions, and logit models, Two-stage model for mode split

Module III: Traffic Assignment and Land Use Transportation Models (16 Hours)

Traffic Assignment Methods: Transportation networks and minimum path algorithms, Assignment methods — All-or-Nothing, capacity restrained, and multi-path assignment, Route-choice behavior and analysis

Land Use Transportation Models: Urban forms and structures, Location models and accessibility, Land use models and Lowry derivative models, Quick response techniques

Non-Transport Solutions for Transport Problems: Exploring non-transport solutions, Integrating land use and transportation planning

Module IV: Plan Preparation, Implementation, and Policy (14 Hours)

Preparation of Alternative Plans: Developing alternative transportation plans, Techniques for plan preparation

Evaluation Techniques: Methods for evaluating transportation plans, Criteria for assessment

Plan Implementation and Monitoring: Steps for implementing transportation plans, Monitoring and performance evaluation

Financing of Projects: Funding sources and financial planning

Urban Development Planning Policy: Policy formulation and analysis, Case studies of successful urban transportation projects

Suggested Readings

1. C. Jotin Khisty, B. Kent Lall, "Transportation Engineering: An Introduction" Prentice Hall
2. Michael D. Meyer, Eric J. Miller, "Urban Transportation Planning: A Decision-Oriented Approach" McGraw-Hill Education
3. John W. Dickey, "Metropolitan Transportation Planning" CRC Press
4. Edward K. Morlok, "Introduction to Transportation Engineering and Planning" McGraw-Hill

Mapping of COs to Syllabus

	CO 1	CO 2	CO 3	CO 4
Module I	H	M		L
Module II		H	L	
Module III		L	H	M
Module IV	L		M	H

CVGW481T :GROUNDWATER HYDROLOGY

B Tech CVE-VIII

(4 Credits) (L: T:P: 4-0-0)

Objectives

To learn the fundamentals of groundwater flow.

To learn the hydraulics of different kinds of wells.

To evaluate the aquifer parameters and groundwater level variations for different hydro-geological boundary conditions.

To understand the various facets of ground water quality modelling.

Enable the learners to understand the significance of conjunctive use of ground water along with other fresh water sources.

Course/ Learning Outcomes

At the end of this course students will be able to:

CO1: Explain the aquifer properties and movement of ground water. (*understand*)

CO2: Solve well hydraulics problems under various hydrogeological scenarios. (*apply*)

CO3: Appraise the basic concepts and techniques associated with ground water flow modelling. (*evaluate*)

CO4: Identify major sources and types of groundwater contamination. (*understand*)

CO5: Identify the challenges and formulate strategies necessary for groundwater management. (*understand, create*)

Detailed Syllabus

Module I (15 hours)

Introduction: Introduction of ground water resources: Definition of groundwater, role of groundwater in hydro-logical cycle, Global and Indian perspectives, Occurrence of ground water, Geological factors governing the occurrence of ground water, groundwater bearing formations, classification of aquifers, flow and storage characteristics of aquifers, Darcy's law, anisotropy and heterogeneity, Governing Equations for Groundwater Flow: Dupuit-Forchheimer assumptions, general differential equations governing groundwater flows and their analytical solutions.

Module II (15 hours)

Wells and Well Hydraulics: Different types of wells, construction of wells, steady and unsteady state solutions for confined, unconfined and leaky aquifers, effect of boundaries, method of images, pumping test analysis. Geophysical methods in ground water exploration, Open wells or dug wells, Tubewells.

Module III (12 hours)

Groundwater Flow Modelling: Role of groundwater flow models, basic introduction to hydraulic, Hele-Shaw and analog models, introduction to numerical modeling: basics of finite difference techniques, finite difference solution for aquifer flow, basics of finite element techniques, finite element solution for aquifer flow.

Module IV (12 hours)

Groundwater Quality: General problem of contamination of groundwater, sources, remedial and preventive measures, seawater intrusion in coastal aquifers - Saline water intrusion, Relationship between fresh and saline water, Structure of fresh-salt water interface, Control of saline water intrusion

Module V (6 hours)

Groundwater Conservation: Regional groundwater budget; resource assessment; estimation of recharge, Indian practice for artificial recharge, Planning of Groundwater Development: constraints on the development, role of flow models, optimal groundwater development.

References:

1. Todd, D.K., "Groundwater Hydrology", John Wiley. 1959
2. Bear, J., "Hydraulics of Groundwater", McGraw. 1979
3. Bouwer, H., "Groundwater Hydrology", McGraw Hill. 1978
4. Walton, W.C., "Groundwater Resources Evaluation", McGraw Hill. 1970
5. Freeze and Cherry, "Groundwater", Prentice Hall. 1979
6. Driscoll, F.G., "Ground Water and Wells", Johnson Division. 1986
7. Raghunath, H. M., "Ground Water", New Age International (P) Limited. 2007

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H	M	M		
Module II	M	H	M		
Module III	H	M	H		
Module IV				H	M
Module V		L	M	H	H

Program Elective Course -7**CVEO482T : ELEMENTS OF GEOINFORMATICS****B Tech CVE-VIII****(3 credits — 45 hours) (L-T-P:3-0-0)**

Objectives: This elective course is designed to familiarize the students with the modern tools of Geoinformatics viz., remote sensing (RS) and geographical information system (GIS) which are useful for analysis and interpretation of occurrences on the earth's surface. Satellite remote sensing in optical bands has been introduced in more detail. Foundation of GIS will help the students to go ahead for using this tool in decision making and Bio-physical modelling.

COURSE /LEARNING OUTCOMES**At the end of the course students will be able to:**

CO1: Define the different types of maps, coordinate systems and recognize the importance and ease of surveying using remote sensing. (Understand)

CO2: Classify different types of remote sensing. Students are able to differentiate the various types of remote sensing data. (Understand)

CO3: Demonstrate the various methods of digital analysis and interpretation of satellite image. (Apply)

CO4: Identify the hardware and software requirements for GIS analysis, organize the data obtained from various remote sensing sources to formulate the map of an area and utilize the same for various planning and other related works.(Apply)

Module I: Basics of Geoinformatics (8 hours)

Map basics: Definition of map and fundamental characteristics, types of map, scale of a map and its representations, map projection – meaning, types and characteristics of each

Coordinates system: geoid and reference ellipsoid, geographic coordinate system - projected coordinate, DEM - meaning and use, geo-referencing of map and image - its meaning and necessity, global positioning system (GPS) - important features and use.

Global Navigation Satellite System: Radio and Satellite Navigation, GNSS Position Location Principles, GNSS system architecture-Satellite constellation, Geo-positioning-Basic Concepts, GNSS Receiver Operation and Differential GPS. NAVSTAR, GLONASS, Indian Geodetic System, GNSS applications: Defense, civilian, Navigational and Geodetic applications; GPS-GIS integration, GNSS applications in surveying, mapping, GNSS in intelligent transportation, fleet management and tracking, Location Based Services, Vehicle- Geo-Locking.

Module II: Foundation of remote sensing (10 hours)

Remote sensing system, passive and active remote sensing, electromagnetic spectrum, atmospheric window, relevant radiation principles, interaction of EMR with atmosphere and earth surface features, spectral signature, atmospheric and geometric influence of spectral response patterns

Data acquisition and visual interpretation: types of satellites, characteristic differences of optical and microwave data, multi-spectral and hyper-spectral data, data acquisition in optical bands - along track and

across track scanning, examples of LANDSAT, SPOT and IRS, data acquisition in microwave bands, advantages and limitations - salient features of few satellites with microwave sensors such as RISAT, ERS etc., types of multi- spectral data products, hard copy and digital image (panchromatic, true colour and FCC etc.) visual interpretation of image - important keys, ground truth verification

Module III: Digital analysis and interpretation of satellite image (17 hours)

Introduction to the broad types of computers assisted operators.

Image rectification and restoration - geometric correction, resampling using nearest neighbour, bilinear interpolation and cubic convolution, radiometric correction due to sun elevation and earth-sun distance, noise removal.

Image enhancements – level slicing, contrast stretching, spatial filtering, convolution, edge enhancements, and spectral ratios, vegetation indices.

Image classification - supervised, unsupervised and hybrid.

Module IV: Introduction to geographic information system (GIS) (10 hours)

Definition of GIS, comparison of GIS with CAD, GIS architecture, components of a GIS – hardware, software, data, people, methods, GIS data type – spatial and attribute, spatial data types – point, line and polygon, raster and vector representation of data GIS workflow diagram with explanation, fundamental operation of GIS, application of GIS – few examples

Suggested Readings

T.M. Lillisand and R.W. Kiefer, Remote Sensing and Image Interpretation, John Wiley and Sons, New York
Satheesh Gopi, R. Sathikumar, N. Madhu, Advanced Surveying – Total Station, GIS and Remote Sensing, Pearson Education

Paul Longely, M.F. Goodchild, et al., Geographical Information System, Volume I and II, John Wiley and Sons, Inc. 1999

J. B. Cambell, Introduction to Remote Sensing, Taylor and Francis, London, 1996

F.F. Sabins, Remote Sensing: Principles and Interpretation, W.H. Freeman and Company, New York, 1997

Jensen, J.R., Remote Sensing of the Environment – An Earth Resources Perspective, Pearson Education, Inc. (Singapore) Pvt. Ltd., Indian edition, Delhi, 2000

George Joseph, Fundamentals of Remote Sensing, Universities press (India) Pte Ltd., Hyderabad, 2003

Mapping of COs to Syllabus

	CO 1	CO 2	CO 3	CO 4
Module I	H			L
Module II	L	H	L	
Module III		H	H	M
Module IV	H	L	M	H

2. CVEG483T : ENVIRONMENTAL GEOTECHNOLOGY

B Tech CVE-VIII

4 Credits : 60 Hours (L:T:P-3:0:0)

Course Objectives:

The main objectives of this course are:

To understand the soil-environment interaction, Soil mineralogy and Mechanisms of soil-water interaction

To learn ground water flow and contaminant transport phenomenon.

To Learn about the principles and practices of waste management, including the design and construction of landfills, hazardous waste containment systems, and other waste disposal methods.

Course Outcomes:

After Successful completion of the course students will be able to:

CO1: Understand Soil-environment interaction, Soil mineralogy and Mechanism of soil-water interaction (Understand)

CO2: Demonstrate a thorough understanding of the physical, chemical, and biological processes that govern the behavior and transport of contaminants in soil and groundwater. (Apply)

CO3: Apply principles of geotechnical engineering to design effective waste management systems, including landfills and hazardous waste containment systems. (Apply)

CO4: Select and implement appropriate remediation technologies for various types of contaminated sites, assessing their effectiveness and limitations. (Apply)

Syllabus:

Module I:(8 hours)

Introduction to Geo Environmental Engineering., Sources & Impact of Contamination and Soil-Waste Interaction

Concepts of Integrated SWM & Geoenvironmental Engineering.

Module II:(7 Hours)

Concepts of waste containment; Sources, production and classification of wastes, Environmental laws and regulations, ground water flow and contaminant transport, desirable properties of soil; contaminant transport and retention; contaminated site remediation.

Module II:(15 Hours)

Mechanisms of soil-water interaction: Diffuse double layer models; Force of attraction and repulsion; Soil-water-contaminant interaction; Theories of ion exchange; Influence of organic and inorganic chemical interaction

Principles and Planning of Landfills, Liners for Landfills, Land-fill Covers, Generation and Control of Leachate and Gas from Landfills, Stability of Slopes and Settlement of Landfills

Module III: (15 Hours)

Contaminant analysis. Contaminated site characterization, estimation of landfill quantities, landfill site location, design of various landfill components such as liners, covers, leachate collection and removal, gas generation and management, ground water monitoring, end uses of landfill sites.

Solved examples, Monitoring and Detection of Subsurface Contamination, Costs, Construction Aspects and Site Selection of Landfills. Control, Rehabilitation of Old Dumps and Contaminated Sites.

Module IV: (15 Hours)

Slurry Deposited Waste and their Geotechnical Properties .Planning & Design, Incremental Raisings and Failures of Slurry Ponds ,slurry walls and barrier systems, design and construction, stability, compatibility and performance, remediation technologies, stabilization of contaminated soils and risk assessment approaches. Environmental Control Measures at Slurry Ponds, Geotechnical Reuse of Waste

Suggested readings:

Mitchell, J.K and Soga, K., Fundamentals of Soil Behavior, John Wiley and Sons Inc., 2005.

Fang, H-Y., Introduction to Environmental Geotechnology, CRC Press, 1997.

Daniel, D.E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993.

Rowe, R.K., Quigley, R.M. and Booker, J.R., Clay Barrier Systems for Waste Disposal Facilities, E & FN Spon, 1995.

Rowe, R.K, Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.

Reddi, L.N. and Inyang, H.F, Geoenvironmental Engineering - Principles and Applications, Marcel Dekker Inc, 2000.

Sharma, H.D. and Lewis, S.P, Waste Containment Systems, Waste Stabilization and Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994.

Moocs Course :<https://archive.nptel.ac.in/courses/105/102/105102160/>

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4
Module I	H			

Module II	M	H		
Module III			H	M
Module IV				H

3. CVPS484T: Prestressed Concrete

B Tech CVE-VIII

(3 credits – 45 hours) (L-T-P: 3-0-0)

Objectives

The course aims to give students a thorough grasp of the principles and techniques used in designing and analyzing prestressed concrete systems. By the end of the course, students will possess the essential knowledge and skills to proficiently design and analyze prestressed concrete structures, readying them for professional careers in civil and structural engineering.

COURSE / LEARNING OUTCOMES

At the end of the course students will be able to

CO1.Analyze and explain the fundamental concepts and principles of prestressed concrete, including the materials and prestressing systems used. (Analyzing)

CO2.Analyze and design prestressed flexural members, ensuring compliance with limit states of collapse, serviceability, shear, and torsion.(Creating)

CO3.Calculate deflection and crack width to evaluate the serviceability of prestressed concrete structures under different loading conditions.(Evaluating)

CO4.Analyze prestress transmission in anchorage zones and design the end blocks accordingly. (Analyzing/Creating)

CO5. Analyze and design composite members and statically indeterminate structures.(Analyzing/Creating)

Detailed Syllabus:

Module I: 5 hours

Basic concept and principles of pre-stressed concrete, materials, prestressing systems – Analysis of prestress and bending stresses loss of pre-stress Stresses at transfer and service loads.

Module II: 8 hours

Limit state design criteria: Inadequacy of elastic and ultimate load method, criteria for limit states, strength and serviceability. Design of sections for flexure codal provisions- ultimate strength in flexure.

Module III: 8 hours

Shear and torsional resistance: design of shear reinforcement, design of reinforcement for torsion, shear and bending..

Module IV: 8 hours

Deflections of prestressed concrete members: Importance, factors, short term and long term deflection. Codal provisions.

Module V:8 hours

Anchorage Zone stresses in post tensioned members: Stress distribution in end block, anchorage zone reinforcement. Prestressed concrete poles and sleepers: Design of sections for compression and bending. Partial pre-stressing- Definitions, principles and design approaches and applications.

Module VI:8 hours

Composite beams –Analysis and design – Ultimate strength – applications, Elementary idea of composite construction for tee beams in bridges.Statically Indeterminate structures: advantages of continuous member(Concepts and steps for analysis)

Refernces

1. G S Pandit & S P Gupta, " Prestressed Concrete", CBS Publishers,2014
2. Krishna Raju N., Prestressed concrete, Tata McGraw Hill Company, New Delhi 1998
3. Rajagopalan, N, "Prestressed Concrete", Alpha Science, 2002
4. Lin T.Y. Design of prestressed concrete structures, Asia Publishing House, Bombay 1995
5. Mallic S.K. and Gupta A.P., Prestressed concrete, Oxford and IBH publishing Co. Pvt. Ltd.,1997

6. Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi, 1990
7. IS 1343 – 1998 ISCode Bureau of Indian Standards.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H				
Module II		H			
Module III		H			
Module IV			H		
Module V				H	
Module VI					H

Open Elective course 1**CVCM346T: CONCRETE MATERIALS****(3 Credits -45 hours-L:T:P- 3:0:0)****Objectives:**

The course aims to provide students with a comprehensive understanding and practical skills in concrete technology, focusing on influence of constituent materials on concrete properties, Implementing specialized concrete mixes and concrete handling, placement, and testing techniques through laboratory practice.

Course/Learning Outcomes:

At the end of the course, students will be able to:

CO1: Evaluate materials' impact on concrete properties and performance. (Evaluate)

CO2: Design advanced concrete mixes using specialized materials. (Create)

CO3: Examine the concrete tests under various conditions. (Analyze)

Syllabus:**Module I: Influence of Materials (12 hours)**

Examines the influence of constituent materials (cements, aggregates and admixtures) on the properties of fresh and hardened concrete, recycled aggregates recovered from construction and demolition wastes, m-sand, light-weight aggregates.

Module II: Advanced and Specialized Concrete Mixes (13 hours)

Use of fly ash in concrete, fibre-reinforced concrete with various types of metallic and non-metallic fibres, various types of concrete such as self-compacting concrete, high performance concrete, etc.

Module II: Comprehensive Concrete Technology (20 hours)

Mix design, handling and placement of concrete, effect of revibration of concrete, behavior of concrete under various types of loading and environment, various laboratory test methods.

Suggested Readings:

1. M. L. Gambhir, "Concrete Technology: Theory and Practice", 5th Edition (2019), McGraw Hill Education.
2. A. M. Neville, "Properties of Concrete", 5th Edition (2012), Pearson Education India.
3. A. R. Santhakumar, "Concrete Technology: Theory and Practice", 2nd Edition (2016), Oxford University Press.
4. N. Krishna Raju, "Advanced Reinforced Concrete Design", 2nd Edition (2010), CBS Publishers & Distributors.

Mapping of COs to Syllabus:

	CO1	CO2	CO3
Module 1	H		L
Module 2	M	H	
Module 3	L		H

Open Elective course 2**CVSC358T: Sustainable construction methods****B Tech CVE -VI****(3 credits – 45 hours) (3L-0T-0P)**

Objectives

This course introduces the concepts of sustainability in civil engineering and explores the role construction materials play in developing green infrastructure.

COURSE / LEARNING OUTCOMES

At the end of the course students will be able to

1. Classify sustainable construction materials. (Understand)
2. Apply cutting-edge construction technologies. (Apply)
3. Apply different rating systems of construction/buildings as a professional. (Apply)
4. Apply life cycle approach to optimize the performance of green construction materials. (Apply)

Module I: 5 hours

Types of foundations and construction methods. Basics of Formwork and Staging. Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls). Modular construction methods for repetitive works.

Module II: 10 hours

Precast concrete construction methods. Basics of Slip forming for tall structures. Basic construction methods for steel structures. Basics of construction methods for Bridges.

Module III: 10 hours

Identification of cutting-edge sustainable construction materials, technologies and project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity.

Module IV: 10 hours

Study and evaluation of current Leadership in Energy and Environmental Design (LEED) and Green Rating for Integrated Habitat Assessment (GRIHA) for construction system. Detailed case study and analysis of highly successful recent "green construction projects". Guidance for students on the LEED Green Associate professional licensing examination.

Module V: 10 hours

Environmental impact of materials; life-cycle assessment; material selection to optimize performance; design, evaluation, and production of green construction materials.

References

1. Rebecca L. Henn; Andrew J. Hoffman (2013), Constructing Green the Social Structures of Sustainability (Urban and Industrial Environments), MIT Press.
2. Steve Goodhew Sustainable Construction Processes: A Resource Text ISBN: 978-1-405- 18759-6 May 2016 Wiley-Blackwell.
3. Kim S. Elliott, Precast Concrete Structures – 12 June 2019, CRC Press Taylor and Francis.
4. S.B.Marinković, Life cycle assessment (LCA) aspects of concrete, Woodhead Publishing Series in Civil and Structural Engineering 2013, Pages 45-80.

Mapping of COs to Syllabus

Course Out-comes	CO1	CO2	CO3	CO4
Module I	H			
Module II	H			
Module III	M	H		
Module IV			H	
Module V			M	H

.Open Elective 3**CVRR472T: Repair & Rehabilitation of Structures****B Tech CVE -7**

3 credits-45 Hours (L:T:P:3:0:0)

Objectives:

1. To provide a thorough understanding of the fundamental principles of structural deterioration and the various factors that contribute to it.
2. To develop the ability to perform detailed assessments of structural conditions using a variety of diagnostic tools and techniques.
3. To impart knowledge about the properties, advantages, and limitations of different materials used in repair and rehabilitation.
4. To teach various repair and strengthening techniques, including both traditional methods and modern innovations.

Course outcomes:

CO1. Identify the causes and mechanisms of structural deterioration, including environmental, chemical, physical, and mechanical factors. (Understand)

CO2. Achieve the knowledge on quality of concrete, durability aspects, causes of deterioration, and assessment of distressed structures by different NDT methods. (Understand)

CO3. Understand the properties and applications of various repair materials, such as concrete repair mortars, grouts, epoxy resins, and fiber-reinforced polymers. (Understand)

CO4. Supervise and manage repair projects to ensure quality control and adherence to safety standards. (Apply)

Module I :(10 hours)

Maintenance and Repair Strategies Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, and causes of deterioration.

Module II :(20 hours)

Strength and Durability Of Concrete- Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete – Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness; Special Concretes- Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High-performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes; Techniques for Repair and Protection Methods- Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection;

Module III: (15 hours)

Repair, Rehabilitation and Retrofitting of Structures- Evaluation of root causes; Underpinning & shoring; some simple systems of rehabilitation of structures; Guniting, shotcreting; Non-Destructive testing systems; Use of external plates, carbon fibre wrapping and carbon composites in repairs. Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – Demolition Techniques – Engineered demolition methods – Case studies.

Suggested Readings:

1. Repair and Rehabilitation of Structures, Hemalatha Alagar.
2. Repair and Rehabilitation of Concrete Structures, Poonam I. Modi and Chirag N. Patel.
3. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit, Gupta, Standard Publications.
4. Concrete Technology by A.R. Santakumar, Oxford University press.
5. Defects and Deterioration in Buildings, EF & N Spon, London.
6. Non-Destructive Evaluation of Concrete Structures by Bungey – Surrey University Press.
7. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W.H. Ranso, (1981).
8. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B.A. Richardson, (1991).

Mapping of COs

	CO1	CO2	CO3	CO4
Module I	H		L	
Module II		H	M	
Module III			L	H

Open Elective 4**CVIT485T: Introduction to Finite Element Analysis****3 Credits -45 Hours-(3-0-0=3 credits)****Course Objectives**

To understand the basic concepts and mathematical methods required for finite element analysis

To apply direct stiffness method in analysis of truss and frames

To develop finite element formulation using one dimensional element and find solution

To develop finite element procedure using two-dimensional element and application to engineering problems

Course Outcome

At the end of the course students will be able to

CO1: Understand basic concepts and mathematical methods required in finite element analysis(Understand)**CO2:** Use direct stiffness method in truss and frame analysis(Apply)**CO3:** Develop finite element procedure using one dimensional bar element and beam element(Create)**CO4:** Formulate finite element procedure in plane stress problem using 2D element (Apply)**Module 1: Fundamental Concepts (8 hours)**

Introduction, historical background, matrix algebra, stresses in elastic body and equilibrium, strain-displacement, stress-strain relations, constitutive matrix, plane stress and plane strain condition, Potential energy, virtual work principle, Rayleigh-Ritz method, Galerkin method, application to axially loaded element and member under bending.

Module 2: Direct stiffness method (12 Hours)

Basic concepts, merits and demerits, kinematic indeterminacy, identification of member and node in structures, global and member co-ordinates, one dimensional member -axially loaded, transverse loading, displacement and force transformation matrix, element stiffness matrix, assembly procedure, illustration in plane truss, continuous beams and frames, computer programme for generating global stiffness matrix, load vector and finding displacement

Module 3: One dimensional problem (15 Hours)

Finite element model, element division and numbering scheme shape function, local co-ordinates, assembly of the global stiffness matrix and load vector, properties of stiffness matrix, application of boundary conditions, quadratic and cubic shape function, stiffness matrix of Euler Bernouli beam element, Problems involving plane frames, use of MATLAB in solving problems.

Module 4: Two dimensional analysis (10 Hours)

Discretization, 2D three noded triangular element, convergence criteria, displacement function in terms of nodal co-ordinates, element stiffness matrix, plane stress problems, Four noded rectangular element, strain-nodal displacement relation, element stiffness matrix, concept of isoparametric element, transformation from physical to isoparametric co-ordinates for the linear element, Gaussian quadrature formula and application.

Suggested Readings:

1. Charaupatla T R and Belagundu A D (2012), Introduction to Finite Element in Engineering, Pearson
2. Desai C.S (1979), Elementary Finite Element method, Desai, C S, Prentice Hall, NJ
3. Textbook of Finite Element Analysis (2012), Prentice Hall, New Delhi
4. Mukhopadhyaya M, Shaik A M (2013), Matrix method and Finite Element Analysis of Structures, Prentice hall, New Delhi

Mapping of Course objectives to Syllabus:

Module No.	CO1	CO2	CO3	CO4
I	H	M	M	
II	L	H		
III	M		H	
IV	M			H

Mandatory -Non credit Audit Course (From Department of Civil Engineering)**1. CVCE232T :Civil Engineering - Societal & Global Impact****B Tech CVE- IV****P/NP: [L-T-P: 3:0:0]**

The course is designed to provide a better understanding of the impact which Civil Engineering has on the Society at large and on the global arena.

Course Outcomes:

After successful completion of the course students will be able to understand :

CO1 - Relate the impact which Civil Engineering projects have on the Society at large and on the global arena. (Analysing)

CO2 - Compare the past, present and future of the Built Environment and factors impacting the Quality of Life(Understanding)

CO3 - Recognize the extent of Infrastructure, its requirements for energy and how they are met(Understanding)

CO4 - Apply professional and responsible judgement and take a leadership role(Applying)

CO5 - Examine the potential of Civil Engineering for Employment creation and its Contribution to the GDP(Analysing)

Detailed Syllabus

Module 1: Introduction to Course and Overview; Understanding the past to look into the future:

Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections, Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis;

Module 2: Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and Wonders in the field of Civil Engineering; Future Vision for Civil Engineering

Module 3: Infrastructure - Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability;

Module 4: Environment- Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control(Dams, Canals, River interlinking), multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and nonstationarity; Environmental Metrics & Monitoring; Other Sustainability measures;Innovations and methodologies for ensuring Sustainability.

Module 5: Built environment – Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability

Module 6: Civil Engineering Projects – Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development;

Suggested Readings:

1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASCE Annual Conference and Exposition
3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
6. <http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx>
7. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge. Foundation for Water Research FR/R0014
8. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130
9. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.
10. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63
11. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.
12. Brugnach M., Dewulf A., Pahl-Wostl C., Taillieu T. (2008) Toward a relational concept of uncertainty: about knowing too little, knowing too differently and accepting not to know. Ecology and Society 13 (2): 30
13. Butler D., Davies J. (2011). Urban Drainage. Spon. 3rd Ed.
14. Cavill S., Sohail M. (2003) Accountability in the provision of urban services. Proc. ICE. Municipal Engineer 156. Issue ME4 paper 13445, p235-244.149
15. Centre for Water Sensitive Cities (2012) Blueprint for a water sensitive city. Monash University.
16. Charles J A. (2009) Robert Rawlinson and the UK public health revolution. Proc ICE Eng History and Heritage. 162 Nov. Issue EH4. p 199-206

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H				
Module II		H			
Module III			H		
Module IV			H	H	
Module V			H	H	
Module VI					H

2.CVPP349T: Professional Practice, Law & Ethics B Tech CVE-V

(P/NP) [L-T-P: 3:0:0]

Course Objectives:

The course is designed to address the following:

The course covers professional relations, civic responsibilities, and ethical obligations for engineering practice. The course will make the students understand contracts management and various legal aspects related to engineering. Further, the course familiarizes students with elementary knowledge of laws that would be of utility in their profession, including several new areas of law such as IPR, ADR. The course is designed to address the following:

To make the students understand the types of roles they are expected to play in the society as practitioners of the civil engineering profession and to develop some ideas of the legal and practical aspects of their profession.

Course Outcomes

At the end of the course students will be able to

CO1 - Identify what constitutes professional practice and the fundamental ethics governing the profession

CO2 - Compare the roles of various stakeholders in civil engineering projects

CO3 - Compare the different contracts and their management in civil engineering

CO4 - Recognize different dispute resolution mechanisms; laws governing engagement of labour and Intellectual Property Rights, Patents

CO5 - Interpret the role students are expected to play in the society as practitioners of the civil engineering profession

Proposed Syllabus :

Module I:(5 Hours)

Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in the website of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

Module II:(8 Hours)

Professional Practice – Respective roles of various stakeholders: Government (constituting regulatory bodies and standardization organizations, prescribing norms to ensure safety of the citizens); Standardization Bodies (ex. BIS, IRC)(formulating standards of practice); professional bodies (ex. Institution of Engineers(India), Indian Roads Congress, IIA/ COA, ECI, Local Bodies/ Planning Authorities) (certifying professionals and offering platforms for interaction); Clients/ owners (role governed by contracts); Developers (role governed by regulations such as RERA); Consultants (role governed by bodies such as CEAI); Contractors (role governed by contracts and regulatory Acts and Standards); Manufacturers/ Vendors/Service agencies (role governed by contracts and regulatory Acts and Standards)

Module III: (10 Hours)

General Principles of Contracts Management: Indian Contract Act, 1972 and amendments covering General principles of contracting; Contract Formation & Law; Privacy of contract; Various types of contract and their features; Valid & Voidable Contracts; Prime and sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders, Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions & Specifications; Critical /“ Red Flag” conditions; Contract award & Notice To Proceed; Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays, Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance; Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping, Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public - Private Partnerships; International Commercial Terms;

Module IV :(10 Hours)

Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system: Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996; UNCITRAL model law – Arbitration and expert determination; Extent of judicial intervention; International commercial arbitration; Arbitration agreements – essential and kinds, validity, reference and interim measures by court; Arbitration tribunal – appointment, challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and court assistance; Award including Form and content, Grounds for setting aside an award, Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and Geneva Convention Awards; Distinction between conciliation, negotiation, mediation and arbitration, confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; Lok Adalats

Module V: (4 Hours)

Engagement of Labour and Labour & other construction-related Laws: Role of Labour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

Module VI: (8 Hours)

Law relating to Intellectual property: Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relating to Patents

under Patents Act, 1970 including Concept and historical perspective of patents law in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H				H
Module II		H			H
Module III			H		
Module IV				H	H
Module V				H	H
Module VI				H	H

Text/Reference Books:

1. Premvir Kapoor, Professional Ethics and Human Values, Khanna Publishing House.
2. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
3. The National Building Code, BIS, 2017
4. RERA Act, 2017
5. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
6. Neelima Chandiramani (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai
7. Avtarsingh (2002), Law of Contract, Eastern Book Co.
8. Dutt (1994), Indian Contract Act, Eastern Law House
9. Anson W.R. (1979), Law of Contract, Oxford University Press
10. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
11. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.

12. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
13. Bare text (2005), Right to Information Act
14. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
15. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
16. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House
17. Vee, Charles & Skitmore, Martin (2003) Professional Ethics in the Construction Industry, Engineering Construction and Architectural management, Vol.10, Iss2,pp 117-127, MCB UP Ltd
18. American Society of Civil Engineers (2011) ASCE Code of Ethics – Principles Study and Application
19. Ethics in Engineering- M.W.Martin& R.Schinzinger, McGraw-Hill
20. Engineering Ethics, National Institute for Engineering Ethics, USA
21. www.ieindia.org
22. Engineering ethics: concepts and cases – C. E. Harris, M.S. Pritchard, M.J.Rabins
23. CONSTRUCTION CONTRACTS, <http://www.jnormanstark.com/contract.htm>
24. Internet and Business Handbook, Chap 4, CONTRACTSLAW, <http://www.laderapress.com/laderapress/contractslaw1.html>
25. Contract & Agreements <http://www.tco.ac.ir/law/English/agreements/General/Contract%20Law/C.htm>
26. Contracts, <http://206.127.69.152/jgretch/crj/211/ch7.ppt>
27. Business & Personal Law. Chapter 7. “ How Contracts Arise”, <http://yucaipahigh.com/schristensen/law-web/lawch7.ppt>
28. Types of Contracts, <http://cmsu2.cmsu.edu/public/classes/rahm/meiners.con.ppt>
29. TYPES OF CONTRACTSAND IMPORTANT PROVISIONS,
30. <http://www.worldbank.org/html/opr/consult/guidetxt/types.html>
31. Contract Types/Pricing Arrangements Guideline- 1.4.G (11/04/02), <http://www.sandia.gov/policy/14g>.

3. CVDP475T: Disaster Preparedness & Planning

B Tech CVE -VII

3 Credits - (L:T:P:3:0:0)

Objectives: *The objectives of the course are to understand basic concepts in Disaster Management , definitions and terminologies used in Disaster Management, types and Categories of Disasters, the Challenges posed by Disasters and the Impacts of Disasters Key Skills*

COURSE/LEARNING OUTCOMES

Upon successful completion of the course, the students will be able to:

- CO1:** Summarize the application of Disaster Concepts to Management (Understand)
- CO2:** Relate Development and Disasters. (Understand)
- CO3:** Make use of the understanding of different categories of Disasters (Apply)
- CO4:** Develop realization that they have responsibilities to society(Apply)

Module I: 2 Hours

Introduction - Concepts and definitions: disaster, hazard, vulnerability, risks- severity, frequency and details, capacity, impact, prevention, mitigation).

Module II: 8 Hours

Disasters - Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); man made disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

Module III: 8 Hours

Disaster Impacts - Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

Module IV: 10 Hours

Disaster Risk Reduction (DRR) - Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post- disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programs in India and the activities of National Disaster Management Authority.

Module V: 5 Hours

Disasters, Environment and Development - Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land- use changes, urbanization etc.), sustainable and environmentally friendly recovery; reconstruction and development methods.

Suggested Readings

1. <http://ndma.gov.in/> (Home page of National Disaster Management Authority)
2. <http://www.ndmindia.nic.in/> (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
6. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
7. Inter-Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	H	L	L	
Module II	M	H	L	
Module III		M	H	L
Module IV		L	M	H
Module V			H	

LABORATORY COURSES**CVGD100T:ENGINEERING GRAPHICS AND DESIGN/ ENGINEERING GRAPHICS & DESIGN LAB**

3 Credits-1L: 0 T: 4P

COURSE OBJECTIVES: *The objective of this course is to teach the basics of engineering drawing and drafting to students by free hand sketching as well as computer aided design.*

COURSE/LEARNING OUTCOMES

After completing the course students will be able to:

CO1: Learn to draw letters, scales and curves (Understanding)

CO2: Learn to draw projection of points, lines, scales and solids(Understanding)

CO3: Learn to draw isometric projection of solids(Applying)

CO4: Learn the functionalities and application of AutoCAD software(Understanding)

Syllabus**Module I: (10 hours)**

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain, Diagonal and Vernier Scales, Conic sections including the Rectangular Hyperbola (General method only), Cycloid, Epicycloid, Hypocycloid and Involute.

ModuleII:(15hours)

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes, Projections of Regular Solids: Solids inclined to both the Planes- Auxiliary Views, simple annotation, dimensioning and scale, Sections and Sectional Views

of Right Angular Solids: Prism, Cylinder, Pyramid, Cone – Auxiliary Views, development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone, sectional orthographic views of geometrical solids.

Module III: (5 hours)

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions, Isometric Views of lines, Planes, Simple and compound Solids, Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module IV: (15 hours)

Demonstrating knowledge of the theory of CAD software such as the Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids, set up of the drawing page and the printer, including scale settings, setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerance; Orthographic constraints, Snap to objects manually and automatically, producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles, Annotations, layering and other functions to create drawings, create, edit and use customized layers; changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

Suggested-Readings

1. N. D. Bhatt, V. M. Panchal, P. R. Ingle (2014), Engineering Drawing, Charotar Publishing House
2. M. B. Shah and B. C. Rana (2008), Engineering Drawing and Computer Graphics, Pearson-Education
3. B. Agrawal and C. M. Agrawal (2012), Engineering Graphics, TMH Publication
4. K. L. Narayana and P. Kanniah (2008), Text book on Engineering Drawing, SciTech-Publishers
5. Corresponding set of CAD Software Theory and User Manuals

Course Mapping

	CO I	CO II	CO III	CO IV
Module I	H			
Module II		H		
Module III			H	
Module IV				H

CVIT190P: Introduction to Construction Techniques & Material Testing Lab

1 Credit:0L:0T:2P

Objectives:

This course aims to introduce students to basic construction materials and standard material testing procedures. It familiarizes them with essential laboratory equipment, helps them perform key tests as per IS codes, and enables them to analyze results to assess material quality while developing good laboratory practices.

Course Outcomes (COs)

After successful completion of the laboratory course, students will be able to:

CO1: Identify, handle, and operate basic material testing equipment such as UTM, CTM, and Proctor apparatus used in construction materials testing. (Linked to Practicals: 1, 2, 3, 4, 7)

CO2: Conduct standard laboratory tests on cement, fine aggregates, coarse aggregates, bricks, water, and concrete and follow the relevant IS codes and procedures. (Practicals: 1, 3, 4, 5, 6, 7)

CO3: Analyze and interpret test results to determine material properties such as strength, consistency, fineness, workability, durability indicators, and compliance with engineering standards (Linked to Practicals: 1, 3, 4, 5, 6, 7)

CO4: Compare test outcomes with IS specifications to assess the suitability and quality of construction materials for civil engineering applications. (Linked to Practicals: 1, 3, 4, 5, 6, 7)

CO5: Document experimental procedures, record observations accurately, and prepare structured laboratory reports with conclusions based on test results. *(Linked to all practicals)*

List of Practical

Seive analysis of fine aggregate

Introduction to:

Universal Testing machine
 Compression testing machine
 Standard Proctor test
 3.Test on Cement
 Fineness
 Consistency
 Soundness
 Initial setting time and final setting time
 4.Tests on coarse Aggregate
 Impact test
 Crushing test
 Water absorption test
 Abrasion test
 5.Tests on Water
 pH Value
 Total Solids
 6.Tests on Bricks
 Water absorption
 Compressive Strength
 7.Tests on Concrete
 Workability of concrete
 Compressive Strength of concrete
 Split tensile strength of concrete

CO Mapping

	CO1	CO2	CO3	CO4	CO5
Expt 1	H	H	H	H	H
Expt 2	H			H	H
Expt 3	H	H	H	H	H
Expt 4	H	H	H	H	H
Expt 5		H	H	H	H
Expt 6		H	H	H	H
Expt 7	H	H	H	H	H

CVBP201P: Building Planning and Computer-aided Civil Engineering drawing-Lab

B.Tech-CVE 3

3 credits: (0L: 2T:2P)

Objectives:

The objectives of the course can be summarized in the following three points:

Equip students with the ability to apply the fundamental principles of building planning and design.

Enable students to proficiently use computer-aided design (CAD) tools to prepare detailed constructional plans, elevations, sections, and layout plans.

Teach students to plan and design essential building services, including water supply and drainage systems, solid waste collection and disposal, electrical services, fire protection systems, HVAC (heating, ventilation, and air conditioning), elevators, and building management systems.

Course outcomes:

After completion of course, students will be able to
 Implement principles of planning of buildings. (Applying)
 Design and draw various constructional drawing of the buildings. (Creating)
 Plan various building services. (Analysing)

Syllabus:**Planning of Building: -**

Preparation of constructional details and drawings-plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window. Planning of building such as:

Residential building - Load bearing structure, RCC framed structure. Building for Education – school, college. Library

Building for health - Dispensary, Hospital Industrial structure

Building for entertainment -Theatre, club house, sports club. Other structure-Office, Hostel, Guest house.

Essential Components of Infrastructure:

Building's Water Supply and Drainage & Solid Waste Collection and Disposal System; Electrical Services; Fire Protection System; Elevators; Heating Ventilation and Air Conditioning; Building Management System.

List of experiments/assignments:

Preparation of detailed constructional plan of a residential building.

Preparation of front elevation, detailed sectional view, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window.

Preparation of line plans of various public buildings like: Building for Education – School, College. Library

Building for health – Dispensary, Hospital Industrial structure; Building for entertainment- Theatre, Club House, Sports Club; Other Structure- Office, Hostel, Guest house etc.

Prepare layout for water supply and drainage for a residential building and for multistoried buildings.

Building's Solid Waste Collection and disposal system: Wet and dry solid waste segregation, Vermicomposting etc.

Fire Protection System: Design of emergency exits and emergency vehicle routes with fire protection symbols

Suggested Readings

M.G.Shah, Kale, Patki, Building Drawing with an Integrated Approach to Built Environment, Tata McGraw-Hill Education India, 5th edition, 2011, (ISBN: 9780071077873, 0071077871).

Building Services Environmental And Electro Mechanical Services, Second Revised, 2014, (ISBN: 9788175259805)

Scott Onstott, AutoCAD 2018 and AutoCAD LT 2018 Essentials, Wiley (2017), (ISBN: 9788126569298)

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3
Expt. 1	H		
Expt. 2		H	
Expt. 3		H	M
Expt. 4		M	H
Expt. 5			H
Expt. 6			H
Expt. 7			H

CVCE202P: CIVIL ENGINEERING MATERIALS AND CONCRETE TECHNOLOGY LAB**B.Tech-CVE 3****1 credits (0L:0T-2P)****Objective:**

The objective of this course is to familiarize the students with physical properties and mechanical behaviour of concrete and related construction materials.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

Distinguish the characteristics of fine aggregates and coarse aggregates for preparation of concrete mix. (Analysing)

Determine the important properties of cement and concrete in fresh and hardened state. (Analysing)

List of Experiments:

- To determine Fineness modulus of fine and coarse aggregate by sieve analysis.
- To determine bulk density of fine and coarse aggregates.
- To determine specific gravity and water absorption of fine and coarse aggregates.
- To determine bulking of sand.
- To determine fineness of cement by sieving.
- To determine soundness, standard consistency, initial and final Setting times of cement.
- To determine compressive strength of cement.
- To determine workability of concrete by slump cone test.
- To determine workability of concrete by compaction factor test.
- To determine workability of concrete by Vee Bee Test.
- To determine workability of concrete by Flow Table test
- To prepare concrete mix of a particular grade and determine compressive strength of concrete for 7 and 28 days.
- To demonstrate NDT equipment and related experiments.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2
Expt. 1	H	
Expt. 2	H	
Expt. 3	H	
Expt. 4	H	
Expt. 5	H	
Expt. 6	H	
Expt. 7		H
Expt. 8		H
Expt. 9		H
Expt. 10		H
Expt. 11		H
Expt. 12		H
Expt. 13		H

CVFM203P :FLUID MECHANICS LAB**(1 Credit)****Objectives**

To enrich the concept of fluid mechanics.

To demonstrate the classical experiments in fluid mechanics.

To demonstrate the applications of the basic fluid mechanics principles.

To provide a more intuitive and physical understanding of the fluid mechanics theory.

Course/ Learning Outcomes

At the end of this course students will be able to:

1. Explain the stability of floating bodies and calculate hydrostatic pressure on curved surfaces. (*understand, apply*)
2. Verify Bernoulli's theorem. (*evaluate*)
3. Determine the Coefficient of discharge for various flow meters and the impact of jet on vanes. (*evaluate*)
4. Visualize fluid flow and calculate Reynold's number. (*understand*)

List of Experiments

1. Hydrostatics Force on Flat Surfaces/Curved Surfaces.
2. Stability of Floating Body.
3. Verification of Bernoulli's Theorem.
4. Venturimeter.
5. Orifice meter.
6. Impacts of jets.
7. Reynold's experiment.

Mapping of COs to Syllabus

Course Out-comes	CO1	CO2	CO3	CO4
Expt. 1	H			
Expt. 2	H			
Expt. 3		H		
Expt. 4		L	H	
Expt. 5		L	H	
Expt. 6			H	
Expt. 7				H

CVTE227P: TRANSPORTATION ENGINEERING LAB

1 credit

COURSE/LEARNING OUTCOMES

After successfully studying this course, students will be able to:

CO1: Summarize engineering properties of aggregates. (Understanding)

CO2: Calculate the engineering properties of soil. (Applying)

CO3: Identify the grade & properties of bitumen. (Understanding)

List of Experiments

1. To determine the IMPACT VALUE of coarse aggregates by use of IMPACT MACHINE.
2. To determine the ABRASION VALUE of coarse aggregates by use of LOS ANGELES MACHINE.
3. To determine the Flakiness Index and Elongation Index of coarse aggregates.
4. To determine the MARSHALL STABILITY of Bitumen mix.
5. To determine the SOFTENING POINT of Bitumen.
6. To determine the DUCTILITY of Bitumen.
7. To determine the Specific Gravity of Bitumen.
8. To determine the Penetration of Bitumen.
9. To determine the CALIFORNIA BEARING RATIO of soil.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3
Expt. 1	H		
Expt. 2	H		
Expt. 3	H		
Expt. 4			H
Expt. 5			H
Expt. 6			H
Expt. 7		H	

CVSA228P :SURVEYING AND GEOMATICS LABORATORY**(1 credit – 15 hours) (0L:0T:2P)****OBJECTIVES:**

1. Acquire practical knowledge on handling survey instruments like Theodolite – to measure horizontal, vertical angles, calculation of area and elevation of ground surface.
2. Acquire adequate knowledge to carryout Triangulation, understand the importance of Triangulation and their applications in surveying
3. Tacheometry - to identify the elevation and horizontal distance between instrument and object
4. Acquire practical knowledge on handling survey instruments like Total station including general field marking for various engineering projects
5. At the end of the course the student will possess knowledge about Survey field techniques.

COURSE OUTCOMES:

At the end of the course student will be able to:

CO1: Develop proficiency in using various surveying instruments such as theodolites, total stations, GPS devices, and levels, and demonstrate the ability to set up, calibrate, and operate these instruments accurately. (Applying)

CO2: Apply proper techniques for measuring distances, angles, and elevations, conduct precise and accurate field measurements using traditional and modern surveying equipment. (creating)

CO3: Collect field data efficiently and effectively. Process and analyze survey data using relevant software and tools. Understand the principles of data accuracy, error reduction, and adjustment techniques. (creating)

CO4: Create detailed maps and plans from survey data.(creating)

LIST OF EXPERIMENTS:**Exp 1: Chain survey:**

1. Study of chains and its accessories, Aligning, Ranging, Chaining and Marking Perpendicular offset
2. Setting out works – Foundation marking using tapes single Room and Double Room

Exp 2: Traversing

1. Compass Traversing – Measuring Bearings & arriving included angles
2. Plane table Traversing

Exp 3: Levelling - study of levels and levelling staff

1. Fly levelling using Dumpy level & Tilting level
2. Check levelling

Exp 4: Theodolite - study of theodolite

1. Measurements of horizontal angles by reiteration and repetition and vertical angles

2. Determination of elevation of an object using single plane method when base is accessible/inaccessible
3. Determination of elevation of an object using double plane method

Exp 5: Tacheometry – tangential system – stadia system

1. Determination of Tacheometric Constants
2. Heights and distances by stadia Tacheometry
3. Heights and distances by Tangential Tacheometry

Exp 6: Total station

1. Study of Total Station, Measuring Horizontal and vertical angles
2. Traverse using Total station and Area of Traverse
3. Determination of distance and difference in elevation between two inaccessible points using Total station.

	CO1	CO2	CO3	CO4
Exp 1		H		H
Exp 2	H	H		L
Exp 3	H		H	
Exp 4		H	M	
Exp 5		H		
Exp 6	H			H

CVGE229P: Geotechnical Engineering Lab**(1 credit – 15 hours) (0L:0T:2P)****COURSE / LEARNING OUTCOMES**

At the end of the course student will be able to:

- CO 1.** Explain the purpose of each soil test and what it measures. (Understanding)
CO 2. Use laboratory equipment to measure soil properties. (Applying)
CO3. Interpret the results of soil tests to determine soil characteristics. (Analyzing)
CO4. Assess the reliability and accuracy of test results. (Evaluating)

List of Experiments

1. Field Density using Core Cutter method and Sand replacement method.
2. Natural moisture content using Oven Drying method.
3. Field identification of Fine-Grained soils.
4. Specific gravity of Soils.
5. Grain size distribution by Sieve Analysis and Hydrometer Analysis.
6. Consistency limits- Liquid limit, Plastic limit and Shrinkage limit.
7. Permeability test using Constant-head test method. and the Falling-head method.
8. Compaction test: Standard Proctor test and Modified Proctor test.
9. Relative density.
10. Consolidation Test.
11. Triaxial Test (UU).
12. Vane shear test.
13. Direct Shear Test.
14. Unconfined Compression Strength Test.

Mapping of COs to Syllabus

Course Out-comes	CO1	CO2	CO3	CO4
Expt. 1	H		H	M
Expt. 2	H		H	M
Expt. 3	H		H	M

Expt. 4	H		H	M
Expt. 5	H		H	M
Expt. 6	H	H	H	M
Expt. 7	H	H	H	M
Expt. 8	H	H	H	M
Expt. 9	H		H	M
Expt. 10	H	H	H	M
Expt. 11	H	H	H	M
Expt. 12	H	H	H	M
Expt. 13	H	H	H	M
Expt. 14	H	H	H	M

CVHE230P: HYDRAULIC ENGINEERING LAB**(1 Credit)****Objectives***To explore the fundamental principles of hydraulic engineering through experimentation.**To investigate engineering principles for pipe networks and open channel systems.**To expose the learners to the principles of hydraulics in flow measurements.***Course/ Learning Outcomes**

At the end of this course students will be able to:

CO1. Determine the head losses for flow through pipes. (*evaluate*)**CO2.** Identify laminar flow and turbulent flow. (*understand*)**CO3.** Calculate coefficient of discharge for notches. (*apply*)**CO4.** Investigate the energy losses associated with a classical hydraulic jump. (*analyze*)**List of Experiments**

1. Major Losses in pipe flow.
2. Minor Losses in pipe flow.
3. Laminar flow through pipes.
4. Turbulent flow through pipes.
5. Flow over weirs and notches.
6. Hydraulic jump

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4
Expt. 1	H	L		
Expt. 2	H	L		
Expt. 3		H		
Expt. 4		H		
Expt. 5			H	
Expt. 6				H

CVSM231P: SOLID MECHANICS & STRUCTURAL ANALYSIS LABORATORY**1 Credits: 0L:0T:2P****Course Outcomes:** Through this course, students should be able to**CO1:** Understand how to represent real structures by idealized structural systems and the deformations of structures under loading.**CO2:** Analyze various statically determinate structures including trusses, beams and frames.**CO3:** Apply various method to determine the deformations.

List of Practical's / Experiments

Clark -Maxwell Theorem: Deflection of a simply supported beam and verification of Clark- Maxwell's theorem.

Elastic property of beam: To verify the elastic property of deflected beam.

Bending moment and shear force: To verify the bending moment and shear force for the simply supported beam.

Moment area theorem: To verify the moment area theorem for a beam.

Behavior of columns: Study of behavior of columns and struts with different end conditions.

Experiment on Curved Beams: To find the deflection of curved beams.

Three hinge arch: To verify the horizontal thrust for three hinge arch.

Two-hinged arch: Experiment on two-hinged arch.

Portal frame: To verify the sway for portal frame.

Redundant frames: To verify Forces in members of Redundant frames.

Suspension Bridge: Demonstration of the characteristics of a simple suspension bridge and examination of the relationship between applied loads and the suspension cable tension.

Recommended Readings:

THEORY OF STRUCTURES by S. RAMAMRUTHAM R. NARAYAN, DHANPAT RAI PUBLICATIONS.
MECHANICS OF STRUCTURES VOL. I AND VOL .2 by DR. H. J. SHAH AND S. B. JUNNARKAR, CHOTAR PUBLISHING HOUSE PVT. LTD.
BASIC STRUCTURE ANALYSIS by C.S REDDY, MCGRAW HILL EDUCATION.

CO Mapping

	CO1	CO2	CO3
Expt 1	M		H
Expt 2	H		
Expt 3		H	
Expt 4			H
Expt 5		H	
Expt 6		H	
Expt 7			
Expt 8			
Expt 9		H	
Expt 10		H	
Expt 11			

CVSD347P: Structural Design –I Lab

B Tech CVE V

1 Credit

Course outcomes:

After Completion of the course , students will be able to ,

CO1:Analyse and design beam , column , slab, foundation, staircases and cantilever and counterfort retaining walls

CO2: Draw detailed structural drawings for slab , beam , column, foundations, staircases and cantilever and counterfort retaining walls .

List of Practicals

1. Design and drawing of singly reinforced, doubly reinforced rectangular and T-section simply supported and continuous beam.
2. Design and drawing of one way, two way simply supported and continuous slab system.
3. Design and drawing of Dog-legged and open wall type staircases.
4. Design and drawing of columns and foundation.
5. Design and drawing of Retaining wall. (Cantilever and counterfort)

CO Mapping

	CO1	CO2
Practical 1	H	H
Practical 2	H	H
Practical 3	H	H
Practical 4	H	H
Practical 5	H	H

CVVE348P : ENVIRONMENTAL ENGINEERING LAB

B Tech-CVE 5

1 Credit-(L-T-P:0-0-2)

COURSE/LEARNING OUTCOMES

After successfully studying this course, students will be able to:

CO1: Implement and demonstrate instructions regarding various parameters of water and sewage quality testing and air quality assessment.(Applying)

CO2: Demonstrate experimental procedures for water quality analysis (Applying)

CO3: Produce report on various parameters of water and sewage quality tests and air quality analysis.(Applying)

CO4: Present and justify results of water and sewage quality tests air quality monitoring.(Analysing)

List of Experiments

1. Physical Characterization of water: Turbidity, Electrical Conductivity, pH
2. Analysis of solids content of water: Dissolved, Settleable, suspended, total, volatile, inorganic etc.
3. Alkalinity and acidity, Hardness: total hardness, calcium and magnesium hardness
4. Analysis of ions: copper, chloride and sulfate
5. Optimum coagulant dose
6. Chemical Oxygen Demand (COD)
7. Dissolved Oxygen (D.O) and Biochemical Oxygen Demand (BOD)
8. Break point Chlorination
9. Bacteriological quality measurement: MPN,

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4
Expt. 1	H	L	H	M
Expt. 2	H	H	H	M
Expt. 3	H	H	H	M
Expt. 4	H	H	H	M
Expt. 5	H	H	H	M

Expt. 6	H	H	H	M
Expt. 7	H	H	H	M
Expt. 8	H	H	H	M
Expt. 9	H	H	H	M

CVSD359P: Structural Design II Lab**B Tech CVE -VI****1 Credit****Course Outcomes:**

After completion of the course , students will be able to ,

Identify and compute the design loads on various structural and steel systems

Apply principles relevant codal provisions for the analysis and design of various structural steel systems

Use commercial software for analysis and design of steel structures

Prepare detailed structural drawings for any given design.

List of Practicals :

Design and drawing of roof truss system

Design of column and column bases

Design of structural steel flooring system

Design of bolted and welded connections

Mapping of Course outcomes to practicals

	CO1	CO2	CO3	CO4
1	H	H	H	H
2	H	H	H	H
3	H	H	H	M
4	H	H	H	L

CVIA208T : Internship Activity (Department Specific)**B Tech CVE-III semester****1 Credit (L-T-P:0-0-2)****Objectives:**

The one-week Department-Specific Internship aims to provide students with focused, hands-on exposure to departmental facilities, laboratory techniques, software tools, and micro-projects relevant to civil engineering. It intends to bridge classroom learning with practical experience by engaging students in structured lab activities, demonstrations, field observations, and mini-assignments conducted within the department. The internship enhances students' understanding of engineering practices, develops basic technical and professional skills, and prepares them for advanced laboratory courses and external internships.

Course Outcomes (COs)

After completing the Department-Specific Internship, students will be able to:

CO1: Describe the purpose, functioning, and applications of various civil engineering laboratories, equipment, and software used in the department.

CO2: Demonstrate basic hands-on skills through supervised experiments, field tasks, or software-based activities.

CO3: Interpret observations, experimental results, or analytical outputs to connect departmental activities with fundamental civil engineering concepts.

CO4: Prepare a concise internship record documenting tasks performed, skills learned, and reflections on departmental practices.

CO5: Exhibit teamwork, discipline, professional conduct, and adherence to safety protocols during departmental activities.

CVIN392P: Internship (after IV Semester)

B Tech CVE-V

4 Credits (L-T P: 0-0-8)

Objectives:

After IV Semester – Civil Engineering Students are required to undergo a four week Summer Internship during the semester break after the fourth semester. This internship is a credited course and will be recorded in the fifth semester.

The Summer Internship provides civil engineering students with valuable exposure to professional engineering practice by enabling them to apply classroom theories and principles to real-world construction sites, consulting firms, government departments, material testing laboratories, infrastructure projects, and environmental/transportation/geotechnical organizations.

During the internship, students gain insight into how civil engineering projects are planned, designed, executed, and managed. They will observe and participate in activities such as surveying, site supervision, quantity estimation, testing of materials, quality control procedures, safety practices, documentation, and project monitoring.

The internship helps students to:

- Explore different career pathways in the civil engineering domain

- Develop industry-relevant technical and professional skills

- Understand practical challenges and site constraints

- Observe real-life application of engineering standards, codes, and practices

- Enhance interpersonal skills, teamwork, and workplace professionalism

This internship bridges academic learning with field experience and strengthens students' readiness for advanced courses and future employment opportunities.

Course Outcomes (COs)

After completion of the Summer Internship, students will be able to:

CO1: Describe the organizational structure, workflow, and functioning of civil engineering firms, construction sites, or government agencies.

CO2: Demonstrate understanding of field practices, materials, equipment, and quality control procedures used in civil engineering projects.

CO3: Apply basic civil engineering concepts to real-life situations observed during the internship, such as surveying, testing, construction methods, and documentation.

CO4: Prepare a structured internship report summarizing observations, tasks performed, learning outcomes, and best practices.

CO5: Exhibit professional behavior, teamwork, communication skills, and adherence to worksite safety norms.

CVSC361P: Survey Camp

B Tech CVE VI

1 Credit (L-T-P: 0-0-2)

Survey Camp Internship – Objectives

To provide hands-on exposure to modern and conventional surveying instruments and field data collection techniques.

To develop the ability to plan and execute surveying tasks such as traversing, leveling, contouring, topographic mapping, route surveying, and construction layout.

To enable students to collect, analyze, and interpret field data accurately for real-world civil engineering applications.

To strengthen teamwork, field management skills, and professional ethics required during onsite civil engineering activities.

To integrate classroom learning with practical field experience, enhancing confidence and preparedness for professional surveying practice.

Course Outcomes (COs)

Upon successful completion of the Survey Camp Internship, students will be able to:

CO1: Use conventional and modern surveying instruments (Total Station, Auto Level, GPS/GNSS, Digital Theodolite) for accurate field measurements.

CO2: Plan and execute field surveys such as levelling, traversing, contouring, topographic surveys, and route alignment surveys.

CO3: Process, analyze, adjust, and interpret the collected field data to prepare maps, profiles, and plans using manual methods and relevant software (e.g., CAD/GIS).

CO4: Apply survey results to real-world civil engineering scenarios such as site planning, design layout, and construction management.

CO5: Work effectively in teams, follow field safety protocols, and prepare professional field books, drawings, and technical reports.

CVIN473P: INDUSTRIAL TRAINING

B Tech CVE-VII

(6 credits) L-T-P :0-0-12

Objectives :

During the semester break at the end of the third year, the students are required to undergo an industrial training. The purpose of the industrial training is to expose students to real-life industry situations, so that they may be able to apply the engineering knowledge and skills that they have gained through classroom teaching and lab activities, in an on-the-job situation. After the period of training, students are required to present their experience in the form of reports and seminar presentations. Students will be evaluated on the seminar, viva-voce examination and written reports.

COURSE / LEARNING OUTCOMES:

On completion of the course the students will be able to:

CO1: Relate the lessons learned in a classroom into real world experience set in a professional practice-oriented environment.

CO2: Summarize the activities required for a complete project and develop professional skills such as team work, effective communication and social interaction.

CO3: Make use of the latest software to analyze problems related to Civil Engineering and adapt to software and equipment as per the industrial requirements.

CO4: Identify, formulate and model problems and find engineering solution based on a system.

CVMP474P: Minor Project –

(1 credit) (L-T-P: 0-0-2)

Course Description / Details

Objectives

The Minor Project aims to develop students' ability to apply theoretical knowledge to practical, real-world civil engineering problems. Students will work in small groups (maximum 5 members) to plan, execute, and document a technically sound project in any selected domain of Civil Engineering. The project encourages creative thinking, problem solving, analytical skills, and professional presentation abilities.

Students may choose any domain of Civil Engineering, including but not limited to:

Structural Engineering

Geotechnical Engineering

Transportation Engineering

Environmental Engineering

Water Resources Engineering

Construction Materials and Management

Surveying and GIS Applications

Sustainability and Green Technologies

Smart Materials / Smart Infrastructure

Waste Utilization in Construction

Automation, AI/ML applications in Civil Engineering

Project Guidelines

Project Selection & Proposal (Phase I):

Students must identify a relevant civil engineering problem, justify its importance, and prepare a project proposal including objectives, scope, methodology, and expected outcomes.

Planning & Initial Study:

Preparation of preliminary drawings, literature review, data collection plan, and methodology design (e.g., sampling plan, modelling approach, mix design, survey plan, software selection, experiment setup etc. based on project type).

Execution (Phase II):

Students will carry out detailed analysis, design, modelling, simulation, experiments, or field work depending on the project domain.

For structural/transportation/water analysis: analytical and/or software-based modelling.

For environmental/materials projects: laboratory studies, testing, and performance evaluation.

For geotechnical/survey/GIS projects: field data, mapping, modelling or testing.

Progress Seminars:

Two progress reviews will be conducted:

After completion of the planning and methodology stage

After completion of the analysis/experimental results stage

These will be evaluated by a panel of internal examiners.

Final Report & Viva Voce:

Students must submit a detailed technical report including background, methodology, results, discussion, and conclusions. A final presentation and viva voce will complete the evaluation.

Course Outcomes (COs)

At the end of the Minor Project, students will be able to:

CO1: Identify, formulate, and define a civil engineering problem in a chosen domain with clear objectives, scope, and relevance.

CO2: Develop and apply appropriate methodologies—including analytical, experimental, computational, or design-based techniques—to investigate the selected problem.

CO3: Analyze, interpret, and validate the results using scientific reasoning, engineering principles, and industry-standard tools/software.

CO4: Prepare a structured project report and effectively communicate technical findings through presentations, demonstrations, and viva voce.

CVPR486P:PROJECT(4 credits) (L-T-P: 0-0-8)

Objectives: Each student group consisting of not more than 5 members is expected to plan, analyze and design a multi storied building and verify the work with a design and analysis software package. Students will identify and plan a multi storied building, prepare the drawings and perform gravity analysis followed by seismic analysis.

There will be three progress seminars - after the planning after the gravity and seismic analysis, after designing and detailing which will be evaluated by a panel of internal examiners. This will be followed by verification

of the analysis and design using a software package. The project work will be concluded with quantity estimation and preparation of report. The internal assessment shall be evaluated by the DPEC and the external assessment shall be done by the external examiner(s) assisted by the DPEC and the supervisor. The modality and components of the internal assessment and their weightages shall be notified at the beginning of each semester.

COURSE/LEARNING OUTCOMES:

On completion of the course the students will be able to:

CO1: List different types of buildings and components, their analyses and design methods and demonstrate a sound technical knowledge on planning a civil Engineering project.

CO2: Identify the support conditions and types of members in a building frame.

CO3: Analyse the structural members to arrive at the design values.

CO4: Design the structural members of a project optimizing the cost and materials and Use design software for analyzing different types of structures.

CO5: Compile all the analysis results for the design of different members.

SERVICE LEARNING (2 credit)

Objective Service Learning is an experience-based approach to education. It is a course-based service experience that produces the best outcomes when meaningful service activities are related to the course material through reflection and critical inquiry. It deepens and enriches the theoretical and conceptual side of learning. Service-Learning combines – Academic Instruction, Meaningful Service and Critical and Reflective thinking.

Module I

Introduction to service learning-Its philosophy, historical background, purpose, value & theoretical framework; Locating Service Learning within the University context, Basic elements of service learning, Historical context of University Community Partnership; Understanding Community & Community Partnership; Ethical understanding of partnership; Understanding the agency of the Community – as co-educators; Community barriers; Understanding of society & social issues; Culture and Power Dynamics; Power & Privilege; social responsibility and engagement with the community.

Module II a.

Disaster management: Basic concepts and definition – hazard , disaster , impacts of disaster , types of hazards , types of disaster ; vulnerability , types of vulnerability , risk , capacity ;

b. Pre-disaster phase activities – awareness campaign in the community , prevention , mitigation measures; Preparedness, participatory learning action with the community , identifying community shelters , protecting livestock , making use of available resources within the community , mock drills, skill training , self-made life jackets , community stock of granary , survival kits , first- aid drill , identify early signs , identify critical facilities and their location like school , shelters , police etc .

c. During and post-disaster disaster activities - Early warning dissemination, response action , evacuation of temporary shelters , use of relief camps , arrangement of safe drinking water and sanitation , assist in rescue and relief efforts , carcass disposal , search , rescue , relief , recovery – safe reconstruction , rehabilitation , identifying safe routes .

d. Field work : Students are required to help the community in designing safe playgrounds , in training them with mock drills and in identifying similar relief and community shelter during and post disaster phase .

Module III

Syllabus for CVE (Field Work): Identification, use and application of different materials used for construction of concrete structures; preparation of concrete, Brick masonry procedure; Types of bond – English and Flemish; temporary structures like formwork, scaffolding, shuttering etc ; Ties , stirrups , reinforcements used in building construction; Casting of slabs , columns , beams ; Types and methods of curing .

Suggested Readings:

1. R. Subramanian , “ Disaster Management “ , Vikas Publishing house .
2. B.C. Punmia , “ Building Construction “ , Laxmi Publications .
3. M.S. Shetty , “ Concrete Technology Theory and Practice “ , S Chand Publishing .
4. R.K. Rajput , “ Engineering materials “ , S Chand & Company.
5. Varghese P.C , “Limit State Design of Reinforced Concrete” , Prentice Hall India Learning P

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
PROGRAMME: BACHELOR OF TECHNOLOGY (BTECH) - COMPUTER SCIENCE AND ENGINEERING

***COURSE STRUCTURE (NEP BATCH 2024)**

***"Undergraduate Degree Course Structure Based on AICTE Model Curriculum 2024 (Subject to Change)"**

SEMESTER I						
Type	Type of Course/Category	Course Code	Course Title	L-T-P	Credits	Page
Theory	BS/IC	PSPT111T	Physics for Technologists	3-1-0	4	1073
	BS/IC	MAMT113T	Mathematics I	3-1-0	4	1070
	HS/IC	EGTW107T	English for Technical Writing	2-0-0	2	
	ES/IC	CSPS100T	Programming for Problem Solving	3-0-0	3	1069
Lab	BS/IC	PSPT112L	Physics for Technologists Lab	0-0-2	1	1074
	ES/IC	CSPS101L	Programming for Problem Solving Lab	0-0-4	2	1070
	ES/IC	CVGD100T	Engineering Graphics and Design	1-0-4	3	
	HS/IC	EGOP108L	Oral Communication Practice Lab	0-0-2	1	
		MNDI101L	Design Thinking and Idea Lab	1-0-2	2	
	MC/IC	BTUH0001	Universal Human Values I: Student Induction Program (UHV I)	0-0-0	NC	
Total Credits					22	
SEMESTER II						
Theory	BS/IC	CHCY118T	Chemistry I	3-0-0	3	1076
	BS/IC	MAMT114T	Mathematics II	3-1-0	4	1072
	ES/IC	EEEL102T	Basic Electrical Engineering	3-1-0	4	
Lab	ES/IC	CHCY119L	Chemistry Lab	0-0-2	1	1075
	ES/IC	EEEL101L	Basic Electrical Engineering Lab	0-0-2	1	1075
	ES/IC	MNWM100L	Workshop/Manufacturing Practice	1-0-2	2	
	MC/IC	BTSY0003	Sports and Yoga or NSS/NCC	0-0-0	0	
	MC/IC	BTUH0002	Universal Human Values II : Understanding Harmony and Ethical Human Conduct	2-1-0	3	
Audit			Constitution of India	0-0-0	0	
			Internship for regular students/Intyernship for exit students			
Total Credits					18	
Skill based internship program for exit policy					6	
SEMESTER III						

Theory		ECEC0050	Analog Electronic Circuits	3-0-0	3	1080
		CSDA206T	Data structure and Algorithms	3-0-0	3	1081
		CSDE207T	Digital Electronics	3-0-0	3	1083
Lab		CSAC201P	Analog Electronic Circuits Lab	0-0-4	2	1081
		CSDA202P	Data structure and Algorithms Lab	0-0-4	2	1083
		CSDE203P	Digital Electronics Lab	0-0-4	2	1084
		CSIW204P	IT Workshop (Sci Lab/MATLAB)	1-0-4	3	1085
		CSMA208T	Mathematics-III (Probability and statistics)	2-0-0	2	
Audit			Wadhani Foundation Course on Entrepreneurship	0-0-0	NC	
			Internship Activity (Internship credit transfer from 2 nd semester for regular students)		1	
Total Credits					21	
Semester IV						
Theory		CSDM221T	Discrete Mathematics	3-1-0	4	1086
		CSCO222T	Computer Organization & Architecture	3-0-0	3	1087
		CSD&223T	Design & Analysis of Algorithms	3-0-0	3	1089
		CSAP224T	Advanced Programming	3-1-0	4	1091
Lab		CSCO225P	Computer Organization & Architecture Lab	0-0-4	2	1088
		CSD&226P	Design & Analysis of Algorithms Lab	0-0-4	2	1090
Theory		CSM1227T	Management 1 (Organizational Behaviour)	3-0-0	3	1126
		CSES228T	Environmental Sciences		0	1127
Audit		CSIK229T	Indian Knowledge System	2-0-0	2	
		CSIF230T	Internship for regular students/ internship for exit students			
Total Credit					23	
Skill based internship program for exit policy					6	
Semester V						
Theory		CSS&331T	Signals & Systems	3-0-0	3	
		CSIT332T	Introduction to Database Systems	3-0-0	3	1092
		CSML333T	Machine Learning	3-1-0	4	1094
		CSOS334T	Operating Systems	3-0-0	3	1096

Lab		CSIT335P	Introduction to Database Systems Lab	0-0-4	2	1093
		CSOS336P	Operating Systems Lab	0-0-4	2	1098
		CSHI337T	Humanities / Economics for Engineers	3-0-0	3	
			Essence of Indian Knowledge Tradition		0	
		CSIC339T	Internship Credit from 4 th semester for regular students		2	
Total Credit					22	
Semester VI						
Theory		CSCN340T	Computer Networks	3-0-0	3	1099
		CSIC341T	Introductory Cyber Security	3-0-0	3	1103
		CSEL342T	Elective-I	3-0-0	3	
		CSEL343T	Elective-II	3-0-0	3	
		CSTO344T	Theory of Computation	3-1-0	4	1105
Lab		CSCN345P	Computer Networks Lab	0-0-4	2	1101
		CSIC346O	Introductory Cyber Security Lab	0-0-4	2	1104
		CSPR347P	Project-1	0-0-6	3	
		CSIF348T	Internship for regular students			
Total Credit					23	
Skill based internship program for exit policy					6	
Semester VII						
Theory		CSCD449T	Compiler Design	3-0-0	3	1106
		CSEL450T	Elective-III	3-0-0	3	
		CSOE451T	Open Elective-I	3-0-0	3	
Lab		CSCD452P	Compiler Design Lab	0-0-4	2	1108
		CSBI453T	Biology	3-0-0	3	1109
Audit		CSWF454T	Wadhani Foundation Course on Employability	0-0-0	0	
		CSPR455P	Project-II	0-0-12	6	1118
		CSIC456T	Internship Credit transfer from 6 th semester for regular students		2	
Total Credit					22	
Semester VIII						
Theory			Elective-IV	3-0-0	3	
			Open Elective-II	3-0-0	3	
			Open Elective-III	3-0-0	3	
		CSPR460P	Project-III	0-0-12	6	
Total Credit					15	

Total Credit	166	

Students will have to complete following two courses in between First semester to Fourth semester
 Constitution of India through Moodle platform
 One NPTEL course in SWAYAM platform

CSPS0079: PROGRAMMING FOR PROBLEM SOLVING

(3 credits-45 Hours)

Course Objectives

Course Outcomes

Define and describe various terms and concepts of C programming language (Remembering)

Compare and interpret information based on their understanding of the concepts of C language syntax, data types, control statements, functions, pointers, arrays, structures, files, graphics and hardware programming using C. (Understanding)

Solve problems using standard algorithms and translate pseudo-codes into C programs and implement them. (Applying)

Analyze their skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. (Analyze)

Combine the various concepts and ideas learnt in C to plan, propose and develop a product. (Creating)

Evaluate various algorithms used for searching, sorting etc., in terms of correctness and computation cost. (Evaluate)

Module I (8 Hours)

Introduction to Programming, Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.), and Idea of Algorithm: steps to solve logical and numerical problems. Types of Algorithm: Sequentially executed, Conditional Based, repetitive structure, Representation of Algorithm: Flowchart/Pseudo code with examples, from algorithms to programs; source code, variables (with data types) variables and memory, locations, Syntax and Logical Errors in compilation, object and executable code.

Module II (12 Hours)

Operators, precedence of operators, Arithmetic expressions, Conditional Branching and Loops, Writing and evaluation of conditionals and consequent branching, Iteration and loops.

Module III (5 Hours)

Arrays, Arrays (1-D, 2-D), Character arrays and Strings

Module IV (5 Hours)

Basic Algorithm Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Module V (8 Hours)

Functions (including built in libraries), Parameter passing in functions, call by value, passing arrays to functions: idea of call by reference, Recursion.

Module VI (7 Hours)

Structures, Defining structures and Array of Structures, Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation), File handling.

Suggested Readings

Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M				
CO2			H			H
CO3	H	H				
CO4	L				H	H
CO5				H		
CO6	L			H		

CSPL6069: PROGRAMMING FOR PROBLEM SOLVING LAB

(2 credits)

Course Outcomes

Relate the programming logic (Remembering)

Illustrate the theoretical concepts learnt in C programming language. (Understanding)

Apply existing algorithms in writing programs using C language and also do graphics programming. (Applying)

Analyze their skills for choosing the right data structure, functions, data types and develop logic to write programs in C. (Analyzing)

Evaluate the sorting and searching algorithms through implementation in terms of correctness and computation cost. (Evaluating)

Combine the various concepts and ideas learnt in C to plan, propose and develop a product. (Creating)

Mapping of COs to Syllabus

Course Outcomes	M1	M2	M3	M4	M5	M6
CO1	H				L	
CO2	H	H				
CO3				H	M	
CO4	L				H	H
CO5	M	L		H		
CO6			H		H	M

MATHEMATICS- I

(3 credits-45 Hours)

Course Objectives: The goal of this course is to achieve conceptual understanding and to retain the best traditions of traditional calculus. The syllabus is designed to provide the basic tools of calculus mainly for the purpose of modelling the engineering problems mathematically and obtaining solutions. This is a foundation course which mainly deals with topics such as single variable and multivariable calculus and plays an important role in the understanding of science, engineering, economics and computer science, among other disciplines.

Course Contents**Module 1: Single-variable Calculus (Differentiation): (10 hours)**

Rolle's Theorem, Mean value theorems and applications; Extreme values of functions; Linear approximation; Indeterminate forms and L'Hospital's rule. Curvature, evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Sequences and series: (10 hours)

Limits of sequence of numbers, Calculation of limits, Infinite series; Tests for convergence; Power series, Taylor and Maclaurin series; Taylor theorem, convergence of Taylor series, error estimates.

Module 3: Multivariable Calculus (Differentiation): (10 hours)

Limit, continuity and partial derivatives, directional derivatives, gradient, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 4: Multivariable Calculus (Integration): (10 hours)

Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Gradient, curl and divergence, Theorems of Green, Gauss and Stokes.

TEXTBOOKS/REFERENCES:

1. AICTE's Prescribed Textbook: Mathematics-I (Calculus & Linear Algebra), Reena Garg, Khanna Book Publishing Co., 2023.
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
4. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
5. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
6. AICTE Model Curriculum for UG Degree Course in Civil Engineering
7. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
8. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
9. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
10. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Note: The modules have been prepared keeping the following from the Textbooks/References in mind:

- (1) Module 1: The relevant sections from Chapters 2, 6 and 11 of [3].
- (2) Module 2: Sections 3.1, 3.2, 3.3, 3.7 & 6.6 of [1].
- (3) Module 3: Sections 8.1-8.6, 8.8-8.10 of [1].
- (4) Module 4: Sections 12.1-12.5, 12.7-12.9 of [1].
- (5) Module 5: Sections 13.1 – 13.7, 14.1 – 14.8 of [1].

Alternative NPTEL/SWAYAM Course:

S. No	NPTEL COURSE NAME	INSTRUCTOR	HOST INSTITUTE
1	Engineering Mathematics - I	PROF. JITENDRA KUMAR	IIT Kharagpur

COURSE OUTCOMES

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate differentiation and integration. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well toward tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

At the end of this course students will be able to:

- CO 1: To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions. (Applying)
- CO 2: The fallouts of Mean value theorems that is fundamental to application of analysis to Engineering problems. (Analysis)
- CO 3: Find the concepts of convergence of sequence and series for real numbers. (Remembering)

CO 4: Classify various functions of several variables that are essential in most branches of engineering. (Understanding)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M		H	M
CO 2	H	M		
CO 3	L	H		
CO 4			H	H

EEBE0038: BASIC ELECTRICAL ENGINEERING

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objectives:

- To understand and Analyse basic electric and magnetic circuits.
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations.

Course Outcomes

- Define basic terminologies related to electrical circuits and machines. (Remembering)
- Explain the working principle, construction, applications of dc machines and ac machines. (Understanding)
- Explain basics of converters, domestic wiring and Electrical Installations. (Understanding)
- Implement network theorems to simplify and solve a complex circuit. (Applying)
- Interrogate basic DC as well as AC circuits. (Analyzing)

Module I (18 lectures)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module II (16 lectures)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, R-L, R-C, R-L-C combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module III (14 lectures)

DC Machines: Principle of operation of generators and motors, construction of DC machine, EMF and Torque Equations, Classification and applications of DC machines. Transformer: Construction and principle of operation of a single-phase transformer, EMF equation, introduction of auto-transformer. Induction Motor: Classification and applications, Construction and principle of operation of single phase and three-phase induction motor

Module IV (6 lectures)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module V (6 lectures)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Readings

- J.B. Gupta, "Basic Electrical Engineering", S.K Kataria and Sons.
- P.V. Prasad, S. Sivanagaraju, K.R. Varmah, Chikku Abraham, "Basic Electrical Engineering,

Cengage Learning India.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H		M		M
CO 2		H	H		
CO 3				H	H
CO 4	H				
CO 5	M			M	

PSPT0038: PHYSICS FOR TECHNOLOGISTS
(4 Credits – 60 Hours) (L-T-P: 3-1-0)

Course Objective: To enhance the fundamental knowledge in Physics and its applications pertinent to diverse areas of Engineering and Technology

COURSE OUTCOMES

At the end of this course students will be able to:

- CO1: Comprehend the principles of wave optics. (Understanding)
 CO2: Explain the electromagnetic theory and electromagnetic waves. (Remembering)
 CO3: Interpret the concepts and principles in quantum mechanics. (Understanding)
 CO4: Analyse the physics of semiconductors and their applications. (Analysing)

Module I: Wave Optics (18Hours)

a) Interference and diffraction: Huygen's principle, superposition of two waves, coherent sources, Young's double slit experiment, intensity distribution; Newton's rings and applications. Fresnel and Fraunhofer diffraction, Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, Harmonic oscillator; Damped harmonic motion – over-damped, critically damped and under-damped oscillators

b) Photonics: spontaneous and stimulated emission, fundamentals of laser action, ruby Laser, He-Ne laser, applications of lasers. Elements of fibre optics, types of optical fibres, numerical aperture. Principles of holography.

Module II: Electromagnetic Theory (14Hours)

a) Electromagnetism: basic idea of divergence and stokes theorems, Gauss's law and its applications, electrostatic potential, Poisson's and Laplace's equation, work and energy, dielectric polarization bound charges, electric displacement (D); magnetic induction (B), magnetic intensity (H), Biot-Savart's Law, Ampere's circuital law; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; Faraday's law of electromagnetic induction, displacement current, Maxwell's equations in differential and integral forms.

b) Electromagnetic waves: Electromagnetic energy densities, Electromagnetic wave equations for E and B, transverse nature and speed of electromagnetic waves.

Module III: Quantum Physics and Applications (14 Hours)

a) Quantum physics: historical overview; particle aspect of radiation – blackbody radiation, photoelectric effect, Compton scattering; wave aspect of particles – de Broglie's hypothesis, matter waves; Heisenberg's uncertainty principle; transition from deterministic to probabilistic states of a system – wave functions, probability density, superposition principle; observables and operators, expectation values. Schrodinger wave equation.

b) Application of quantum mechanics: solutions of one-dimensional problem, infinite deep potential well – energy eigenvalues, eigenfunctions, potential barrier – tunneling.

Module IV: Semiconductor Physics (14Hours)

a) Free electron theory, density of states and energy band diagrams, Kronig-Penny model (to introduce origin of band gap), energy bands in solids, E-k diagram, direct and indirect bandgaps, types of electronic materials: metals, semiconductors, and insulators, density of states, occupation probability, Fermi level, effective mass, phonons.

b) Intrinsic and extrinsic semiconductors, dependence of Fermi level on carrier- concentration and temperature (equilibrium carrier statistics), carrier generation and recombination, carrier transport: diffusion and drift, p-n junction, Special purpose diodes: metal- semiconductor junction, Zener Diode, LED, Photovoltaic Effect, Solar cell

Suggested Readings

Physics for Engineers and Technologists, S. Dey, Eastern Book House.

Applied Physics for Engineers –Neeraj Mehta (PHI Learning Pvt. Limited)

A text Book of Engineering Physics –Dr. M.N. Avadhanulu and Dr.P.G.Kshirsagar (S. Chand and Company Pvt. Limited).

Optics, A. Ghatak, Tata Mcgraw Hill.

Introduction to Electrodynamics, D. J. Griffiths, Pearson, Prentice Hall.

Concepts of Modern Physics, A. Beiser, McGraw Hill.

Quantum Mechanics, L. I. Schiff, McGraw Hills.

Quantum Mechanics, E. Merzbacher, Wiley.

Quantum Mechanics, G. Aruldas, PHI learning.

Classical Mechanics, H. Goldstein, Addison-Wesley.

Semiconductor Optoelectronics: Physics and Technology, J. Singh, McGraw Hill.

Semiconductor Devices: Physics and Technology, S. M. Sze, Wiley.

Semiconductor Optoelectronic Devices, P. Bhattacharya, Prentice Hall of India.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2		H		
CO 3		L	H	
CO 4			L	H

PSTC6016: PHYSICS LAB FOR TECHNOLOGISTS

(1 credits) (L-T-P:0-0-2)

At the end of this course students will be able to:

CO1: explain the usage of mechanical and optical systems for various measurements (Understanding)

CO2: apply the analytical techniques and graphical analysis to the experimental data (Applying)

CO3: evaluate vernier calipers, various rulers, meters, scales and other measuring devices to acquire measurements within the stated precision (Evaluating)

At least 10 experiments should be performed from the following

1. To determine the frequency of an Electrical maintained tuning fork by Melde's experiments
2. Determination of surface tension by capillary rise method.
3. Determination of wavelength of light by Newton's ring method.
4. Determination of grating element of a diffraction grating.
5. Determination of wavelength of laser source by diffraction grating method.
6. Study of photoemission.
7. Determination of Rigidity modulus by static method.

8. Determination of acceleration due to gravity by Bar pendulum.
9. Determination of thermal conductivity by Lee's method
10. Plotting of characteristic curve of a PN junction diode.

EEBL6027: BASIC ELECTRICAL ENGINEERING LABORATORY

(1 Credit- 30 hours) (L-T-P: 0-0-2)

Course Outcomes

Find different parameters related to basic electrical circuits. (Remembering)

Explain the procedure for performing experiments related to DC and AC circuits. (Understanding)

Identify various rotating AC and DC machines. (Applying)

Compare the theoretical prediction with experimental results. (Analyzing)

Check errors and correction of meters by calibration (Evaluating)

Construct a circuit to perform a particular experiment. (Creating)

List of experiments:

Calibration of a Voltmeter.

Calibration of an Ammeter.

Calibration of milliammeter as a voltmeter.

Calibration of a millivoltmeter as an ammeter.

Verification of Thevenin's theorem.

Resonance in series RLC circuit

Reversal of direction of rotation of 3-phase induction motor by changing phase sequence.

Different types of Connections of the transformer.

Demonstration of DC and AC machines.

Demonstration of LT switchgear.

Mapping of COs to Syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	M	M	M	M	M
CO 3				L		L	L	L	L	L
CO 4	M	M	M	M	H	H	H	H	H	H
CO 5	H	H	H	H	L	L	L	L	L	L
CO 6	H	H	H	H	H	H	H	H	H	H

MNWM6023: WORKSHOP/MANUFACTURING PRACTICES

(3 Credits) (L-T-P: 1-0-2)

Objective

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

Course/Learning Outcomes

At the end of the experiments students will be able to

Recognize different fabrication techniques. (Remembering)

Identify the tools and machinery involved in the various experiments related to material processing. (Understanding)

Demonstrate some of the advanced and latest manufacturing techniques being employed in the industry. (Applying)

Recognize the different manufacturing processes which are commonly employed in the industry. (Understanding)

Fabricate simple components using different materials and fabrication techniques. (Applying)

Manufacturing Practice

Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 hours)

CNC machining, Additive manufacturing (1 hour)

Fitting operations and power tools (1 hour)

Electrical and Electronics (1 hour)

Carpentry (1 hour)

Plastic moulding, glass cutting (1 hour)

Metal casting (1 hour)

Welding (arc welding and gas welding), brazing (1 hour)

Workshop Practice

Machine shop (10 hours)

Fitting shop (8 hours)

Carpentry (6 hours)

Electrical and Electronics (8 hours)

Welding shop (8 hours) (Arc welding 4 hrs + gas welding 4 hrs)

Casting (8 hours)

Smithy (6 hours)

Plastic moulding and Glass Cutting (6 hours)

Suggested Readings

Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol I and VolII, Media promoters and publishers private limited, Mumbai, 2010.

Kalpakjian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I", Pearson Education, 2008.

Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

MATHEMATICS- II

(4 Credits – 60 Hours)

Course Objective:

Mathematics fundamental necessary to formulate, solve and analyze engineering problems.

Course Content:

Module 1: Matrices (12 hours)

Determinant, Inverse of a matrix, Linear Systems of Equations; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Rank of a Matrix; Echelon form, Normal form, Gauss-Jordan method, Gauss elimination method, Linear Dependence and Independence; Eigenvalues and eigenvectors; Orthogonal transformation; Diagonalization of matrices; Cayley-Hamilton Theorem, rank-nullity theorem.

Module 2: First and higher order ordinary differential equations: (12 hours)

Exact, linear and Bernoulli's equations. Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Second order linear differential equations with variable coefficients: Euler-Cauchy equations, solution by variation of parameters; Power series solutions: Legendre's equations and Legendre polynomials, Bessel's equation and Bessel's functions of the first kind and their properties.

Module 3: Complex Variable – Differentiation: (8 hours):

Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

Module 4: Complex Variable – Integration: (8 hours):

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof),

TEXTBOOKS/REFERENCES:

1. AICTE's Prescribed Textbook: Mathematics-II (Calculus, Ordinary Differential Equations and Complex Variable), Reena Garg, Khanna Book Publishing Co, 2023.
2. Reena Garg, Engineering Mathematics, Khanna Book Publishing Company, 2022.
3. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2021.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley & Sons, 2006.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
7. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
8. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
9. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
10. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
11. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
12. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
13. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Note: The modules have been prepared keeping the following from the Textbooks/References in mind:

- (1) Module 1: Sections 7.3-7.5, 7.7, 7.8, 8.1-8.4 of [1].
- (2) Module 2: Sections 1.4, 1.5 of [1]; Section 5.1 of [2].
- (3) Module 3: Sections 2.5, 2.6, 2.10, 5.1, 5.3, 5.4, 5.5 of [1].
- (4) Module 4: Sections 13.3 – 13.7, 17.1 – 17.3 of [1].
- (5) Module 5: Sections 14.1 – 14.4, 15.2 – 15.4, 16.1 – 16.4 of [1].

Alternative NPTEL/SWAYAM Course:

S. No	NPTEL COURSE NAME	INSTRUCTOR	HOST INSTITUTE
1	Engineering Mathematics - II	PROF. JITENDRA KUMAR	IIT Kharagpur

COURSE OUTCOMES

The objective of this course is to familiarize the prospective engineers with techniques in matrices, ordinary differential equations and complex variables. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

At the end of this course students will be able to:

CO 1: Determine the essential tool of matrices and linear algebra in a comprehensive manner. (Understanding)

CO 2: Recall the effective mathematical tools for the solutions of differential equations that model physical processes. (Remembering)

CO 3: Use the tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems. (Applying)

CO 4: Analysis complex techniques applied to diverse problem-solving situations in engineering and other mathematical contexts. (Analysing)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	M	M
CO 3			H	H
CO 4			H	H

CHCE0027: Engineering Chemistry Theory

Credit: 4 (L: 3, T: 1, P: 0)

Course Objective: The course of Engineering Chemistry enables the students to gain knowledge on atomic and molecular structures, basics of thermodynamics, periodic properties of elements, application of some important spectroscopic techniques and structure of organic molecules as well as some important organic reactions used in the synthesis of organic compounds used for medicinal purposes.

Course Outcomes:

CO1: Recall fundamental concepts of 10+2 level of physical, organic and inorganic chemistry. (*Remembering*).

CO2: Ability to gain knowledge on molecular structure and spectroscopy, intermolecular forces and periodic properties (*Understanding*).

CO3: Analyze the structures of atoms and molecules using spectroscopic techniques. (*Analysis*)

CO4: Apply the knowledge of spectroscopy for determining molecular geometries, interpret the thermodynamics of system and structure of organic compounds and their reaction paths/mechanism. (*Applying*)

CO5: Assess the knowledge of atomic and molecular structure to evaluate the energy level diagram in the atomic and molecular level (*Evaluating*)

Course Contents:

Module 1: Atomic and Molecular Structure (10 lectures)

Schrodinger's Equation, Particle in a box solutions, Forms of Hydrogen atom wave functions and the plots of these functions to explore their spatial variations, equations for atomic and molecular orbitals, energy level diagrams of diatomic, π molecular orbitals of butadiene and benzene and aromaticity, Crystal Field Theory and the energy level diagrams for transition metal ions and their magnetic properties, structure of solids, band theory of solids and their role of doping on band structures.

Module 2: Spectroscopic Techniques and applications (12 lectures)

Principles of spectroscopy and selection rules, Electronic Spectroscopy, Fluorescence and its applications in medicine, Vibrational and Rotational spectroscopy of diatomic molecules, nuclear magnetic resonance and magnetic resonance imaging, surface characterization techniques, diffraction and scattering.

Module 3: Use of free energy in chemical equilibria (10 lectures)

Thermodynamic functions: energy, entropy and free energy, free energy and emf, cell potentials, the Nernst equation and applications, Acid base, oxidation reduction and solubility equilibria, Corrosion, Use of free energy considerations in metallurgy through Ellingham diagrams.

Module 4: Intermolecular forces and periodic properties (10 lectures)

Ionic, di-polar and van der Waal's interactions.

Effective nuclear charge, penetration of orbitals, variations of s, p, d orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases.

Module 5: Stereochemistry (12 lectures)

Representation of three dimensional structures, structural isomers and stereoisomers, configurations and symmetry and Chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis, isomerism in transition metal compounds.

Module 6: Organic Reactions and Synthesis of Drug molecule (6 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation and reduction, synthesis of a commonly used drug molecule – Aspirin and Paracetamol.

Suggested Readings:

Engineering Chemistry (NPTEL Web Book) by B. L. Tembe, Kamaluddin and M. S. Krishnan

a) <https://nptel.ac.in/courses/122/101/122101001/>

b) <https://nptel.ac.in/courses/122/106/122106029/>

c) <https://youtu.be/UNWOGM5R6as>

Engineering Chemistry, Shashi Chawla, Dhanpat Rai and Co, Education and technical publishers

Fundamentals of Molecular Spectroscopy, C.N. Banwell

Physical Chemistry, P.W. Atkins

Organic Chemistry, Clayden

Physical Chemistry, Puri, Sharma and Pathania

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	L		H	H		
CO 2	H	H		H	H	H
CO 3			M	L	H	
CO 4	M	H	M			H
CO 5	M	H			M	M

CHCE6006: ENGINEERING CHEMISTRY LAB

Credit: 2 (P-2)

Objective: This course consists of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

Course Outcomes:

CO1: Explain the principles of the experiments learned about in class, illustrating the principles of chemistry relevant to the study of science and engineering (*Understanding*)

CO3: Estimate molecular/system properties such as surface tension, viscosity, conductance of solution, water hardness, etc. (*Applying*)

CO4: Assess the limitations and advantages of the procedures they use in the laboratory for the various estimations and analysis. (*Evaluating*)

List of experiments:

Standardization of given HCl with standard sodium carbonate solution.

Determination of water hardness with EDTA.

Estimation of Calcium in Limestone.

Determination of dissolved oxygen in water sample by Winkler's method.

Determination of surface tension of a given liquid by stalagmometer.

To determine the coefficient of viscosity of a given liquid or solution with the help of Ostwald's Viscometer.

To measure the Adsorption of acetic acid by charcoal.

Determination of chloride content of water.

To determine the strength of magnesium ions in magnesium sulphate solution by complexometric method.

Determination of partition coefficient of a substance between two immiscible liquids.

Determination of free carbon dioxide in given water sample.

To determine the alkalinity of given water sample.
Determination of Ferrous Ions in Mohr's salt by KMnO_4
To determine the acidity of a given water sample.
Determine the cell constant and conductance of solution.
Determination of sodium hydroxide and sodium carbonate in a mixture.
Determination of the composition of the given mixture by viscosity method.

Suggested Readings:

Engineering Chemistry, Shashi Chawla, Dhanpat Rai and Co, Education and technical publishers.
Vogel's Practical Chemistry.

ECEC0050: ANALOG ELECTRONIC CIRCUITS (L-T-P: 3-0-0)

(3 Credit-45 hours)

Objective:

The course provides basic analog electronic circuit design techniques and analytical skills using diodes, op-amps, FETs and BJTs. The student will develop the ability to apply basic engineering sciences to the design, analysis and operation of electronics devices and circuits and problem solving skills of electronic circuits.

Course Outcomes

Define various terminologies related to different analog electronic devices and circuits. (Remembering)
Illustrate the basic working principle and operation of various electronic components and circuits. (Understanding)

Solve problems related to the modeling and design of various analog circuits. (Applying)

Analyse the characteristics/working principle/operation of various analog circuits. (Analysing)

Design and develop different analog electronic circuits. (Creating)

Module I (7 hours)

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, LED, photodiode, clamping and clipping circuits

Module II (10 Hours)

PNP and NPN transistors, Structure and I-V characteristics of a BJT, BJT as a switch, BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers, phototransistor, Small signal equivalent circuits (h-parameter model) and analysis CE configuration.

Module III (10 Hours)

JFET and MOSFET structure and I-V characteristics, JFET and MOSFET as a switch, as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, transconductance, CMOS inverter

Module IV (4 Hours)

Internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product, output voltage swing)

Module V (7 Hours)

Op-amp as Inverting and non-inverting amplifier. Op-Amp applications in constant gain multiplier, Voltage summing, Integrator, Differentiator and controlled sources. Differential amplifier, instrumentation amplifier, active filters, voltage regulator, Zero Crossing Detector, Square-wave and triangular-wave generators

Module VI (7 Hours)

555 Timer: Block diagram, Monostable operation, Astable operation Regulated Power Supply: Voltage feedback regulation, Current limiting characteristics, Power supply characteristics, Current boosters, Switching regulators

Suggested Readings

A. S. Sedra and K. C. Smith, Microelectronic Circuits, Oxford University Press, New York

J. Millman and A. Grabel, "Microelectronics", McGraw Hill Education

S Salivahanan, N Suresh Kumar and A Vallavaraj, Electronic Devices and Circuits, Tata McGraw-Hill

Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, Pearson Education, New Delhi

David A. Bell, Electronic Devices and Circuits, 4th Edition, Prentice Hall of India, New Delhi

Ramakant A Gayakwad Op-Amps and Linear Integrated Circuits, 4th Edition, PHI Learning Publishers

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H	M	H		
CO 2	H	H	H		H	H
CO 3	L	H	M		M	L
CO 4		L	L		H	M
CO 5	H	H	M		M	L

ECEEC6039: ANALOG ELECTRONIC CIRCUITS LAB

(L-T-P: 0-0-2) (1 credit)

Course Outcomes

Define PN junction diode and their properties and uses. (Remembering)

Explain the working of basic electronic circuits such as transistors, diodes and amplifiers. (Understanding)

Build different circuits using diodes, transistors and OPAMPs. (Applying)

Analyse various amplifier and filter circuits. (Analysing)

Evaluate the performance of the 555 timer as a monostable and astable vibrator. (Evaluating)

Design amplifiers, integrators, oscillators and filter circuits using OPAMPs. (Creating)

List of Experiments:

To Study the Characteristics of Zener Diodes.

Study of the Half-wave and Full-wave rectifier circuits with and without capacitor filter

To Study the characteristics of a Bipolar Junction Transistor (CE Mode)

To design of CE amplifier and analyse the frequency response of the amplifier

To Study the Characteristics of JFET

Inverting and non-inverting op-amp amplifiers

Op-amp linear applications: adders, sub-tractors

Op-amp based active filters: Low Pass and High Pass

Instrumentation Amplifier

555 timer applications: Monostable and Astable

CSXXXXXXX: DATA STRUCTURES AND ALGORITHMS

(3 credits – 45 hours)

COURSE/LEARNING OUTCOMES

Understanding abstract specification of data-structures and their implementation. (Understanding)

Ability to use suitable data-structures in different programs and applications. (Applying)

Ability to analyse different algorithms and the trade-offs involved in terms of time and space complexity. (Analysing)

Choose and implement efficient data structures and apply them to solve problems. (Evaluating)

Module 1 (5 hours)

Basics of data structures and algorithms. Understanding the growth rates of functions such as logarithmic and polynomial. Analysis of algorithms in terms of space and time, worst-case, average-case and best-case complexity analysis. Asymptotic Notation: Ω and Θ .

Module II (8 hours)

Abstract data-type (ADTs): arrays and linked list ADTs. Stacks, Queues: ADTs and implementations using arrays, linked lists. Doubly linked lists: ADT and implementation. Dictionary ADT: implementation using array, linked lists. Binary search and linear search and their advantages/disadvantages and their complexity analysis. Binary tree: concept, traversal (inorder, preorder and post-order), implementation using array and linked list.

Module III (5 hours)

Priority Queue ADT, Definition of heap. Implementation of Priority Queues using heap and running time analysis. Implementation of heap using arrays. Heap-sort and its analysis.

Module IV (8 hours)

Binary Search Trees: definition and some basic algorithms. Implementation of Dictionary ADTs using Binary Search trees and running time analysis. AVL trees: height balance condition, rotations, and implementation of dictionary ADT. 2-4 Trees: Multi-way search trees, implementation of dictionary ADT, B-trees: characteristics, insertion, and deletion.

Module V (7 hours)

Map ADT, Hash Tables and implementation of Map using Hash Tables. Design of hash functions, Collision resolution schemes: chaining, open addressing schemes like linear probing, quadratic probing, double hashing. Applications of Hashing: finding duplicates, set intersection, etc. Tries: implementation of Map ADT using tries. Compressed tries and suffix tries.

Module VI (6 hours)

Bubble sort, insertion sort, selection sort. Merge sort and divide and conquer paradigm, Quick sort: average and worst-case analysis, randomized quicksort (intuitive explanation). Selection based on partitioning ideas used in Quick Sort.

Module VII (6 hours)

Graph ADTs and applications, Adjacency list and adjacency matrix representations and relative merits. Basic graph definitions: paths, cycles, trees, spanning trees, connected components, Euler's formula. Depth First Search Traversal algorithm for directed graphs: classification of edges into forward, back, and cross edges. Applications to cycle finding, topological sort in directed acyclic graphs, finding connected components. Running-time analysis. Breadth first search algorithm: implementation using queues, shortest path tree property. Running time analysis.

Suggested Readings

Lipschutz, S., Data structures, Indian Adapted Ed, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006

Gilberg, Richard F. Forouzan, and Behrouz A., Data Structures, 2nd Ed, Course Technology, Cengage Learning, New Delhi, 2005.

Pai, GA, Data Structures and Algorithms, 1st Ed, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Langsam, Augenstein, and Tanenbaum, Data Structures Using C and C++, 2nd Ed, Phi Publication, New Delhi, 2007.

Krishnamoorthy R., Kumaravel, and G. Indirani, Data Structures Using C, 1st Ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.

Horowitz, Sahni, Susan Freed, Fundamentals of Data Structures in C, 2nd Edition, University press, 1997.

Mapping of COs to syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO 1	H	H	H	H			H
CO 2	L	H	H	H	H		H
CO 3		L	L	M	H	H	

CO 4		H	H	H	L	H	H

CSDS6072: DATA STRUCTURE AND ALGORITHM LAB

(2 credits)

Course Outcomes

Explain the concept of different data types, primitive, derived and their representation and application through coding. (Understanding)

Apply the concept of ADT and linear and nonlinear data types and their representation. (Applying)

Apply these data types in various applications like arithmetic expression evaluation and conversion. (Applying)

Explain the concept of Graphs and Trees and their real time application. (Understanding)

Develop various searching and sorting techniques. (Creating)

Choose and implement efficient data structures and apply them to solve problems. (Evaluating)

Solution of problems on

dynamic memory allocation

structures and pointers to structures

Arrays

Stacks and Stack application, Queues

Linked Lists, Circular and Doubly Linked Lists.

Binary Trees

Searching and data modification: Linear Search, Binary Search, Hashing.

Sorting Techniques: Selection, Insertion, Bubble, Merge, Heap, Quick, Radix, and Merge-Sort.

Mapping of COs to syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8
CO1	H	M	M					
CO2	H	H	H					
CO3			M	H	M			
CO4				H	H	M		
CO5				L	M	H		
CO6							H	H

CSDC0081: DIGITAL ELECTRONICS

(3 credits – 45 hours)

Course Outcomes

Explain number systems, coding methods, Boolean algebra, logic circuits, logic families, and memory types. (Understanding)

Convert numbers between different number and coding systems and perform the basic arithmetic operations (addition, subtraction, division, and multiplication). (Applying)

Minimize Boolean functions using postulates and theorems of Boolean algebra, Karnaugh maps and Quine McCluskey method. (Applying)

Analyze combinational and sequential logic circuits to obtain Boolean expressions, state tables and state diagrams implemented by the circuits. (Analysing)

Design combinational and sequential logic circuits for given problem statements. (Creating)

Build logic gates using TTL, ECL and CMOS technologies. (Creating)

Module I: Data representation and arithmetic operations (5 Hours)

Introduction, numbering systems, decimal to binary conversion, binary coded decimal numbers, hamming code for error, correction, alphanumeric codes, Boolean Algebra.

Module II: Algebra for Digital systems (8 Hours)

Binary addition, binary subtraction, complement representation of numbers, addition/ subtraction of numbers in 1's complement Notation, addition/subtraction of numbers in 2's complement Notation, binary multiplication, multiplication of signed numbers, binary division, arithmetic with binary coded decimal numbers, representation of integers, Floating point representation of numbers, Floating point arithmetic.

Module III: Logic gates and Boolean Algebra (7 Hours)

Introduction to Basic logic gates (AND, OR, NOT, NOR, NAND), Truth tables, simplification of truth tables, the K-map method, SOP and POS simplifications, Quine-McCluskey tabulation method.

Module IV: Combinational logic and Sequential logic (15 Hours)

Combinational logic: Introduction, Combinational circuits, Analysis procedure, design procedure Binary Adder-Subtractor, Decimal adder, binary multiplier, Magnitude comparator, decoders, encoders, multiplexers, HDL models and Combinational Circuits

Sequential logic: Introduction, Sequential circuits, Storage elements: Latches, Storage elements: Flip-flops, Analysis of clocked sequential circuits, State reduction and Assignment, Design procedure.

Module V: Digital integrated circuits (10 Hours)

Introduction, Special characteristics, Bipolar-Transistor characteristics, RTL and DTL circuits, Transistor-Transistor Logic, Emitter-Coupled Logic, Metal-oxide semiconductor, complementary MOS, CMOS transmission gate circuits, Switch-level Modeling with HDL

Module VI: Memories (5 Hours)

Memory types and terminology, read only memory, Semiconductor RAMs, Non-volatile RAMs, Sequential memories, Programmable logic Devices, Magnetic memories, Optical disk memory, Charge coupled devices.

Suggested Readings

M. Morris Mano, Digital Logic and Computer Design, Pearson Education, 2009

V. Rajaraman, An Introduction to Digital Computer Design, 5th ed., PHI

R. P. Jain, Modern Digital Electronics, 4th ed., TMH

William Stallings, Computer Organization, PHI

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H	M	L	L	M	H
CO2	H	H				
CO3			H			
CO4			M	H		
CO5			M	H		
CO6					H	

CSDC6071: DIGITAL ELECTRONICS LAB

(2 credits)

Course Outcomes

Recall the truth table of all logic gates. (Remembering)

Explain the working of combinational and sequential logic circuits. (Understanding)

Model the structure and behavior of digital logic circuits using hardware description language. (Applying)

Illustrate the truth table and timing diagram for combinational and sequential logic circuits. (Analysis)

Design combinational and sequential logic circuits for given problem statements. (Creating)

List of Experiments and tool**Experiments**

To study the Truth tables of logic gates

To realize half/full adder and half/full adder subtractor

Simulation with VHDL/VERILOG

Adders
Subtractors
Logic gates
MUX and DEMUX
Encoder and Decoder and
Sequential logic Circuit

Mapping of Cos to syllabus

Course Outcomes	Experiment 1	Experiment 2	Experiment 3
CO 1	H		
CO 2	H	M	
CO 3	H	M	
CO 4		H	L
CO 5			H

CSXXXXX: IT WORKSHOP**(3 credits – 45 hours)****COURSE/LEARNING OUTCOMES**

To make the students aware about the Scilab software environment.

To make the students able to implement the basics of Scilab programming

To make the students able to apply the knowledge of Scilab programming for different engineering applications

To enable the students to learn and apply Scilab Simulink for simulation, analysis and design of the system

Module I (2 hours)

Introduction to Scilab and its benefits. Installing Scilab. Introduction to Toolboxes.

Module II (10 Hours)

Basic functions. Vector Operations, length of a vector, mathematical operations on Vectors such as addition, subtraction and multiplication. Matrix Operations, access the elements of Matrix, determine the determinant, inverse and eigen values of a matrix, special matrices, elementary row operation, Conditional Branching- if, then, else, elseif keyword, for statement, Scripts and Functions, introduction to the file formats in Scilab. script files, sce and. sci, inline functions, Plotting 2D graphs. File Handling- Scilab. User Defined Input and Output in Scilab Input Function

Module III (10 Hours)

Develop Scilab code for different Composite Numerical Integration algorithms. Apply the algorithm to each interval. Numerical methods- Solving Non-linear Equations Solve nonlinear equations using numerical methods, Bisection method, Secant method. Gauss Elimination method algorithm, Gauss Jordan method algorithm, linear equations using iterative methods, Jacobi and Gauss Seidel iterative methods. Develop Scilab code for different Numerical Interpolation algorithms, ODEs using Euler Methods, ODEs using Euler and Modified Euler methods, Xcos, Palette.

Module IV (10 Hours)

Use of Scilab function Karmarkar in Optimization, Plotting continuous and discrete sine waves. Plotting step function. Plotting ramp function, continuous time system: second and higher order, Response plot for step input, sine input and bode plot, discrete time system variable z, first order discrete time system, flts, dscr, ss2tf functions, Use of scifunc block in XCOS, Use of MUX block, Simulating a PID controller using Xcos, Scilab Toolbox for calling external C libraries, Scilab Toolbox for calling Python and its functions.

Suggested Readings

Introduction to Scilab: For Engineers and Scientists, Author: by [Sandeep Nagar](#), APRESS
<http://www.aagasc.edu.in/Scilab-Book-Akhilesh.pdf>

Mapping of COs to syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	L	H	H	
CO 3		M	M	
CO 4		M	H	H

CSDM221T: DISCRETE MATHEMATICS

(4 credits – 60 hours)

Course Outcomes

Interpret a given logic sentence in terms of predicates, quantifiers, and logical connectives.

(Understanding)

Solve a given problem using deductive logic and prove the solution based on logical inference.

(Applying)

Classify the algebraic structure for a given a mathematical problem. (Analysing)

Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

(Evaluating)

Develop the given problem as graph networks and solve with techniques of graph theory. (Creating)

Module I: Sets, Relation and Function (14 lectures)

Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module II: Introduction to Counting (8 lectures)

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

Module III: Propositional Logic: (12 lectures)

Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.

Module IV: Algebraic Structures and Morphism (14 lectures)

Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form

Module V: Graphs and Trees (12 lectures)

Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Suggested Readings

Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill

Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.

C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and Its Application to Computer Science”, TMG Edition, Tata Mcgraw - Hill
 Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press.
 Discrete Mathematics, Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson, Tata McGraw – Hill

Mapping of COs to syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		H			
CO 3			H		
CO 4			M	H	
CO 5					H

CSCO222T: COMPUTER ORGANIZATION & ARCHITECTURE

(3 credits – 45 hours)

Course Outcomes

The key components of a CPU and how the instructions are executed. (Understanding)

The need for memory hierarchy and efficiency achieved due to the use of cache. Execution and time taken by instructions in a pipelined processor. (Understanding)

Compare and Analyse different styles, strategies and formats adopted for designing the instruction set, register set, memory organization and I/O transfer. (Analysing)

Construct and organize a new architecture by considering various design issues to make it more efficient with less overhead. (Creating)

Module 1 (6 hours)

Role of abstraction, basic functional units of a computer, Von-Neumann model of computation, A note on Moore's law, Notion of IPC, and performance. Data representation and basic operations.

Module 2 (12 hours)

CPU registers, instruction format and encoding, addressing modes, instruction set, instruction types, instruction decoding and execution, basic instruction cycle, Reduced Instruction Set Computer (RISC), Complex Instruction Set Computer (CISC), RISC-V instructions; X86 Instruction set. Control Unit: Hardwired and Microprogrammed. Micro-operations, execution of a complete instruction. Horizontal and Vertical Microprogramming.

Module 3 (6 hours)

Revisiting clocking methodology, Amdahl's law, Building a data path and control, single cycle processor, multi-cycle processor, instruction pipelining, Notion of ILP, data and control hazards and their mitigations.

Module 4 (9 hours)

SRAM/DRAM, locality of reference, Caching: different indexing mechanisms, Trade-offs related to block size, associativity, and cache size, Processor-cache interactions for a read/write request, basic optimizations like write-through/write-back caches, Average memory access time, Cache replacement policies (LRU), Memory interleaving.

Module 5 (6 hours)

Introduction to magnetic disks (notion of tracks, sectors), flash memory. I/O mapped, and memory mapped I/O. I/O data transfer techniques: programmed I/O, Interrupt-driven I/O, and DMA.

Module 6 (6 hours)

Limits of ILP, SMT processors, Introduction to multicore systems and cache coherence issues.

Suggested Readings

William Stallings, Computer Organization, PHI

Vrnesic, Hamacher and Zaky, Computer Organization, TMH

M. Morris Mano, Computer System Architecture, PHI

Patterson, Computer Organisation and Design, Elsevier Pub. 2009

John P Hayes, Computer Organization, McGraw Hill
 K.K Tripathi, Rajesh K. Gangawar, Microprocessor and its Applications, Acme Learning, New Delhi, 2010
 Brey, Barry B, INTEL Microprocessors, PHI

Alternative NPTEL/SWAYAM Course

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H	H	H	H	H
CO 3		H	L	L	H	
CO 4		H	L	L	L	

CSCO225P: COMPUTER ORGANISATION AND ARCHITECTURE LAB

(2 credits)

Course Outcomes

At the end of the Lab experiments students will be able to:

Recall different OPcodes used in 8086 (Remembering).

Recall the syntax of 8086 assembly language (Remembering).

Illustrate the syntax of 8086 assembly language (Understanding).

Categorize different types of OPcodes (Analysing).

Choose the appropriate method to write an 8086 assembly program (Evaluating).

Module1:

Dismantling and assembling a PC along with study of connections, ports, chipsets, SMPS etc.

Module2:

Assembly language programming using IA32(gcc) I. Introduction gcc assembly programming II. Verification of Instruction Set. III.Arithmetic operations

Module3:

Addition, Subtraction, Multiplication and Division of two 8-bit numbers.

Multi byte Addition and Subtraction, Multiplication and Division – Signed and unsigned Arithmetic operation, ASCII – arithmeticoperation.

Module4:

Logic operations – Shift and rotate – Converting packed BCD to unpacked BCD, BCD to ASCII conversion.

By using string operation and Instruction prefix: Move Block, Reverse string, Sorting, Inserting, Deleting, Length of the string, String comparison.

DOS/BIOS programming: Reading keyboard (Buffered with and without echo) – Display characters, Strings.

Alternative NPTEL/SWAYAM Course

Mapping of COs with Syllabus:

Course Outcomes	Module1	Module2	Module3	Module4
CO1	H	H		
CO2	H	M		L
CO3	M	H	L	
CO4	L	L	H	
CO5		L	M	H

CSD&223T: DESIGN & ANALYSIS OF ALGORITHMS

(3 credits – 45 hours)

Course Outcome

Know the importance of analysis of an algorithm and the basic concepts of time and space complexity analysis of algorithms. (Remembering)

Understand standard computational problems, their best solutions and correctness, the main algorithm designing techniques and recognize similar problems. (Understanding)

Apply mathematical foundations and algorithmic principles to algorithm design in a way that demonstrates comprehension of the trade-offs involved in design choices. (Applying)

Analyze asymptotic runtime complexity of algorithms including formulating and solving recurrence relations. (Analyzing)

Assess various algorithms in terms of correctness, computation cost and memory space used. (Evaluating)

Build algorithmic algorithms (in a programming language) for given problems by using the most appropriate algorithmic strategy considering the domain. (Creating)

Module I (9 hours)

Basic Concepts of Algorithms: Introduction, Notion of Algorithm, Fundamentals of Algorithmic Solving, Important Problem types, Fundamentals of the Analysis Framework – Asymptotic Notations and Basic Efficiency Classes.

Mathematical Aspects and Analysis of Algorithms: Mathematical Analysis of Non-recursive Algorithm, Mathematical Analysis of Recursive Algorithm – Example: Fibonacci Numbers, Empirical Analysis of Algorithms, Algorithm Visualization. (12 hours)

Module II (9 hours)

Analysis of Sorting and Searching Algorithms: Brute Force – Selection Sort and Bubble Sort – Sequential Search and Brute-force string matching – Divide and conquer – Merge Sort – Quick Sort. Randomized divide and conquer algorithms: randomized quicksort and selection.

Binary Search – Binary tree – Traversal and Related Properties – Decrease and Conquer – Insertion Sort – Depth first Search and Breadth First Search.

Module III (10 hours)

Algorithmic Techniques: Transform and conquer – Presorting – Balanced Search trees – AVL Trees – Heap and Heapsort – Dynamic Programming – Warshall's and Floyd's Algorithm – Optimal Binary Search trees – Greedy Techniques – Prim's Algorithm – Kruskal's Algorithm – Dijkstra's Algorithm. Ford Fulkerson algorithm or maximum flow. Max-flow min cut theorem.

Huffman trees. Branch and Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving.

Module IV (9 hours)

Tractable and Intractable Problems: Models of computation, Turing machines, RAM model. Computability of Algorithms, Decision vs optimization, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

Module V (8 hours)

Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE

Suggested Readings

Introduction to Algorithms, 4th Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.

Fundamentals of Algorithms – E. Horowitz et al.

Algorithm Design, 1st Edition, Jon Kleinberg and Éva Tardos, Pearson.

Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T. Goodrich and Roberto Tamassia, Wiley.

Algorithms – A Creative Approach, 3RD Edition, Udi Manber, Addison-Wesley, Reading, MA.

Mapping of COs to Syllabus

	Mod- ule1	Mod- ule2	Mod- ule3	Mod- ule4	Mod- ule5
CO1	H	M	M	L	L
CO2	H	H	L	L	L
CO3	M	M	H	H	L
CO4	M	M	H	L	M
CO5	L	M	M	H	M
CO6	M	M	M	H	M

CSD&226P: DESIGN & ANALYSIS OF ALGORITHMS LAB

(2 credits)

COURSE / LEARNING OUTCOMES

On successful completion of the course the students will be able to:

Examine running time and analyze the performance of algorithms. (Remembering)

Learn standard algorithms for fundamental problems. (Understanding)

Apply knowledge of computing and mathematics to algorithm design. (Applying)

Analyze a problem and identify the computing requirements appropriate for its solution. (Analyzing)

Design, implement, and evaluate an algorithm to meet desired needs. (Evaluating)

Create efficient applications by using right algorithm depending on domain. (Creating)

Detailed Syllabus

Implementation and analysis of Sorting algorithms–Bubble, Selection, Insertion, Merge, and Quick Sort.

Implementation and analysis of Linear and Binary Search algorithm (Divide and Conquer).

Implementation and analysis of Quick Sort, Merge Sort, and Heap Sort algorithms

(Divide and Conquer, Recursion).

Implementation and analysis of Factorial and Fibonacci sequence using iteration and recursion

(Recursion).

Implementation and analysis of 0-1 and Fractional Knapsack problem using i) Greedy Method and ii)

Dynamic Programming.

Implementation of Chain matrix multiplication using Dynamic Programming.

Implementation of making a change problem (Coin-change) using Greedy method and Dynamic Programming.

Implementation of Graph Searching (DFS, BFS), MST problem (Prim's algorithm, Kruskal's algorithm),

Shortest path (Dijkstra's algorithm) using Greedy method and Dynamic Programming.

Implementation of Longest Common Subsequence problem using Dynamic Programming.

Implement N Queen's problem using Back Tracking.

Mapping of Cos to Syllabus

	Experiments									
	1	2	3	4	5	6	7	8	9	10
CO1	H	M	H	H	M	M	M	M	M	M
CO2	M	H	H	M	M	M	M	H	M	M
CO3	M	M	M	M	M	M	M	M	M	M
CO4	M	H	H	M	M	H	M	M	H	M
CO5	M	M	M	M	M	H	H	M	M	H
CO6	M	M	M	M	M	M	M	M	M	M

XXXXXXX: ADAVANCED PROGRAMMING

(4 credits-60 Hours)

Course Outcomes

Understanding the build system: IDE, tools for testing, debugging, profiling, and source code management.

Students are able to demonstrate proficiency in object-oriented programming.

Identify and abstract the programming task involved for a given programming problem.

Learning and using language libraries for building large programs.

Ability to apply defensive programming techniques (e.g., assertions, exceptions).

Desirable/Advanced:

Ability to implement basic event-driven programming.

Understanding of the fundamentals of parallel programming.

Understanding of the basics of cloud computing

Module I: Familiarity with the programming environment (4 hours)

Understanding the build system, , IDE, debugging, profiling , (Eclipse TPTP / gprof / VTune etc.), and source code , management

Module II: Basic principles of the object-oriented development process (6 Hours)

Introduction to Object-Oriented , Paradigm: Data encapsulation, ,modularity, code reuse, identifying classes, attributes, , methods and objects, class , relationships

Module III: Advanced features of OOP (12 Hours)

Interfaces, inheritance, polymorphism, abstract classes, immutability, copying and cloning objects

Module IV : Unit testing (2 Hours)

Unit testing, developing test suite

Module V: Using language APIs (6 Hours)

Language supported libraries for handling advanced data structures

Module VI : Defensive programming (6 Hours)

Exception handling, assertions

Module VII : Modeling and Design patterns (12 Hours)

Basic modeling techniques – e.g. Class diagram, sequence diagram, use case diagrams, etc. Introduction to design patterns: iterator, singleton, flyweight, adapter, strategy, template, prototype, factory, façade, decorator, composite, proxy, chain of responsibility, observer, state)

Suggested text books:

Taming Python by Programming, Jeeva Jose, Khanna Book Publishing Company, New Delhi.

Grady Booch, Robert A. Maksimchuk, Michael W. Engle, Bobbi J. Young, Jim Conallen, Kelli A. Houston. Object-Oriented Analysis and Design with Applications.

M. Scott. Programming Language Pragmatics. 4th edition.

Suggested reference books / Online resources:

- R1. Jeeva Jose, Introduction to Computing and Problem Solving with Python, Khanna Book Publishing Company, New Delhi.
- R2 R. Sebesta. Concepts of Programming Languages. 10th edition
- R3. J. Rumbaugh et al. The Unified Modeling Language Reference Manual.
- R4. Erich Gamma, Richard Helm, Ralph Johnson, John Vlissides, and Grady Booch. Design Patterns: Elements of Reusable Object-Oriented Software.
- R5. P. Van Roy and S. Haridi. Concepts, Techniques, and Models of Computer Programming.
- R6. <https://missing.csail.mit.edu/>
- R7. <https://www.baeldung.com/junit>
- R8. <https://www.tutorialspoint.com/junit/index.htm>
- R9. For UML tools, open source tools may be used (e.g. www.starUML.io, argouml.tigris.org/)

Alternative NPTEL/SWAYAM Course

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H						
CO2	M	H	H		L		
CO3			H	M			
CO4					H		
CO5			M			H	
CO6							M

CSIT332T: INTRODUCTION TO DATABASE SYSTEMS

(3credits-45Hours)

Course Objectives

Course Outcomes

Define the fundamental concepts necessary for designing, using and implementing database systems and applications. (Remembering)

Understanding of internal working of a DBMS including data storage, indexing, query processing, transaction processing, concurrency control and recovery mechanisms. (Understanding)

Ability to design and implement database schema for an application using RDBMS concepts. (Creating)

Ability to write SQL queries for tasks of various complexities. (Applying)

Ability to write an application program that uses a database system as the backend. (Applying)

Module I (3Hours)

Database System Architecture - Data Abstraction, Data Independence, Data Definitions and Data Manipulation Languages. Introduction to Data Models (Relational, Semi structured, ER)

Module II (5Hours)

Relational Data Model, Relational Algebra, Relational Calculus or Connection to First Order Logic (Optional)

Module III (9Hours)

DDL, Insert/Delete/Update, Simple Queries (select/project/join/ aggregate queries), Complex queries

(With Clause, Nested Subqueries, Views), Programming in a standard language and interfacing with a DB backend

Module IV (3Hours)

Key-value Stores and Semi- structured Data, using JSON and MongoDB, or other combinations

ModuleV(6Hours)

Introduction to ER model, Mapping from ER to relational model, Functional Dependencies, Normalization (BCNF, Optionally 3NF)

Module VI (6Hours)

Overview of Physical Storage (Hard Disks, Flash/SSD/RAM), sequential vs random I/O, Reliability via RAID, Storage Organization (Records, Pages and Files), Database Buffers, Database Metadata, Indexing, B+-Trees

ModuleVII (6Hours)

Query Processing: External sort, Joins using nested loops, indexed nested loops, Overview of Query Optimization: equivalent expressions, and concept of cost- based optimization.

ModuleVIII (6Hours)

Concept of transactions and schedules, ACID properties, Conflict-serializability, Concurrency control: locks, 2PL, Strict 2PL, optional: isolation levels, Recovery using undo and redo logs

SuggestedReadings

Database System Concepts, 7th Edition, Silberschatz, Korth and Sudarshan, McGraw-Hill. Indian Edition released 2021

Fundamentals of Database Systems, 7th Edition, Elmasri and Navathe, Pearson Pubs, 2017

Principles of Database Management, Lemahieu, Broucke and Baesens, Cambridge University Press, 2018

Database Management Systems, RP Mahapatra, Khanna Publishing House, 2020.

Database Management Systems, Krishnan, McGraw Hill.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	H	H			H			
CO2		H				H	H	H
CO3		H	H		H			
CO4			H	M				
CO5			H	H				

CSIT335P: INTRODUCTION TO DATABASE SYSTEMS LAB

(2credits-30Hours)

Module I (2Hours)

Simple pen + paper, and using Relax Relational Algebra calculator in browser

Module II(6Hours)

Laboratory exercises where students write SQL queries for various tasks.

Platform can be PostgreSQL preferably, or MySQL. W3Schools/SQLite in web browser can also be used but beware of non-standard SQL features.

Practice interfacing with a database from a program using connectors like JDBC/ODBC

Module III(4Hours)

Small exercises on MongoDB

Module IV(6Hours)

Exercise in ER design for an application starting with natural language description

Convert ER design to tables

Pen-and-paper exercises with FDs and normalization

Module V (4Hours)

Use a B+-tree visualization system to understand how B+- trees work

Module VI (4Hours)

Examine query plans for sample queries by using the Explain feature of database systems.

Small exercises to show benefit of indices.

Module VII(4Hours)

Pen-and-paper exercises on conflicts, cycles, conflict serializability, recoverability, etc.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H			H			
CO2	H				H	H	H
CO3	H	H		H			
CO4		H	M				
CO5		H	H				

**CSML333T: MACHINE LEARNING
(3credits-45Hours)****Course Objectives****Course Outcomes**

Understanding popular ML algorithms with their associated mathematical foundations. (Understanding)

Capability to implement basic algorithms using basic (python) libraries. Have hands-on experience in applying ML to problems encountered in various domains. Have exposure to high level ML libraries or frameworks such as TF, pytorch. (Applying)

Make aware of the role of data in the future of computing and solving real-world problems. (Analyzing)

Helping them connect/map real-world problems to the appropriate ML algorithm(s) to solve them. (Applying)

Appreciate the mathematical background behind the popular ML algorithms. (Evaluating)

Module I (6Hours)

Motivation and role of machine learning in computer science and problem- solving, Representation (features), linear transformations, Appreciate linear transformations and matrix vector operations in the context of data and representation. Problem formulations (classification and regression). Appreciate the probability distributions in the context of data, Prior probabilities and Bayes Rule. Introduce paradigms of Learning (primarily supervised and unsupervised. Also a brief overview of others)

Module II (12Hours)

PCA and Dimensionality Reduction, Nearest Neighbours and KNN, Linear Regression, Decision Tree Classifiers, Notion of Generalization and concern of Overfitting, Notion of Training, Validation and Testing; Connect to generalisation and overfitting.

Module III (13Hours)

Ensembling and RF, Linear SVM, K Means, Logistic Regression, Naive Bayes

Module IV (14Hours)

Role of Loss Functions and Optimization, Gradient Descent and Perceptron/Delta Learning, MLP, Back-propagation, MLP for Classification and Regression, Regularisation, Early Stopping, Introduction to Deep Learning, CNNs.

Suggested Readings

Ian Goodfellow, Yoshua Bengio, and Aaron Courville Deep Learning MIT Press Ltd, Illustrated edition

Christopher M. Bishop Pattern Recognition and Machine Learning - Springer, 2nd edition

Trevor Hastie, Robert Tibshirani, and Jerome Friedman - The Elements of Statistical Learning: Data Mining, Inference, and Prediction - Springer, 2nd edition

Rajiv Chopra, Machine Learning, Khanna Book Publishing Company, New Delhi

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2	L	H	H	M
CO3	L	H	M	H
CO4	L	H	H	H
CO5	H	H	H	H

CSXXXXX: MACHINE LEARNING LAB (2credits-30Hours)

Module I (8 Hours)

Experiments/notebooks/code that refresh Python, programming frameworks used for the course

Experiments/Code that allows students to appreciate mathematics and data manipulation. Appreciate

- (a) Features, Representation of the data/real-world phenomena (b) mathematical operations or transformations that manipulate the data (c) plot/visualise the data distributions (say in 2D), (d) Eigen values, eigen vectors, rank of matrices.

Lab/Experiments that appreciate the problem of Classification and problem of Regression

Lab/Experiments that appreciate the notions related to “Training” and “Testing” by considering algorithms like decision trees, nearest neighbour as black boxes.

Module II (8Hours)

Dimensionality Reduction using PCA and its applications in (a) removing irrelevant features (b) compression/compaction (c) efficient ML pipeline

Experiment related to Nearest neighbour classifier, (a) visualize the decision boundaries (b) appreciate the role of hyper parameter K. Role of validation data in choice of hyper parameters

Decision Tree as a classifier and see the overfitting with “deep” trees. How the overfitting can be controlled by seeing validation performance during the training.

Module III (6Hours)

Experiments related to K- Means, by varying in “K”, “initialization”. How the “analysis of the algorithm” can be seen in the lab (e.g. change of objective across iterations). Try multiple datasets. Appreciate that “unsupervised discovery” makes sense in the problem under consideration.

An experiment that demonstrates how SVM can yield a solution better than a simple linear separating solution. Appreciate the role of support vectors. Appreciate how SVMs extend to problems even if data is not linearly separable.

An experiment that makes students appreciate the utility of naive Bayes classifier in practice (say designing a text classifier).

Module IV (8Hours)

Experiment that exposes the GD and BP in simple neural networks. Show the learning process (graphs) and performances.

Experiment that use a modern library and implementation of a deep neural network, expose computational graphs, expose the generalized way of appreciating BP as a learning algorithm in Deep Neural Networks

Experiment that uses a popular CNN architecture for practical application (say image classification).

Experiments that strengthen the empirical skills in training with (a) initializations (b) update strategies (c) regularisation (d) multi fold validation on a small/medium size deep neural network that can be trained in 5 minutes.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2	L	H	H	M
CO3	L	H	M	H
CO4	L	H	H	H
CO5	H	H	H	H

CSOS334T: OPERATING SYSTEMS (3credits-45Hours)

Course Objectives

Course Outcomes

Module I (8 Hours)

Elaborate what operating systems are, what they do and how they are designed and constructed. (Creating)

Define process concept like process scheduling, inter-process communication, process synchronization

and concurrency. (Remembering)

Explain different memory management schemes, relate various approaches to memory management and effectiveness of a particular algorithm. (Understanding)

Identify different page replacement algorithms to solve problems. (Applying)

Explain how the file system, mass storage and I/O are handled in a modern computer system. (Remembering, Understanding)

Module I (1 hour)

Application requirements, the systems stack and role of OS, resources, abstractions and interfaces, Components overview of an OS, Examples of different types of OSes (RTOS vs. desktop vs. mobile etc.), OS and OS distributions.

Module II (2 hour)

Basic organization of hardware components, Role of OS relative to hardware functionality with examples related to the von Neumann architecture.

Module III (6 hour)

Process abstraction --- program vs. process, Process Control Block (PCB), Design of system calls --- invocation and basic OS handling, Process control system calls, fork, wait, exec, getpid, getppid and variants. The limited direct execution model.

Module IV (10 hour)

Address bus and memory access. Memory view of a process -- heap, stack, code, data, Process memory usage requirements, The address space abstraction using virtual memory and related system calls (mmap, munmap, sbrk, mprotect), Address translation mechanisms --- static mapping, segmentation, paging. Page faults, page sharing, read/write permissions, swapping, process vs. OS memory. Memory bookkeeping and management --- motivation and mechanisms (process and OS). Case studies --- (i) malloc and (ii) role of OS for program to process

Module V (6 hour)

The process lifecycle--- source code to execution. The OS mode of execution -- limited direct execution recap, interrupts, system calls. The process context switch mechanism and PCB state, Scheduling policies --- set of scheduling metrics, goals and examples (interactive vs. real-time, priority).

Module VI (11 hour)

Motivation --- application, process and OS use cases. Introduction to threads and the pthread API. Synchronization primitives --- limitations of software solutions, atomic instructions, test-and-set, spinlocks, mutexes, condition variables, semaphores. Introduction to the pthread synchronization API, Case studies --- producer- consumer, reader-writers, barriers, Discussion on issues with concurrency --- race conditions, deadlocks, order violation.

Module VII (9 hour)

Persistence and the File abstraction, Hardware view: Hard disk architecture and its interfacing, Process view: System calls for file handling, Roles and responsibilities of file system. File system design details-- file and file system metadata, directory structure, caching optimizations, File System case study (the Unix file system etc.)

Suggested Readings

Modern Operating Systems, Andrew S. Tannenbaum and Herbert Bos, Pearson Education India; 4th edition

Operating System Concepts, Avi Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley India; 9th, edition

Operating System courses offered on NPTEL, <https://nptel.ac.in/>

Think OS, A Brief Introduction to Operating Systems. Allen B. Downey
<https://www.greenteapress.com/thinkos/index.html>

Linux Kernel Development, Robert Love, Pearson Education India; 3rd edition

Operating Systems: Principles and Practice, Thomas Anderson, Michael Dahlin, Recursive Books; 2nd Edition, <https://osp.cs.washington.edu/index.htm>

Computer Systems: A Programmer's Perspective, Randall E. Bryant, David R.O' Hallaron, Pearson Education India; 3rd edition.

The C Programming Language, Brian Kernighan, Dennis Ritchie, Pearson Education India; 2nd edition

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	M	M	M	H	H	H	H
CO2					H	H	H
CO3				H			
CO4				H			
CO5			H				

CSOS336P: OPERATING SYSTEMS LAB (2credits-30Hours)

Module I (10 hour)

1. Usage of tools --- unix shell commands (file commands, ps, ls, top), text editor (nano, vi, gedit, emacs)
2. C programming language refresher --- header files, compilation and linking using GCC, program execution, functions, argument passing, structures, pointers, file handling.

Module II (10 hr)

1. Usage of tools --- GCC, GDB, Objdump, shell scripts
1. Simple strace usage to showcase different interfaces (stdlib, system call)
2. Tools usage --- ps, pstree, top
3. Usage of process control system calls to identity process identifiers, create process hierarchies, launch new executables, control exit sequence of parent and child processes.
4. Familiarity with files in the /proc/<pid>/ directory

Module III (10 hour)

1. (Virtual) addresses of variables and initialized pointers.
2. Use of malloc() and demonstration of per-process virtual addresses
3. Tools usage --- strace, free, top, htop, vmstat,
/proc/<pid>/maps
4. Free memory statistics correlated with malloc(). Number of system calls and malloc() usage.
5. Implement a custom memory allocator using system calls.

Module IV (10 hour)

1. User mode programs to demonstrate LDE
2. Demonstration of process execution interleaving in different orders
3. Simulation based analysis of scheduling policies
4. Tools usage --- nice,

/proc/<pid>/status

Module V (10 hour)

1. Creation of threads using the pthread API and modification of shared variables with and without synchronization
2. Using spinlock, mutexes and condition variables to implement semaphores, barriers (using the pthreads API)
3. Implement solutions to the producer-consumer, reader- writers problems using the different synchronization primitives
4. Develop synchronization solutions for applications that use shared data (e.g., ordering of threads, concurrent hash tables, etc.)
5. Optional: Using shared memory and semaphores implement synchronized access to a shared memory area across processes (e.g., a message queue).

Module VI (10 hr)

1. Tools usage --- state, file, du, df, fsck.
2. Implementation of file utilities (e.g., find, grep) using the system call API.
3. Implement a simple file system to handle files on an emulated disk (via a large file) --- file system API, superblock, inode and data block management.

Mapping of Cos toSyllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	M	M	M	H	H	H	H
CO2					H	H	H
CO3				H			
CO4				H			
CO5			H				

CSCN340T: COMPUTER NETWORKS

(3 credits-45 Hours)

Course Objectives

This course aims to provide a comprehensive understanding of the fundamentals of computer networks, including Internet architecture, key protocols, and performance metrics. Students will explore application layer protocols, transport and IP layers, and data link and wireless networks. The course also covers advanced topics such as software-defined networking, data center networking, and mobile data networks, enabling students to analyze and evaluate network performance and security measures.

Course Outcomes

Identify and recall fundamental concepts and terminologies related to Internet architecture, including browser, web server, URL, domain name, IP address, and packet switching. (Remembering)

Explain the working principles of wireless networks, SDN, and layers in the OSI and TCP/IP models. (Understanding)

Apply socket programming techniques to create simple client-server applications using TCP and UDP. (Applying)

Compare and contrast the features and functionalities of IPv4 and IPv6, layers in the OSI and TCP/IP models, and different security schemes such as NATs, firewalls, and DMZs. (Analyzing)

Evaluate different security measures, and congestion control mechanisms used in TCP, such as slow start and congestion avoidance, and their effectiveness in managing network traffic. (Evaluating)

Design and develop a comprehensive network topology for a data center, and strategies for implementing wireless network protocols. (Creating)

Module I (3 Hours)

Introduction to the Internet: Overview of how the Internet works. Understand at a high level what happens when we browse a website. Understand basic terminology like browser, web server, URL, domain name, IP address, packets. Overview of the design principles of the Internet: packet switching vs circuit switching, store-and-forward networks, layering for modularity. Introduction to the various layers in the Internet. Introduction to performance metrics like end-to-end throughput, delay, jitter and drop rates in a network. Statement of Little's Law. How performance is measured.

Module II (7 Hours)

Application layer: Internet names, how DNS works. Application layer protocols: HTTP, SMTP, SNMP, web applications. Peer-to-peer applications. P2P file distribution. Audio and video streaming. Challenges of streaming over best effort IP. Linux Network Programming: Introduction to socket programming in Linux. Understand how to build a simple client-server application using TCP/UDP sockets.

Module III (8 Hours)

Transport Layer: Importance of the transport layer; end-to-end principle. Transport layer protocols: basics of TCP and UDP, process-to-process delivery, multiplexing, port numbers, header structure. Reliable transmission of packets over an unreliable network: sequence numbers, ACKs, timeout, retransmissions. Stop and wait, and sliding window. TCP connection setup and teardown. Flow control and congestion control at the transport layer. Differences between the two. Overview of TCP congestion control: Slow start and reaction to timeouts. TCP congestion control: Slow start; congestion avoidance using loss-based and delay-based control.

Module IV (10 Hours)

The IP Layer: Network architecture and performance - Network topology; Router architecture: queueing and switching. Performance evaluation of a network link: traffic characteristics, performance measures, Kendall's notation. IP Protocol - Need for an Internet address, and its design. Hierarchical IP addressing, IPv4 and IPv6, structure of IP datagram, IP forwarding. NATs, security attacks and defences: DMZ, firewalls. Routing protocols and Internet architecture: Routing protocols: Link state routing. Distance vector routing: count-to-infinity, routing convergence. Understand the structure of the Internet: end-user organizations and ISPs. Understand the difference between intra-domain (OSPF) and inter-domain (BGP) routing. Intra-domain routing: OSPF.

Module V (10 Hours)

Data Link Layer - Mechanisms for error detection/recovery: Parity checks, CRC. Medium access protocols: Polling vs. contention-based: TDM, Aloha, CSMA/CD. Switched LANs: L2 addressing and ARP, Ethernet frame structure, learning switches. Wireless Networks: Wireless physical layer: signal-to-noise ratio, bit error rate, modulation, multipath, interference. Wireless LANs: 802.11 architecture (access points, SSID, channels, beacons, scanning, association), 802.11 CSMA-CA protocol; summary of 802.11 variants.

Module VI (7 Hours)

SDN and data center networking: Data center network design and topology. Transport protocols optimized for data centers. Introduction to software defined networking. Mobile data networks: Cellular Internet access. Mobility management and handovers. Impact of mobility on higher layers. Streaming media protocols and services: Multimedia applications. Audio and video streaming over UDP, HTTP. Adaptive streaming. Voice over IP. Recovering from packet loss and jitter. QoS. Protocols for real time applications.

Suggested Readings

J.F. Kurose and K.F. Ross, Computer networking: a top-down approach, 6th edition, Pearson, 2017. (6th edition is low-cost Indian edition. 7th edition is high-cost, may be used if available.)
 Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2021.
 R. Jain, The art of computer systems performance analysis, Wiley India, 1991.
 S.K. Bose, An Introduction to Queueing Systems, Springer Science + Business Media New York, 2012.
 A.S. Tanenbaum and D.J. Wetherall, Computer Networks, 5th edition, Pearson, 2013.
 Larry Peterson and Bruce Davie, Computer Networks: A Systems Approach, 6th Edition.
 N. Feamster, J. Rexford, Ellen Zegura, "The Road to SDN", ACM Queue, 2013.
 Alizadeh et al., "Data Center TCP", ACM SIGCOMM 2010.
 The Network Simulator - NS-2, <https://www.isi.edu/nsnam/ns/>
 E. Altman and T. Jimenez, NS-2 Simulator for Beginners, 2003.
 NS-3 network simulator. <https://www.nsnam.org/>

Alternative NPTEL/SWAYAM Course

Computer Networks and Internet Protocol, Prof. Soumya Kanti Ghosh and Prof. Sandip Chakraborty, IIT Kharagpur

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H		L	L	L	
CO2		M	H	H		M
CO3		H				
CO4		L	M	H	H	
CO5			H			
CO6					H	H

CSCN345P : COMPUTER NETWORKS LAB

(2 credits-60 Hours)

Course Objectives

This lab course is designed to offer hands-on experience with network configuration and analysis using Linux tools and Wireshark. Students will develop practical skills in socket programming, network performance measurement, and simulation of network protocols using NS-2/NS-3. The course includes tasks such as setting up mesh networks, evaluating wireless and cellular signal strength, and implementing streaming servers, fostering a deeper understanding of real-world networking scenarios.

Course Outcomes

Recall and identify various Linux networking tools and commands such as ifconfig, dig, ethtool, route, netstat, nslookup, and ip to understand network configurations. (Remembering)
 Understand and describe the principles of socket programming by developing simple client-server programs using TCP and UDP. (Understanding)
 Apply Linux utilities such as iperf and tc to measure and modify TCP throughput and observe the impact of network configurations on performance. (Applying)
 Examine and interpret link layer packet statistics and errors using Linux tools like ethtool and simulate medium access protocols using NS-2/NS-3. (Analyzing)
 Evaluate the performance of various network configurations and congestion control protocols using NS-2/NS-3 simulations and tools like iperf. (Evaluating)
 Develop and simulate transport protocols optimized for data centers using NS-2/NS-3, set up static routes in a mesh network to achieve desired topology, and implement streaming audio/video server. (Creating)

Module I

Use Linux tools like ifconfig, dig, ethtool, route, netstat, nslookup, and ip to understand the networking configuration of the computer that the student is working on. Use Wireshark to capture packets when browsing the Internet. Examine the structure of packets: the various layers, protocols, headers, payload. Install and configure some network applications, e.g. Apache, Bind (DNS), etc. Understand various header fields and their usage in different application layer protocols using Wireshark packet capture.

Module II

Socket programming: write a simple client- server program using TCP and UDP sockets. Modify server to handle multiple clients concurrently. Measure TCP throughput between two hosts in a network using tools like iperf. Modify TCP configuration parameters. Use the tc Linux utility or similar to control bandwidth, delay, loss. Observe impact on measured throughput. Experiment with multiple applications running concurrently to generate congestion. Observe the behaviour of congestion control protocols in NS-2/NS-3, change various network parameters and observe evolution of the TCP congestion window.

Module III

Use tools like ping and traceroute to explore various Internet paths to popular servers. Use web-based tools like the whois utility to query Internet registries, and understand which IP addresses are allocated to the student's network. Find out which are the major ISPs, and which is the ISP of the student's network. Configure a simple mesh network using computers in the lab, or using Mininet. Setup static routes to conform to the desired mesh topology. Use NS-2/NS-3 to simulate a mesh of at least 4 nodes and 3 links to evaluate performance under various conditions.

Module IV

Use Linux network tools like ethtool to observe and analyze link layer packet statistics and errors. Use NS-2/NS-3 to simulate medium access protocols. Observe contention, collisions and packet loss in medium access protocols. Observe the working of error detection/recovery mechanisms. Use cellphone to measure Wi-Fi signal strength (RSS) at various places in the campus. Draw a contour map with access points and RSS levels. Correlate with upload/download speed using tools like Measurement Lab speed test. Understand the behavior of Wi-Fi using NS-2/NS-3.

Module V

Simulate transport protocols optimized for data centers in NS-2/NS-3. Use cellphone to measure cellular signal strength (RSS) at various places in the campus. Draw a contour map with cellphone towers and RSS levels. Correlate with upload/download speed using tools like Measurement Lab speed test.

Module VI

Implement a streaming audio/video server using open-source software.

Suggested Readings

- J.F. Kurose and K.F. Ross, Computer networking: a top-down approach, 6th edition, Pearson, 2017. (6th edition is low-cost Indian edition. 7th edition is high-cost, may be used if available.)
 Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2021.
 R. Jain, The art of computer systems performance analysis, Wiley India, 1991.
 S.K. Bose, An Introduction to Queueing Systems, Springer Science + Business Media New York, 2012.
 A.S. Tanenbaum and D.J. Wetherall, Computer Networks, 5th edition, Pearson, 2013.
 Larry Peterson and Bruce Davie, Computer Networks: A Systems Approach, 6th Edition.
 N. Feamster, J. Rexford, Ellen Zegura, "The Road to SDN", ACM Queue, 2013.
 Alizadeh et al., "Data Center TCP", ACM SIGCOMM 2010.
 The Network Simulator - ns-2, <https://www.isi.edu/nsnam/ns/>
 E. Altman and T. Jimenez, NS2 Simulator for Beginners, 2003.
 ns-3 network simulator. <https://www.nsnam.org/>
 Jim Kurose Homepage, https://gaia.cs.umass.edu/kurose_ross/about.php

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H		M	M		

CO2		H				
CO3		H	M			
CO4	M			H		
CO5		H	M	M		
CO6			H		H	H

CSIC341T : INTRODUCTORY CYBER SECURITY

(3 credits-45 Hours)

Course Objectives

The objective of the Cyber Security Theory course is to provide students with a comprehensive understanding of the fundamental principles of cyber security, including the CIA triad, cryptographic techniques, authentication and authorization mechanisms, and application security vulnerabilities. Students will learn to analyze recent cyber-security incidents, evaluate intrusion detection and prevention systems, and assess the security of mobile applications and wireless networks. The course aims to equip students with the knowledge to design secure systems and develop robust cyber defense strategies.

Course Outcomes

Recall and define key cyber security concepts and terminology, including the CIA Triad, cyber-attack surfaces, recent cybersecurity incidents, and different cryptographic methods. (Remembering)

Explain the role of cryptography, strong authentication, and access control mechanisms. (Understanding)

Apply cryptographic techniques to secure data, and utilize security tools such as firewalls and intrusion detection systems to protect networks and detect intrusions. (Applying)

Analyze basic application vulnerabilities, such as buffer overflow, SQL injection, and cross-site scripting (XSS), and propose mitigation techniques and examine network security threats. (Analyzing)

Assess the security of web applications by identifying and mitigating vulnerabilities, and evaluate different classes of malware. (Evaluating)

Design and implement intrusion detection systems, secure communication protocols and develop comprehensive security solutions for mobile applications. (Creating)

Module I (3 Hours)

Introduction and basic terminology: Cyber Security and CIA Triad, basic cyber threats to CIA, cyber-attack surfaces, recent cyber-security incidents and their high-level analysis

Module II (6 Hours)

Basic Cryptography: Role of Cryptography in ensuring confidentiality for data at rest, data in motion, and data in process. Symmetric and Asymmetric Cryptography, their needs as complementary of each other, some basic symmetric and asymmetric algorithm outlines (RSA, DH, DES, AES), Role of cryptography in data integrity, non-repudiation Hashing and Digital Signature and some example hash function outlines (MD5, SHA-256), understanding digital signature and its role. Digital Certificate and PKI. Importance of the role of a proper Pseudo Random Number Generator.

Module III (6 Hours)

Authentication, Authorization and Privilege: Importance of strong Authentication, distinction between authorization and authorization, importance of authorization, access control, Mandatory and Discretionary Access control, role based authorization, privilege and privilege escalation

Module IV (15 Hours)

Application Security: Basic application vulnerabilities (Buffer overflow, Integer Overflow, format string vulnerability), Basic mitigations of buffer overflow – platform bases, compiler based, secure programming practice, Web Client Security, Same Origin Principle, DOM, Java Script Vulnerability, Cookies and Cookie Attributes Secure, http only, Concept of session and session ID, Session hijacking vulnerability, http vs. https and SSL/TLS and version issue, Web Server Security – XSS, CSRF, SQL Injection, Command Injection concepts, examples of each and mitigation techniques Vulnerabilities in DNS, Routing and IP protocols especially in IPv4 and suggested remedies with DNSSEC, S-BGP, and IPSec

Module V (6 Hours)

Perimeter protection and Intrusion Detection: Host Intrusion Detection techniques, what are the indicators to look for and how an SIEM tool can consolidate such indicators into a management console Network Intrusion Detection – signature based vs. behavior based, Snort Firewall vs. Intrusion Detection tool, Firewall rules and customization techniques.

Module VI (9 Hours)

Basic Malware Analysis: Various malware classes and their characteristics, Difference between static analysis and dynamic analysis, Signature vs. behavioral detection techniques. Mobile Application Security: Basic mobile attack surface and the ideas of permissions, and their abuse; Execution model of mobile apps in Android (Sandboxing) and communication. WLAN Security: Some common ways WLAN are compromised including weak cipher such as WEP, evil twin attack, unauthorized access point based attacks (rogue WLAN) etc.

Suggested Readings

Ross J. Anderson, Security Engineering, Third Edition, Wiley, Nov 2020
 Cyber Crime and its Prevention in Easy Steps, Debturu Chatterjee, Khanna Publishing House, 2022.
 Cyber Attacks and Counter-Measures Made Simple, Debturu Chatterjee, Khanna Publishing House, 2022
 The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws 2nd Edition, D Stuttard and M Pinto
 Cryptography and Network Security, William Stallings
 The Hacker Playbook: Practical Guide to Penetration Testing (vol. 1 and 2) by Peter Kim.
 Introduction to Security of Cyber-Physical Systems, Jeeva Jose, Khanna Publishing.
 Mastering Hacking, Harsh Bothra, Khanna Book Publishing House.

Alternative NPTEL/SWAYAM Course

Cyber Security and Privacy, Prof. Saji K Mathew, IIT Madras
 Cyber Security, Dr. G. Padmavathi, Avinashilingam Institute for Home Science & Higher Education for Women, Coimbatore

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	H		M		
CO2		H	H			
CO3		H			H	
CO4			L	H		M
CO5				H	L	H
CO6		L	L		H	H

CSIC3460 : INTRODUCTORY CYBER SECURITY LAB

(2 credits - 60 Hours)

Course Objectives

The objective of the Cyber Security Lab course is to offer hands-on experience with key cyber security tools and techniques. Students will practice using cryptographic libraries, implementing two-factor authentication, and performing vulnerability testing for buffer overflows and injection attacks. The course also includes configuring and monitoring intrusion detection systems, analyzing malware, and evaluating the security of mobile and WLAN networks. By the end of the lab course, students will be able to apply theoretical knowledge to practical scenarios, enhancing their skills in securing computer systems and networks.

Course Outcomes

Recall and identify the usage of cryptographic functions such as RSA, AES, and SHA-256 for encryption and hashing. (Remembering)

Explain the process and importance of two-factor authentication, demonstrate an example of privilege escalation, and describe various application vulnerabilities. (Understanding)

Apply cryptographic library functions to encrypt data and hash information, analyze digital certificates, and implement vulnerability testing techniques such as SQL injection, XSS, CSRF, and command injection using DVWA. (Applying)

Analyze the effectiveness of host monitoring by installing and configuring Wazuh to monitor a host, and examine network traffic and detect intrusions by installing and configuring Snort on a local network. (Analyzing)

Evaluate the security of applications by performing static analysis to identify potential vulnerabilities in executables. (Evaluating)

Develop comprehensive monitoring solutions for both hosts and networks using tools like Wazuh and Snort to enhance cybersecurity measures, and implement secure communication protocols using cryptographic techniques in practical applications. (Creating)

Module I

Using library functions to use RSA, AES, SHA-256 and show the result of encryption, Hashing etc. Taking apart a digital certificate and show the various components and their significance.

Module II

2 factor authentication, Privilege escalation example

Module III

Buffer overflow, integer overflow and format string vulnerability testing in vulnerable applications. DVWA based command injection. SQL injection, XSS and CSRF

Module IV

Install Wazuh and monitor a host. Install snort and monitor a network on the local network.

Module V

Use static analysis tools to find how an executable can be analyzed.

Suggested Readings

Ross J. Anderson, Security Engineering, Third Edition, Wiley, Nov 2020

Cyber Crime and its Prevention in Easy Steps, Debturu Chatterjee, Khanna Publishing House, 2022.

Cyber Attacks and Counter-Measures Made Simple, Debturu Chatterjee, Khanna Publishing House, 2022

The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws 2nd Edition, D Stuttard and M Pinto

Cryptography and Network Security, William Stallings

The Hacker Playbook: Practical Guide to Penetration Testing (vol. 1 and 2) by Peter Kim.

Introduction to Security of Cyber-Physical Systems, Jeeva Jose, Khanna Publishing.

Mastering Hacking, Harsh Bothra, Khanna Book Publishing House.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H	M		
CO3	H		H		
CO4				H	
CO5			H		H
CO6	H			H	

CST0344T : THEORY OF COMPUTATION

(4 credits - 60 Hours)

Course Objectives

The objective of the Theory of Computation course is to introduce students to the fundamental concepts and mathematical foundations of computational theory. Students will explore various models of computation, such as finite automata, context-free grammars, and Turing machines, and understand their capabilities and limitations. The course aims to develop the ability to analyze the properties of languages and automata, prove theorems related to computational theory, and classify problems based on their computational complexity. By the end of the course, students will be equipped to tackle advanced topics in computer science and apply theoretical principles to practical problems.

Course Outcomes

Define key concepts of automata theory, including alphabets, formal languages, regular expressions, deterministic and non-deterministic finite automata (DFAs and NFAs).

Explain the relationship between regular expressions and regular languages, and the differences between context-free grammars (CFGs) and context-free languages (CFLs).

Construct deterministic and non-deterministic finite automata for given regular languages and apply the pumping lemma to demonstrate the non-regularity of certain languages.

Analyze the closure properties of regular languages and context-free languages and the differentiate between the acceptance conditions of pushdown automata (PDAs) and their equivalence to CFGs.

Evaluate the decidability and recognizability of problems using Turing machines and assess the complexity of problems and classify them into complexity classes such as P, NP, and EXP.

Design Turing machines to solve specific computational problems and formulate reductions to prove the undecidability and NP-completeness of various problems.

Module I (20 Hours)

Finite Automaton: Why automata theory? Alphabets, formal languages, and problems. What are regular languages and automata models for them: Deterministic Finite automaton, Formal argument of correctness, Regular languages. Properties of regular languages - Closure, properties, product construction. Limitations of Automata Non-regularity, Pumping Lemma. Non-Deterministic Finite Automaton, Subset construction, Equivalence with DFAs. Regular expressions. Equivalence with regular languages. Algorithms for regular languages, Minimization and its algorithm, Myhill-Nerode relations, Characterization of regular languages.

Module II (20 Hours)

Grammars, Context-free Languages and machine models: Grammars and the motivation from language theory. Context-free grammars, closure properties. Chomsky Normal Form for CFGs. PDAs. Empty-stack vs Final state acceptance conditions. Equivalence of PDAs and CFGs. Limitations of PDA computation, non-context-free language. Pumping Lemma for CFLs. Deterministic CFLs and PDAs. CYK Algorithm for parsing of CFLs.

Module III (20 Hours)

Turing machines and Computability: Modeling computation using Turing Machines. Equivalent models. Church Turing Hypothesis. Decidability and Turing recognizability (i.e., recursive and recursively enumerable). Closure properties. Undecidability by diagonalization. Reductions to show undecidability. Examples of reductions. Resource bounded Turing machines & Intro to Complexity. Basic complexity classes. Time bounded classes: P, NP, EXP. Post's correspondence problem and other undecidable problems. Polytime reductions, NP-completeness, Cook-Levin Theorem without proof.

Suggested Readings

Theory of Computation, R.B. Patel, Khanna Book Publishing, 2020.

Introduction to the Theory of Computation, 3rd edition. Michael Sipser, Cengage Publications (Low-cost Indian edition available).

Introduction to Automata, Theory, Languages and Computation. Third Edition. John Hopcroft, Rajeev Motwani, Jeffrey D. Ullmann, Pearson Publications.

Automata and Computability, Dexter C. Kozen. Part of the Undergraduate Texts in Computer Science book series (UTCS), Springer.

Elements of the Theory of Computation, 2nd edition. Harry Lewis, Christos Papadimitriou, Prentice Hall.

Alternative NPTEL/SWAYAM Course

Theory of Computation, Prof. Raghunath Tewari, IIT Kanpur

Theory of Computation, Prof. Subrahmanyam Kalyanasundaram, IIT Hyderabad

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H		
CO2	H	H	
CO3	H		
CO4		H	
CO5			H
CO6			H

CSCD449T:COMPILER DESIGN

(3credits-45Hours)

Course Outcomes

Recall the role, functionality and structure of program translation and interpretation in software development. (Remembering)

Understand the difference between abstraction levels of a high-level language and a machine language. (Understanding)

Understand the role of a sequence of intermediate representations in lowering the level of abstractions in

the process of language translation. (Understanding)
 Get a first-hand experience of a practical application of elegant data structures, algorithms, and other core CS concepts such as automata theory. (Creating)
 To make effective use of tools such as LEX and YACC. (Applying)

Module I (12 Hours)

Introduction to Compilers: Comparing abstractions of a high-level language and a low-level language; compilation as a series of steps for lowering the abstraction level through stepwise refinement; phases of compilation; bootstrapping; cross-compilation. Lexical Analysis: The role of lexical analysis; Token, lexemes, and token codes; Regular Expressions (RE) to represent tokens, Deterministic finite automata (DFA), Traversing a DFA for recognizing tokens; Generating a lexical analyzer using LEX/Flex.

Module II (14 Hours)

Syntax Analysis: Context Free Grammars (CFG), Concept of parsing, sentences and sentential forms, leftmost and rightmost derivations, parse trees, ambiguous grammars; Overview of top-down and bottom-up parsing;

Option 1: Introduction to shift reduce parsing; viable prefixes and valid items, Constructing LR(0) sets of items; Constructing SLR parsing tables; Generating a parser using a parser generator such as YACC/Bison.

Option 2: Top-down parsing, Left factoring, Elimination of left-recursion, predictive parsing, recursive descent parsing, LL(1) parsing. Generating a parser using a parser generator such as ANTLR, JavaCC, etc.

Module III (8 Hours)

Semantic Analysis: The need of semantic analysis; abstract syntax trees for expressions, assignment statements and control flow statements; attribute evaluation, syntax directed translation schemes (SDTS); Applications of Semantic Analysis: Applications of SDTS for (a) declaration processing and type checking, (b) generating three-address code

Module IV (5 Hours)

Run time support: Parameter passing by value, reference, and name; activation records, stack and static allocation of activation records; translating a function call, allocating offsets to variables, generating code for function prologue, function epilogue, call sequence, and return sequence.

Module V (6 Hours)

Introduction to Code Optimization: Control flow graphs; Local optimizations (common subexpression, copy propagation, dead code elimination). Code Generation: Generating assembly code from three address codes using simple register allocation and instruction selection.

Suggested Readings

[Textbook] Aho, Lam, Sethi, and Ullman. Compilers: Principles, Techniques, and Tools. 2/e, Addison-Wesley, 2006.

[Reference book] Andrew Appel and Jens Palsberg. Modern Compiler Implementation in Java. 2/e, Cambridge University Press, 2002.

https://en.wikipedia.org/wiki/Cross_compiler.

[https://en.wikipedia.org/wiki/Bootstrapping_\(compilers\)](https://en.wikipedia.org/wiki/Bootstrapping_(compilers))

https://en.wikipedia.org/wiki/Function_prologue_and_epilogue

<https://nptel.ac.in/courses/106106237>

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2			H		
CO3	H	H			

CO4					H
CO5				H	

CSCD452P: COMPILER DESIGN LAB

(2 Credits)

Course Outcomes

Recall and illustrate the different syntax of compiler construction tools like LEX and YACC. (UNDERSTANDING)

Experiment with regular expression to match the pattern. (APPLYING)

Solve various problem using LEX and YACC. (CREATING)

Interpret the techniques of parsing practically. (UNDERSTANDING)

Analyze different rules using standard parser generator YACC. (ANALYZING)

Evaluate problems using both SPIM Simulator. (EVALUATING)

List of Experiments:

Write 5 simple test-cases in MMC and then inspect the generated code.

Write a lexer to recognize valid tokens.

Write a parser to parse the given input MMC program.

Write a type-checker for a syntactically correct input MMC program.

Write a Translator that takes a type-checked MMC program and generates equivalent IR code in TACoC format; TACoC is a subset of MMC such that code is in a form similar to three-address code. Details of TACoC is given towards the end of this section.

Generate MIPS code. Use the SPIM simulator to run the code.

Write a translator to translate a type-checked MMC program to equivalent three-address code.

Mapping of COs to Syllabus

Course Outcomes	Expt 1	Expt2	Expt3	Expt4	Expt5	Expt6	Expt7
CO1	H	M					
CO2	M						H
CO3		H					
CO4			H		H		M
CO5			H	H			
CO6						H	

CSBI453T: BIOLOGY

(3credits-45Hours)

Course Outcomes

Compare the two, three, four and five kingdom classifications. Highlight the criteria for classification (Understanding)

Apply thermodynamic principles to biological systems. (Applying)

Analyze biological processes at the reductionist level. (Analyzing)

Examine DNA as a genetic material in the molecular basis of information transfer (Evaluating)

Module I: Classification (8hours)

Classification and its criteria: Morphological, Biochemical and Ecological; Hierarchy of

Classifications, based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotrophs (d) Ammonia excretion – amonotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life; Organism from different based on classification for the study :1. E.coli, 2. S.cerevisiae, 3. D. Melanogaster, 4.C. elegans, 5. A. Thaliana, 6. M. musculus

Module 2: Genetics and Information Transfer (13 hours)

a. Mendel's laws: Law of segregation and Law of independent assortment, Dominance, Recessiveness; Allele, Gene mapping, Gene interaction, Epistasis ; Meiosis and Mitosis in heredity; Gene – mapping; Genetic disorders in humans; complementation in human genetics.

b. DNA as a genetic material; Structure of DNA- single stranded, double stranded and nucleosomes; Genetic code- Salient features; Gene - complementation and recombination.

Module 3: Biomolecules and Enzymes (14 hours)

a. Biomolecules of life: Micromolecules and Macromolecules- sugars, starch and cellulose; Amino acids and proteins; Nucleotides and DNA/RNA; Two carbon units and lipids. Structure of proteins: Primary, Secondary, tertiary and Quaternary; Proteins as enzymes, transporters, receptors and structural elements.

b. Enzyme classification. Mechanism of enzyme action of any two enzyme. Enzyme kinetics and kinetic parameters; RNA catalysis.

Module 4: Metabolism (6hours)

Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. ΔG and its relation to standard free energy. Spontaneity. ATP as an energy currency; Glycolysis and Krebs cycle; Photosynthesis; Energy yielding and energy consuming reactions. Energy charge

Module 5: Microbiology (4 hours)

Unicellular organisms; Species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of unicellular organisms. Sterilization and media compositions. Growth kinetics.

Suggested Readings

Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M. L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd

Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H., John Wiley and Sons

Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company

Molecular Genetics (Second edition), Stent, G. S.; and Calendar, R.W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher

Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.Brown Publishers

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M		H	
CO2				M	
CO3	M		M	H	H

CO4	M	H	H		

CSEC0163: E-COMMERCE & CYBER SECURITY

(3 credits – 45 hours)

Course Outcomes

Find the scopes of e-commerce and their association with different trade cycles.

Summarize the concept of business to consumer mode of transaction in e-commerce.

Present the legal issues associated with electronic documents, jurisdiction issues, copyrights etc.

Explain and categorize the in-depth knowledge of EDI and its constituent elements.

Evaluate the symmetric and asymmetric cryptosystem implementations on e-commerce.

Integrate the gathered knowledge on certain case studies like internet bookshops, electronic newspapers, virtual auctions etc.

Module 1(10 hours)

Definition, Scope of E-Commerce, Hardware requirements, E-Commerce and Trade Cycle, Electronic Markets, Electronic Data Interchange and Internet Commerce. Business to Business E-Commerce: Electronic Markets, Electronic Data Interchange (EDI): Technology, Standards (UN/EDIFACT), Communications, Implementations, Agreements, Security, EDI and Business, Inter- Organizational E-commerce.

Module 2(15 hours)

Risks-Paper Document vs. Electronic document, Authentication of Electronic document, Laws, Legal issues for Internet Commerce: Trademarks and Domain names, Copyright, Jurisdiction issues, service provider liability, Enforceable on line contract. Security Issues: Security Solutions-Symmetric and Asymmetric Cryptosystems, RSA, DES, AES and Digital Signature, Protocols for secure messaging, Secure Electronic Transaction (SET) Protocol, Electronic cash over internet, Internet Security.

Module 3 (10hours)

Consumer trade transaction, Internet, Page on the Web, Elements of E-Commerce with VB, ASP, SQL.

Module 4 (10 hours)

Internet bookshops, Software supplies and support, Electronic Newspapers, Internet Banking, Virtual Auctions, Online Share Dealing, Gambling on the net, E-Diversity, Case studies through internet.

Suggested Readings

D. Whitley, E-Commerce-Strategy, Technologies and Applications, TMH.

K. K. Bajaj, E-Commerce- The Cutting Edge of Business, TMH.

W. Clarke, E-Commerce through ASP, BPB.

M. Reynolds, Beginning E-Commerce with VB, ASP, SQL Server 7.0 and MTS, Wrox.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	L		H	
CO3		H		
CO4	H	M		L
CO5		H		
CO6			L	H

CSIC0164: ICT FOR DEVELOPMENT

(3 credits – 45 hours)

Course Outcomes

Define the various terms and technologies used for Information and Communication System. (Remembering)

Analyze the foundational and implementation issues of ICT.(Analyzing)

Illustrate the various impacts of ICTs on Social and Economical developments. (Understanding)

Classify and compare the models of e-Governance with ICTs and its impact on the Environment sustainability. (Applying)

Conclude and evaluate the various aspects of ICTs in future. (Evaluating)

Module 1: Information and Communication System Overview (12 lectures)

Definition of terms – Elements and Components – Basics of Information theory – Objectives of communications – components and methods of communications – Hardware subsystem (PC, Network, Enterprise, Grid and Cloud Computing) – Internet, Intranet, WEB technology in communication .

Module 2: Foundations and Implementation of ICT4D (7 lectures)

ICT4D value chain, Technological foundations of ICT4D, Human foundations, Institutional foundations, Implementing ICT4D: Strategy, Design and implementation, Adoption, monitoring and use.

Module 3: ICTs for Economic and Social development (11 lectures)

Economic growth: Development goal, ICTs and micro-economic growth, ICTs and meso-economic growth, ICTs and macro- economic growth, Poverty eradication: Development goal, ICTs and financial poverty, ICTs and livelihoods, Social development: Development goal, ICTs health, ICTs education.

Module 4: ICTs for e-Governance and Environment Sustainability (10 lectures)

Good Governance: Development goal, ICTs for e-Services, ICTs for e-Accountability, ICTs for e-Democracy, Environment Sustainability: Development goal, ICTs for e-Mitigation, e-Monitoring, e-Strategy, e-Adaptation, e-Resilience.

Module 5: Future of ICT4D (5 lectures)

Future directions, Development 2.0, Data intensive development, Open development.

Suggested Readings

The Language of ICT: Information and Communication Technology, Tim Shortis, 2001, Routledge.

Information and Communication Technology for Development (ICT4D), Richard Heeks, 2017, Taylor and Francis.

Information and Communications Technologies for Development: A Comparative Analysis of Impacts and Costs, Balaji, P. and Keniston, K

Mapping of COs to Syllabus

CourseOutcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3		M	H	M	
CO4				H	
CO5					H

CMCG0150: COMPUTATIONAL GEOMETRY

(3 Credits – 45 Hours)

Course Outcomes

Construct algorithms for simple geometrical problems (Applying)

Solve linear programs geometrically (Applying)

Apply geometric techniques to real-world problems in graphics. (Applying)

Analyze randomized algorithms for small domain problems. (Analyzing)

Develop efficient algorithms using line-point duality. (Creating)

Module 1 (11 Hours)

Polygon triangulation: area of a simple polygon, counting the number of triangulations in a convex polygon, Plane sweep -- the general paradigm, Line segment intersection, Doubly Connected Edge List (DCEL), Triangulation of a monotone polygon, Triangulations of Planar Point Sets, The Delaunay Triangulation, Computing the Delaunay Triangulation

Module 2(9 Hours)

Convex hull in 2D -- lower bound, Graham's scan, Jarvis march, output sensitive Chan's algorithm. Range search -- Kd tree, Range tree, Fractional Cascading, Art Gallery theorem. Convex hull in 3D--The Complexity of Convex Hulls in 3-Space, Computing Convex Hulls in 3-Space

Module 3(9 Hours)

Linear Programming: The Geometry of Casting, Half-Plane Intersection, Incremental Linear Programming, Randomized Linear Programming, Unbounded Linear Programs
Arrangements and Duality-- Computing the Discrepancy, Duality, Arrangements of Lines, Levels and Discrepancy

Module 4(10 Hours)

Voronoi Diagrams: The Post Office Problem, Definition and Basic Properties, Computing the Voronoi Diagram, Voronoi Diagrams of Line Segments, Farthest-Point Voronoi Diagrams
Point Location: Knowing Where You Are, Point Location and Trapezoidal Maps, A Randomized Incremental Algorithm, Dealing with Degenerate Cases

Module 5(6 Hours)

Robot Motion Planning: Getting Where You Want to Be, Work Space and Configuration Space, A Point Robot, Minkowski Sums, Translational Motion Planning

Suggested Readings

Computational Geometry: Algorithms and Applications, Mark de Berg, Otfried Cheong, Marc van Kreveld, Mark Overmars, Springer Verlag
Computational Geometry -- An Introduction, Franco Preparata and Michael Ian Shamos, Springer Verlag
Computational Geometry in C, Joseph O'Rourke, Cambridge University Press
Lecture Notes by David Mount - <http://www.cs.umd.edu/~mount/754/Lects/754lects.pdf>

Mapping of COs to Syllabus

CourseOutcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H			
CO2			H		
CO3	M	M	M	H	H
CO4				H	
CO5			H		

CSOS0151: ADVANCED OPERATING SYSTEMS
(3 Credits – 45 hours)

Course Outcomes

Define the concepts of concurrent processes, deadlock, process synchronization and list the various conditions for identifying these scenarios. (Remembering)

Explain the advanced terms like distributed deadlock, distributed mutual exclusion and distributed file system etc. (Remembering)

Apply various algorithms like Lamport's algorithm and Ricart- Agarwala algorithm to solve the problem of distributed mutual exclusion. (Applying)

Compare techniques of implementing distributed file systems, distributed shared memory, different load scheduling algorithms like- load balancing and load sharing. (Analysing)

Determine the requirements of security and protection for a computer system and estimate the efficiency of different security models. (Evaluating)

Discuss the design and implementation issues of multiprocessor operating systems. (Creating)

Module I (10 hours)

Concepts of processes, Concurrent processes, Threads, Overview of different classical synchronization problems, Monitors, Communicating Sequential processes (CSP), Process deadlocks: Introduction, causes of deadlocks, Deadlock handling strategies, Models of deadlock.

Module II (11 hours)

Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lamport's global state recording algorithm, Basic concepts of Distributed Mutual Exclusion, Lamport's Algorithm, Ricart-Agrawala Algorithm; Basic concepts of Distributed deadlock detection, Distributed File system, Architecture, Design issues, SUN Network File system, Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing

Module III (12 hours)

Multiprocessor System: Motivation, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions and requirements; Design and Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization. Performance, Coprocessors, RISC and data flow: Introduction, Necessity, Measures, Techniques, Bottlenecks and Saturation, Feedback loops, Coprocessors, RISC.

Module IV (12 hours)

Analytic Modeling: Introductions, Queuing Theory, Markov Process. Security and Protection: Security-threats and goals, Penetration attempts, Security Policies and mechanisms, Authentication, Protections and access control Formal models of protection, Cryptography, worms and viruses.

Suggested Readings

Milan Milenkovic, Operating Systems Concepts and Design, TMH.

<https://nptel.ac.in/courses/106108101>

<https://nptel.ac.in/courses/106102132>

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2	M		H	
CO3		H		
CO4		M		
CO5				H
CO6			H	M

CSSN0152: SPEECH AND NATURAL LANGUAGE PROCESSING

(3 credits-45Hours)

Course Outcomes

Recall algorithms and methods for building computational models of speech and natural language processing (Remembering)

Explain syntactic analysis, semantic representations, discourse analysis, phonetics, and automatic speech recognition. (Understanding)

Apply statistical and corpus-based methods and algorithms for text and speech processing. (Applying)

Analyse syntactic structure and meaning of given text taking into account ambiguity. (Analysing)

Evaluate the performance of algorithms and models used for text and speech processing. (Evaluating)

Develop natural language and speech processing systems for applications such as information extraction, question answering, machine translation etc. (Creating)

Module I (5 Lectures)

Introduction to NLP, Knowledge in language processing, Representation and Understanding, Organization of NLP systems, Models and algorithms, Linguistic Essentials

Module II (12 Lectures)

Grammars and Parsing - Syntactic Processing: Collocations; Regular Expression and Automata; Morphology and Finite-State Transducers; N-grams; Word Classes and Part-of-Speech Tagging; Context-Free Grammars for English; Parsing with Context-Free Grammars: Top-down parsing, Bottom-up parsing; Features and Unification; Lexicalized and Probabilistic Parsing

Module III (12 Lectures)

Semantic processing: Representing Meaning; Semantic Analysis: Integrating semantic analysis to parsers, Semantic Grammars; Lexical Semantics; Word Sense Disambiguation and Information Retrieval: Selection-Restriction based disambiguation, Machine learning approaches; Dictionary based approaches, Information retrieval

Module IV (7 Lectures)

Pragmatics :Discourse, Dialogue and Conversational Agents: Dialogue acts, Automatic Interpretation of Dialogue acts; Natural Language Generation: Discourse Planning; Machine Translation: Direct Translations, Translation using Statistical techniques

Module V (7 Lectures)

Phonetics: Articulatory Phonetics, Phonetic features, Phonetic variations, Acoustic phonetics and signals; Speech Synthesis: Text normalization, Phonetic analysis, Prosodic analysis; Automatic Speech Recognition: Speech recognition architecture, Feature extraction - MFCC vectors, Search and decoding; Text-to-speech

Module VI (2 Lectures)

NLP Applications and Tools :Sentiment Analysis, Text Summarization, Text Entailment, Machine Translation, Question Answering, Cross Lingual Information Retrieval (CLIR), NLTK, WordNet

Suggested Readings

D. Jurafsky, J. H. Martin, Speech and Language Processing, Pearson Education
 Christopher D. Manning, Hinrich Schütze, Foundations of Statistical Natural Language Processing, The MIT Press,
 Cambridge, Massachusetts
 James Allen, Natural Language Understanding, 2/e, Pearson Education

Mapping of COs to Syllabus

CourseOutcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	H	L		L	
CO2		L	L	H	L	
CO3		L	M	M	H	
CO4		H	H			
CO5		H	H	M		
CO6		L	L	H		H

CSCG6100: COMPUTATIONAL GEOMETRY LAB (credits)

Course Outcomes

Construct algorithms for simple geometrical problems (Applying)

Apply geometric techniques to real-world problems in graphics. (Applying)

Analyze computational geometrical algorithms for small domain problems. (Analyzing)

Develop efficient computational geometrical algorithms. (Creating)

Implement the following task constructing algorithms in C language.

Area of a Polygon

Triangulating a polygon

Convex Hull in two dimensions

Convex Hull in three dimensions

Delaunay triangulation

Segment/ray-segment intersection

Segment/ray-triangle intersection

Point in polygon

Point in polyhedron

Intersecting convex polygons

Minkowski convolution with a convex polygon

Multilink robot arm reachability

Suggested Readings

Computational Geometry in C, Joseph O'Rourke, Cambridge University Press

<http://www.science.smith.edu/~jorourke/books/ftp.html>

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M				
CO2		H	M			
CO3	M	M	H	H	M	M
CO4			M	H	H	

CSAS6101: ADVANCED OPERATING SYSTEMS LAB

(credits)

Course Outcomes

Demonstrate the understanding on shell designing and scripting (Understanding)

Build and experiment with distributed operating systems algorithms (Applying)

Recall the basic concepts of distributed mutual exclusions (Remembering)

Experiment with the applications of distributed scheduling algorithms (Applying)

Construct a multithreaded program to understand the implementation issues of multiprocessor system.(Creating)

Design a program to classify and compare the security threats relating to virus (Understanding)

List of Experiments

Design and develop a shell that supports atleast 10 commands.

Design and develop a program to implement Lamport's algorithm.

Use ECOS operating system to develop a program for controlling accessing to a pool of resources using mutexes and condition variables.

Develop a program for a forward scheduling for unequal distribution.

Design a multi-class multithreaded program which simulates multiple sleeping barbers, wherein all in one barbershop having a finite number of chairs in the waiting room. Each customer is instantiated from a single customer class & each barber is instantiated from a single barber class.

Develop a program to identify the virus classification, such as boot sector infector, file infector and macro virus.

Suggested Readings

Milan Milenkovic, Operating Systems Concepts and Design, TMH.

M. Singhal and N.G. Shivaratri, Advanced Concepts in Operating Systems, TMH.

A. Silberschatz, P.B. Galvin and G. Gagne, Operating System Concepts, John Wiley and Sons.

Mapping of COs to Syllabus

CourseOutcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3		H		
CO4		H		
CO5			H	M
CO6				H

CSSN6102: SPEECH AND NATURAL LANGUAGE PROCESSING LAB (Credits)

Module I (4 Hours)

Natural Language Toolkit (NLTK): Installation and getting started; Accessing text corpora; Ngrams; Conditional Frequency Distribution; Regular expressions for detecting word patterns; Regular expressions for tokenizing text

Module II (3 Hours)

Using a tagger; Tagged corpora; Automatic tagging, Ngram tagging;

Module III (4 Hours)

Classify text; supervised classification; Naive Bayes classifiers; Information extraction; Chunking; Named entity recognition; Relation extraction

Module IV (4 Hours)

Parsing with context free grammars; Dependency grammar; Grammar development; Grammatical features; Processing feature structures; Natural language understanding; Propositional logic; First order logic

Suggested Readings

Steven Bird, Ewan Klein, Edward Loper, Natural Language Processing with Python, O'Reilly Media.

Jacob Perkins, Python Text Processing with NLTK 2.0 Cookbook, O'Reilly Media.

Mapping of COs to Syllabus

CourseOutcomes	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2		H	H	
CO3		M		H

CO4			L	H
CO5		L	H	
CO6	L		H	H

CSMP6103: PROJECT II (6 credits)

Course Outcomes

Recall the software development life cycle and fundamental phases of system/application/software design and research. (Remembering)

Explain how to carry out a project work and explain the importance of different phase of a system design, workflow and time estimation with research outlook. (Understanding)

Implement a system and plan how to perform research for real time application. (Applying)

Compare the feasibility of a project in terms of time, effort and money. (Analyze)

Evaluate a project based on its efficiency applicability robustness, user friendliness etc., with socio economic factors (Evaluating)

Design applications by examining and scientifically designing each phase of the project.(Creating)

CSNT0162: COMPUTER NETWORKS (Theory - 3 Credits)

Course Outcomes

1. Describe various technologies used for data communication (Understanding)
2. Identify possible errors in data transfer and solutions for them (Applying)
3. Describe the various protocols used in data communication (Remembering)
4. Classify the routing protocols and analyze how to assign the IP addresses for the given network (Applying)
5. Identify security issues in networks and available protection mechanisms (Applying)

Module 1 (10 hours)

Introduction to Computer networks, Topology of networks, Protocol Stack, OSI and TCP/IP models, Switching – Circuit Switching, Packet Switching and Message Switching.

Module 2 (12 hours)

Data link layer, Types of errors, Error detection and correction, Hamming distance, Cyclic Redundancy Check(CRC), checksum, Hamming code, Multiple Access, Random Access, ALOHA, pure ALOHA and slotted ALOHA, CSMA/CD and SCMA/CA, Polling, Wired LANs, Ethernet - IEEE standards.

Module 3 (14 hours)

Network layer, Networking and Internetworking devices - Repeaters, Bridges, Routers, Gateways, Logical addressing, Network Address Translation(NAT), Internet protocols, Address Mapping, Error reporting and multicasting - Delivery, Forwarding and Routing algorithms, Distance Vector Routing, Link State Routing.

Module 4 (12 hours)

Transport layer, Process-to-process Delivery: UDP, TCP and SCTP, Congestion control and Quality of Service, Application Layer, Domain Name Systems-Remote Login-Email FTP, WWW, HTTP, Introductory concepts on Network management: SNMP.

Module 5 (12 hours)

Cryptography and Network Security: Introduction, Types of attacks, confidentiality and integrity, various terminologies in cryptography, Basics of Symmetric Key Ciphers, block cipher and stream cipher, Basics of Asymmetric Key Ciphers – RSA Cryptosystem. Message Digest: Hash Function, Digital Signature.

Suggested Readings

1. Data Communications and Networking, 4th Edition, Behrouz A Forouzan, 2007
2. Computer Networks, 4th Edition, Andrew S Tannenbaum, 2003, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H	M		
CO3		H	H	H	
CO4			H		
CO5					H

CSCB0165: CYBER LAW AND ETHICS
(3 CREDITS – 45 HOURS)
Course Outcomes

1. Identify knowledge related to the constitution and its legal issues in cyberspace. (Remembering)
2. Explain the different cybercrimes, and the related cyber laws. (Understanding)
3. Demonstrate the different perspectives of professional ethics and responsibilities of engineers. (Understand)
4. Illustrate the concepts behind Cyber Torts, Intellectual Property Rights. (Understanding)
5. Describe the concepts in connection to dispute resolution in cyberspace. (Understanding)

Module 1 (10 HOURS)

Constitutional & Human Rights Issues in Cyberspace Freedom of Speech and Expression in Cyberspace, Right to Access Cyberspace – Access to Internet, Right to Privacy, Right to Data Protection, Cyber Crimes & Legal Framework Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber Pornography, Identity Theft & Fraud Cyber terrorism, Cyber Defamation.

Module 2 (15 HOURS)

Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies, Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities in Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering

Module 3 (10 HOURS)

Cyber Torts Cyber Defamation, Different Types of Civil Wrongs under the IT Act 2000, Intellectual Property Issues in Cyber Space Interface with Copyright Law, Interface with Patent Law, Trademarks & Domain Names Related issues.

Module 4 (10 HOURS)

Dispute Resolution in Cyberspace, Concept of Jurisdiction, Indian Context of Jurisdiction, and IT Act,

2000. International Law and Jurisdictional Issues in Cyberspace, Dispute Resolutions.

Suggested Readings

1. Engineering Ethics M. Govindarajan, S. Natarajan, V. S. Senthilkumar Prentice –Hall, 2004
2. Constitution of India, Professional Ethics and Human Rights Shubham Singles, Charles E. Haries, and et al Cengage Learning India 2018
3. Justice Yatindra Singh, Cyber Laws, Universal Law Publishing Co, New Delhi.
4. Verma S, K, Mittal Raman, Legal Dimensions of Cyber Space, Indian Law Institute.
5. Jonthan Rosenoer, Cyber Law, Springer, New York. 6. Sudhir Naib, The Information Technology Act, 2005: A Handbook, OUP, New York.

Mapping of COs to Syllabus

Course comes	Out-	Module 1	Module 2	Module 3	Module 4
CO1		H	M	L	L
CO2		M	H	L	L
CO3		L	H	L	L
CO4		L	L	H	L
CO5		L	L	L	H

CSQC0156: QUANTUM COMPUTING (3 credits – 45 hours)

Course Outcomes

1. Explain the working of a Quantum Computing program, its architecture and program model.
2. Develop the mathematical foundation for Quantum Computing.
3. Understand the architecture of a Quantum Computing platform.
4. Program quantum algorithm on major toolkits.

Module 1 (6 hours) Introduction to Quantum Computing - Motivation for studying Quantum Computing, Major players in the industry (IBM, Microsoft, Rigetti, D-Wave etc.), Origin of Quantum Computing, Overview of major concepts in Quantum Computing - Qubits and multi-qubits states, Bra-ket notation, Bloch Sphere representation, Quantum Superposition, Quantum Entanglement

Module 2 (9 hours) Mathematical Foundation for Quantum Computing, Matrix Algebra - basis vectors and orthogonality, inner product and Hilbert spaces, matrices and tensors, unitary operators and projectors, Dirac notation, Eigen values and Eigen vectors.

Module 3 (10 hours) Building Blocks for Quantum Program, Architecture of a Quantum Computing platform, Details of q-bit system of information representation - Bloch Sphere, Multi-qubits States, Quantum superposition of qubits (valid and invalid superposition), Quantum Entanglement, Useful states from quantum algorithmic perspective e.g. Bell State, Operation on qubits: Measuring and transforming using gates, Quantum Logic gates and Circuit: Pauli, Hadamard, phase shift, controlled gates, Ising, Deutsch, swap etc. Programming model for a Quantum Computing Program - Steps performed on classical computer, Steps performed on Quantum Computer, Moving data between bits and qubits.

Module 4 (20 hours) Quantum Algorithms, Basic techniques exploited by quantum algorithms - Amplitude amplification, Quantum Fourier Transform, Phase Kick-back, Quantum Phase estimation, Quantum Walks. Major Algorithms, Shor's Algorithm, Grover's Algorithm, Deutsch's Algorithm, Deutsch-Jozsa Algorithm. OSS Toolkits for implementing Quantum program, IBM quantum experience, Microsoft Q, Rigetti PyQuil (QPU/QVM)

Suggested Readings

1. Michael A. Nielsen, "Quantum Computation and Quantum Information", Cambridge University Press.
2. David McMahon, "Quantum Computing Explained", Wiley

Mapping of COs to Syllabus

Course Out-come	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		H	M	
CO3		M	H	M
CO4			M	H

CSAD0157: AD HOC AND SENSOR NETWORKS
(3 credits – 45 hours)
Course Outcomes

1. Recall and understand the concept design issues in ad hoc and sensor networks (Remembering)
2. Understand the different types of MAC protocols.(Understanding)
3. Apply the concept of routing protocol in Adhoc network (Applying)
4. Analyse the TCP issues in Adhoc networks. (Analysing)
5. Formulate the architecture and protocols of wireless sensor networks. (Evaluating)

Module 1 (9 hours) Fundamentals of Wireless Communication Technology – The Electromagnetic Spectrum – Radio propagation Mechanisms – Characteristics of the Wireless Channel -mobile ad hoc networks (MANETs) and wireless sensor networks (WSNs) : architectures, Applications of Ad Hoc and Sensor networks. Design Challenges in Ad hoc network

Module 2 (9 hours) Issues in designing a MAC Protocol- Classification of MAC Protocols- Contention based protocols-Contention based protocols with Reservation Mechanisms- Contention based protocols with Scheduling Mechanisms – Multi channel MAC-IEEE 802.11

Module 3 (9 hours) Issues in designing a routing and Transport Layer protocol for Ad hoc networks- proactive routing, reactive routing (ondemand), hybrid routing- Classification of Transport Layer solutions-TCP over Ad hoc wireless Networks.

Module 4 (9 hours) Single node architecture: hardware and software components of a sensor node – WSN Network architecture: typical network architectures-data relaying and aggregation strategies -MAC layer protocols: self-organizing, Hybrid TDMA/FDMA and CSMA based MAC- IEEE 802.15.4.

Module 5 (9 hours) Issues in WSN routing – OLSR- Localization – Indoor and Sensor Network Localization-absolute and relative localization, triangulation-QOS in WSN-Energy Efficient Design-Synchronization-Transport Layer issues.

Suggested Readings

1. C. Siva Ram Murthy, and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols “, Prentice Hall Professional Technical Reference, 2008.
2. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, World Scientific Publishing Company, 2006.
3. Feng Zhao and Leonides Guibas, “Wireless Sensor Networks”, Elsevier Publication – 2002.
4. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005
5. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks-Technology, Protocols, and Applications”, John Wiley, 2007. 6. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003

Mapping of COs to Syllabus

Course Out-comes	Module 1	Module 2	Module 3	Module 4	Module 5

CO 1	H				
CO 2	M	H			
CO 3			M		
CO 4			M		
CO 5				M	H

CSNN0158: NEURAL NETWORKS AND DEEP LEARNING (3 credits – 45 hours)

Course Outcomes

1. Summarize the role of Deep learning in Machine Learning Applications.(Understanding)
2. To design and implement Deep Learning Applications. (Creating)
3. Critically Analyse Different Deep Learning Models in Image Related Projects. (Analysing)
4. To design and implement Convolutional Neural Networks. (Applying)
5. Apply Deep Learning in NLP and Image Processing.(Applying)

Module I (12 hours) INTRODUCTION TO ANN Features, structure and working Computing Comparison of BNN and ANN, Backpropagation networks: (BPN)Architecture of feed forward network, single layer ANN, multilayer perceptron, back propagation learning, input - hidden and output layer computation, backpropagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning. Basics of Artificial Neural Networks -History of neural network research, characteristics of neural networks terminology, models of neuron Mc Culloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture.

Module II (9 hours) TRAINING NEURAL NETWORK Risk minimization, loss function, backpropagation, regularization, model selection, and optimization. Conditional Random Fields: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.

Module III (15 hours) INTRODUCTION TO DEEP LEARNING ARCHITECTURES Feed Forward Neural Networks, Gradient Descent, Back Propagation Algorithm, Vanishing Gradient problem, Mitigation, ReLU Heuristics for Avoiding Bad Local Minima, Heuristics for Faster Training, Nestors Accelerated Gradient Descent, Regularization, Dropout. CNN Architectures, Convolution, Pooling Layers, Transfer Learning, Image Classification using Transfer Learning LSTM, GRU, Encoder/Decoder Architectures, Autoencoders, Standard-Sparse, Denoising, Contractive, Variational Autoencoders, Adversarial Generative Networks Autoencoder and DBM.

Module IV (9 hours) APPLICATIONS OF NEURAL NETWORKS DEEP LEARNING Image Segmentation, Object Detection, Automatic Image Captioning, Image generation with Generative Adversarial Networks, Video to Text with LSTM Models, Attention Models for Computer Vision, Case Study: Named Entity Recognition, Opinion Mining using Recurrent Neural Networks, Parsing and Sentiment Analysis using Recursive Neural Networks, Sentence Classification using Convolutional Neural Networks, Dialogue Generation with LSTMs.

Suggested Readings

1. Ian Good Fellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.
3. Phil Kim, "Matlab Deep Learning: With Machine Learning, Neural Networks and Artificial Intelligence", Apress, 2017.
4. Ragav Venkatesan, Baixin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
5. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
6. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	M	

CO 3		M	H	M
CO 4			H	
CO 5		M		M

CSBF0159: BLOCKCHAIN FUNDAMENTALS**(3 credits – 45 hours)****Course Outcome**

1. The student will be able to identify the history, technology, and applications of Blockchain (Remembering)
2. The student will be able to explain Blockchain applications (Understanding)
3. The student will be able to demonstrate Blockchain concepts clearly and persuasively (Applying)
4. The student will be able to assess crypto currency exchanges and wallets safely (Evaluate)
5. The student will be able to create Crypto token (Create)

Module I (8 hours) Distributed systems, Byzantine Generals problem, Consensus, History of Blockchain Technology, Cryptographic Hashes, Digital Signatures, Peer to Peer Networks

Module II (12 hours) Introduction to Blockchain, Generic elements of a Blockchain, Features of a Blockchain, Applications of Blockchain technology, Tiers of Blockchain technology, Types of Blockchain, Hash-based Ledgers, Hash Validation - Proof Of work, Proof of stake, UTXO Model, Wallets and Private Keys, Ask-the-Expert session

Module III (10 hours) Consensus in Blockchain, CAP theorem and Blockchain, Structure of a Block: Header, Merkle trees, Benefits and limitations of Blockchain, Smart Contracts, Types of Blockchains

Module IV (10 hours) Platforms to implement Blockchain: Ethereum – Ether, Gas, Solidity, Multichain - permission, asset, streams, Hyperledger – Architecture, Framework (Fabric, Sawtooth Lake)

Module V (5 hours) Design Thinking, Business Awareness, Customer Handling, Case studies: Smart contract for crowd funding, Stock market transactions.

Suggested Readings:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton University Press (July 19, 2016).
2. Wattenhofer, The Science of the Blockchain
3. Antonopoulos, Mastering Bitcoin: Unlocking Digital Cryptocurrencies
4. Satoshi Nakamoto, Bitcoin: A Peer-to-Peer Electronic Cash System
5. DR. Gavin Wood, "ETHEREUM: A Secure Decentralized Transaction Ledger," Yellow paper.2014.
6. Nicola Atzei, Massimo Bartoletti, and Tiziana Cimoli, A survey of attacks on Ethereum smart contracts

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M			
CO 2	M	M	H		
CO 3	M	M	H		
CO 4	L		M	H	
CO 5			H	M	H

CSCM0160: CLOUD COMPUTING**(3 credits – 45 hours)****Course Outcomes**

1. Define the various evolutionary steps of computation. (Remembering)
2. Illustrate security issues associated with cloud computation. (Understanding)

3. Apply the use of a virtual private cloud in Amazon web service and Experiment with the management console for virtualization using hypervisors. (Applying)
4. Develop an application using map reduce program and create an application and deploy on real time cloud platform like IBM Bluemix. (Creating)
5. Analyze the concepts of big data and Hadoop components. (Analysing)
6. Develop and assess a real time application deployed on cloud platform. (Creating/Evaluating)

Module 1(10 hours) Introduction to Cloud Computing, the Evolution of Cloud Computing, Hardware Evolution, Internet Software Evolution, Server Virtualization, Web Services Deliver from the Cloud, Communication-as-a-Service, Infrastructure-as-a-Service, Monitoring-as-aService, Platform-as-a-Service, Software-as-a-Service, Building Cloud Network

Module 2 (13 hours) Datan the cloud: Relational databases, Cloud file systems: GFS and HDFS, Big Table, HBase and Dynamo. Map-Reduce and extensions: Parallel computing, The map-Reduce model, Parallel efficiency of Map-Reduce, Relational operations using MapReduce, Enterprise batch processing using Map-Reduce, Introduction to cloud development, Example/Application of Mapreduce.

Module 3 (14 hours) Putting Security on the Spot with Questions: Understanding Security Risks, Reducing Cloud Security Breaches, Implementing Identity Management, Benefits of identity management, Aspects of identity management, Playing Detective: Detection and Forensics, Activity logs, HIPS and NIPS, Data audit, Encrypting Data, Creating a Cloud Security Strategy

Module 4 (8 hours) Virtualization and the Cloud: Visualizing Virtualization, Characteristics, Using a hyper visor in virtualization, Abstracting hardware assets, Managing Virtualization, Foundational issues, Abstraction layer, Provisioning software, Virtualizing storage, Hardware provisioning, Security issues, Taking Virtualization into the Cloud.

Suggested Readings

1. Cloud Computing for Dummies by Judith Hurwitz, R. Bloor, M. Kaufman, F. Halper, (Wiley India Edition)
2. Enterprise Cloud Computing by Gautam Shroff, Cambridge.
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
4. Google Apps by Scott Granneman, Pearson
5. Cloud Security and Privacy by Tim Malhar, S. Kumaraswamy, S. Latif (SPD,O'REILLY)
6. Cloud Computing: A Practical Approach, Anthony T Velte, et.al McGraw Hill
7. Cloud Computing Bible by Barrie Sosinsky, Wiley India

Mapping of COs to Syllabus

Course comes	Out-	Module 1	Module 2	Module 3	Module 4
CO 1		H			
CO 2		H			
CO 3			H		
CO 4			M	H	
CO 5			H		
CO 6				H	H

CSMP6104: MAJOR PROJECT - PHASE II (3 credits)

Course Outcomes

1. Define and choose the Software Development Life Cycle and fundamental phases of system / application / software design and research. (Remembering)
2. Demonstrate how to carry out a project work and understand the importance of different phases of a system design, workflow and time estimation with research outlook. (Understanding)
3. Construct a system and identify how to perform research for real time application. (Applying)
4. Analyze the feasibility of a project in terms of time, effort and money. (Analysing)

5. Evaluate a project based on its efficiency, applicability, robustness, user friendliness etc., with socio-economic impact. (Evaluating)
6. Design applications by examining and scientifically designing each phase of a project work. (Creating)

**PYTK0103: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
(2 Credits)**

Description of the Course This paper is an introduction to some of the basic concepts, themes and questions in traditional Indian insights. We shall begin with a brief darshan and the *jijñāsā* ('desire to know') of the *ṛṣi* ('Sage') on the dominant concepts, themes and queries that developed into a system of thinking. This shall be followed by a discourse on the principal themes and concepts, which emerged as the basis of belief systems and ethics of life. And, finally we shall reflect on the ethics and goals of life with its present-day challenges, and see if the wisdom of the past – Indian darshan could offer a way forward for philosophising the essence of life.

Objective:

The objective of this course is two-fold.

1. To gain insight of and appreciate the richness of ancient Indian philosophical traditions
2. To inculcate *jijñāsā* (desire to know) and develop the art of philosophising with the essence of Indian tradition.

Course Outcome: On completion of this course the students shall be able to:

1. name the Indian schools of thought and relate the concepts associated with the schools. (Knowledge/Memory)
2. differentiate the schools of thoughts and explain the characteristic of the schools. (Comprehension/Understanding)
3. identify and locate the school of thought and concepts in contemporary thinking. (Application/Usage)
4. compare and analyse the schools of thought with the current day thinking (Analysis/Enquiry)
5. generalise and summarise the influence of concepts and schools of thought in our present day thinking. (Synthesis/amalgamation)
6. assess and determine the importance philosophising and thinking in human life. (Evaluation/Appraisal)

UNIT I: Introduction (4 HOURS)

1. Introduction to Indian thinking
2. The Vedas and Upanisads: Ritual to critique of ritual and the doctrine of the self

UNIT II: Astika Schools (10 HOURS)

1. Sāṃkhya: Prakṛti and Puruṣa, Theory of Evolution
2. Yoga – Body, Mind and Self
3. Nyāya-Vaiśeṣika - Nature of Knowledge
4. Mīmāṃsā - Vedānta – Knowledge and Knowledge of Reality

UNIT III: Nastika Schools (6 HOURS)

1. Cārvāka: Metaphysics and Epistemology
2. Early Buddhism: Four Noble Truths (Arya Satyas) and Doctrine of Dependent Origination (Pratītyasamutpāda)
3. Jainism: Anekāntavāda and Syādvāda (Theory of relativity)

UNIT IV: INDIAN ETHICS (10 HOURS)

1. Bhagavad-Gita: Niṣkāmakarma
2. Ashrama: Brahmacharya, Grihastha, Vanaprastha and Sannyasa
3. Puruṣārthas: Dharma, Artha, Kāma, and Mokṣa
4. Conception of Satya and Ahimsā
5. Environmental Ethics and Sustainability

Suggested Readings:

1. Chakravarty, N. (1992), Indian Philosophy: The Path Finder's and System Builders. New Delhi: Allied Publishers.
2. Chatterjee, S.C. & Datta, D.M. (1984). An Introduction to Indian Philosophy, (reprint). Calcutta: University of Calcutta.
3. Dasgupta, S.N. (2004). A History of Indian Philosophy (vol.1). Delhi: Motilal Banarasidass Publishers, Pvt. Ltd.
4. Hiriyana, M. (1951). Outlines of Indian Philosophy. London: Allen & Unwin.
5. Radhakrishnan, S. (2008) Indian Philosophy (Vol. 1 & Vol. 2). 2nd Edition. Oxford University Press.
6. Narayan, R. and Kumar, J. (2003) Ecology and Religion: Ecological Concepts in Hinduism, Buddhism, Jainism, Islam, Christianity and Sikhism, Deep and Deep Publications: New Delhi.
7. Singh, V. (2012). The Human Footprint on Environment: Issues in India. Macmillan India: New Delhi. 2012

Mapping of COs to Syllabus

Course comes	Unit I	Unit II	Unit III	Unit IV
CO 1	H			
CO 2	H			
CO 3		H		
CO 4		M	H	
CO 5		H		
CO 6			H	H

CSM1227T: ORGANISATIONAL BEHAVIOUR (3 credits – 30 hours)

(L-T-P:3-0-0)

Objective: This course is designed to give students the basic knowledge of human behavior needed to provide a more effective organizational environment. The basic elements of the course will be the behavior of individuals in organizations, group behavior in organizations, and how these behaviors affect the overall performance of organizations. Particular emphasis is placed on individual difference, attitude, motivation, job satisfaction, communication, leadership, stress, change, and organizational culture.

Module I (5 hours)

The Study of Organizational Behaviour (OB): Learning objectives, Definition and Meaning, Why Study OB, Models in OB, New Challenges for OB Manager. Learning – Nature of Learning, How Learning occurs, Learning and OB. Case Analysis

Module II (7 hours)

Foundations of Individual Behaviour: Personality – Meaning and Definition, Determinants of Personality, Personality Traits, Personality and OB. Perception – Meaning and Definition, Perceptual Process, Importance of Perception in OB. Motivation– Nature and Importance, Herzberg's Two Factor Theory, Maslow's Need Hierarchy Theory, Alderfer's ERG Theory, Evaluations. Case Analysis

Module III (10 hours)

Organizational Behaviour Process: Communication – Importance, Types, Gateways and Barriers to Communication, Communication as a tool for improving Interpersonal Effectiveness. Groups in Organizations - Nature, Types, Why do people join groups, Group Cohesiveness and Group Decision making Managerial Implications, Effective Team Building.

Leadership – Leadership and Management, Theories of Leadership – Trait theory, Leader Behaviour theory, Contingency Theory, Leadership and Followership, How to be an effective Leader. Conflict – Nature of Conflict and Conflict Resolution. An Introduction to Transactional Analysis (TA). Case Analysis

Module IV (8 hours)

Organization: Organizational Culture – Meaning and Definition, Culture and Organizational Effectiveness. Introduction to Human Resource Management – Selection, Orientation, Training and Development, Performance Appraisal, Incentives; Organizational Change – Importance of Change, Planned Change and OB techniques. International Organizational Behaviour – Trends in International Business, Cultural Differences and Similarities, Individual and Interpersonal Behaviour in Global Perspective. Case Analysis

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

- CO1: Define the meaning of organization behavior (Knowledge)
- CO2: Explain the models and the theory of learning and the foundations of individual behavior. (Comprehension)
- CO3: Establish the relationship between the various theories of motivation and workplace behavior. (Application)
- CO4: Differentiate between leadership and management and the different leadership theories. (Analysis)
- CO5: Formulate different types of leadership strategies. (Synthesis)
- CO6: Evaluate the various human resource management functions. (Evaluation)

Suggested Readings

VSP Rao, Organizational Behaviour, Excel Books.
Stephen P Robbins, Organizational Behaviour, PHI Learning, New Delhi
JW Newstorm and K. Davis, Organizational Behaviour: Human Behaviour at Work, MGH, New Delhi
K. Aswathappa, Organizational Behaviour, Himalaya Publishing House, New Delhi
PN Khandawalla, Organizational Behaviour, McGraw Hill, New Delhi.

CSES228T: ENVIRONMENTAL SCIENCE (0-0-0)

Course Outcomes:

Name different types of natural resources; state the concept of an ecosystem, recall the types of biodiversity and ways of conserving biodiversity, causes, effects and control measures of pollution, social issues and its effect on the environment. (Remembering)
Explain what they understand by an ecosystem, biodiversity, explain how environmental pollution occurs and steps that can be taken to control pollution. (Understanding)
Value the overall benefit to the environment of preserving natural resources, preserving ecosystems and conserving biodiversity. Learn about sustainable development to protect the environment and promote human health. (Evaluating)
Develop ideas of how to preserve the environment by connecting the ideas of minimizing pollution, regulating human population growth, conserving biodiversity by preserving ecosystems and judicious use of natural resources. (Creating)

Module 1: The Multidisciplinary Nature of Environmental Studies (3 lectures)

Definition, scope and importance, need for public awareness.

Module 2: Natural Resources (3 lectures)

Different types of natural resources and associated problems - forest resources, water resources, mineral resources, food resources, energy resources, land resources.
Conservation of natural resources.

Module 3: Ecosystems (4 lectures)

Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, food chains, food webs.
Structure of following ecosystems - forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems.

Module 4: Biodiversity and Its Conservation (4 lectures)

Types of biodiversity – genetic, species and ecosystem, value of biodiversity, global biodiversity, India as a mega-diversity nation, threats to biodiversity, conservation of biodiversity - in-situ and ex-situ conservation.

Module 5: Environmental Pollution (6 lectures)

Definition, causes, effects and control measures of - air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards and e-pollution, Solid waste management, Disaster management

Module 6: Social Issues and the Environment (6 lectures)

From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, climate change, global warming, acid rain, ozone layer depletion.

Environment protection act.

Introduction to environmental impact assessment.

Module 7: Human Population and the Environment (4 lectures)

Population growth and sex ratio; Population explosion - family welfare programme; Environment and human health; HIV/AIDS; Role of information technology in environment and human health.

Suggested Readings

Textbook of Environmental Studies, Erach Bharucha; UGC, New Delhi

Environmental Studies, University, J.P. Sharma; Science Press

Real World Cases in Green Chemistry, Cann, M.C. & Connelly, M.E., ACS, 2000

Understanding our Environment: An Introduction to Environmental Chemistry and Pollution, Roy, M. Harrison; R.S.C.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7
CO 1		H			M		H
CO 2	M			H		H	
CO 3		M					M
CO 4			M		H		

CSAP224T: Advanced Programming**Course Outcome**

(Essential) Use medium-level programming constructs effectively (objects, data abstraction, recursion, etc.)

(Essential) Design and implement software using modular, object-oriented techniques

(Essential) Work with data structures within programs (arrays, lists, trees) in this course's context.

(Desired/Advanced) Understand more advanced programming paradigms (e.g., concurrency or generic programming) if the institute includes them.

Syllabus Modules and Topics**Module 1: Objects and Classes**

Object-oriented programming fundamentals

Classes, objects, encapsulation

Constructors, destructors

Static members, access control

Module 2: Inheritance and Polymorphism

Types of inheritance

Method overriding

Polymorphism (compile-time and run-time)

Abstract classes and interfaces

Module 3: Exception Handling

Errors and exceptions

Try-catch-finally blocks

Custom exceptions

Best practices in exception handling

Module 4: Generic Programming

Templates (in C++ / generics in Java)
Generic classes and functions / methods

Module 5: Recursion and Advanced Data Structures

Recursive functions: definition and usage
Data structures: linked lists, stacks, trees (especially binary trees)
Implementation using OOP principles

Module 6: File Handling / I/O

Streams, file I/O
Text and binary file operations
Serialization (if included as advanced)

Module 7: (Optional / Advanced) Concurrency / Threads

Thread creation, synchronization
Issues: deadlock, race condition
Thread-safe programming (if institute has capacity)

Recommended Textbooks / References

Concepts, Techniques, and Models of Computer Programming by Peter Van Roy & Seif Haridi.

Standard OOP texts (depending on language used) — e.g., Java or C++ programming books.

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

BACHELOR OF TECHNOLOGY (BTECH) – ELECTRICAL AND ELECTRONICS ENGINEERING
***COURSE STRUCTURE (NEP BATCH 2024)**

*Undergraduate Degree Course Structure from first to fourth semester is based on AICTE Model Curriculum 2024 (Subject to Change)"

SEMESTER I (NEP Batch)						
Type	Type of Course/ Category	Course Code	Course Name	L-T-P	Credits	Page No
Theory	BS/IC	PSPT111T	Physics for Technologists	3-1-0	4	
	BS/IC	MAM113T	Mathematics I	3-1-0	4	
	ES/IC	CSPS100T	Programming for Problem Solving	3-0-0	3	
	ES/IC	CVGD100T	Engineering Graphics and Design	1-0-4	3	
	ES/IC	MNDI101L	Design Thinking and Idea Lab	1-0-2	2	
	HS/IC	EGTW107T	English for Technical Writing	2-0-0	2	
Lab	BS/IC	PSPT112L	Physics for Technologists Lab	0-0-2	1	
	ES/IC	CSPS101L	Programming for Problem Solving Lab	0-0-4	2	
	HS/IC	EEET102P	English for Technical Writing Lab	0-0-2	1	
Audit	MC/IC Weeks (3 Compulsory)	BTUH0001	Universal Human Values (UHV I): Student Induction Program	0-0-0	NC	
Total Credits					22	
SEMESTER II (NEP Batch)						
Theory	BS/IC	CHCY118T	Chemistry	3-1-0	4	
	BS/IC	MAMT114T	Mathematics II	3-1-0	4	
	ES/IC	EEEL102T	Basic Electrical Engineering	3-1-0	4	1135
	BS/IC	BOBE113T	Biology for Engineers	3-0-0	3	
	ES/IC	MNWM100L	Workshop/Manufacturing Practices	1-0-2	2	
	HS/IC	BTUH0002	Universal Human Values (UHV II)	2-1-0	3	
Lab	BS/IC	CHCY119L	Chemistry Lab	0-0-2	1	
	ES/IC	EEEL101L	Basic Electrical Engineering Lab	0-0-2	1	
Audit	MC/IC	BTSY0003	Sports and Yoga or NSS/NCC	1-0-4	NC	
Total Credits					22	
SEMESTER III (NEP Batch)						
Theory	PC/DC	EEAE205T	Analog Electronics	3-1-0	4	1136
	PC/DC	EEIS206T	Information and Signals	3-1-0	4	1137
	PC/DC	EENA207T	Network Analysis	3-1-0	4	1139
	PC/DC	EEEM210T	Electrical Machines-I	3-1-0	4	1140
	ES/IC	MNEM204T	Engineering Mechanics	3-1-0	4	
	HS/IC	MIKS0109T	Introduction to Indian Knowledge Systems	2-0-0	2	1142
Lab	PC/DC	EEEM206P	Electrical Machines-I Laboratory	0-0-2	1	1184
	PC/DC	EENA205P	Network Analysis Laboratory	0-0-2	1	1185
	PC/DC	EEAE204P	Analog Electronics Laboratory	0-0-2	1	1186
Audit	MC/IC	CHES0029	Environmental Science	3-0-0	NC	

	MC/IC		Constitution of India	3-0-0	NC	
Total Credits					25	
SEMESTER IV (NEP Batch)						
Theory	PC/DC		Digital Electronics	3-1-0	4	1146
	PC/DC		Control Systems	3-1-0	4	1147
	PC/DC		Power Electronics	3-1-0	4	1148
	PC/DC		Electromagnetic Fields	3-1-0	4	1150
	PE		Digital Signal Processing	3-1-0	4	1151
			Electric Machines – II			1152
	HS/IC		Entrepreneurship	2-0-0	2	
Lab	PC/DC		Digital Electronics Laboratory	0-0-2	1	1187
	PC/DC		Control Systems Laboratory	0-0-2	1	
	PC/DC		Power Electronics Laboratory	0-0-2	1	1189
Intern-ship			Summer Internship I		1	
Total Credits					26	
SEMESTER V (Non-NEP Batch)						
Theory	PC/DC	EEPS0072	Power Systems -I	3-0-0	3	1155
	PC/DC	EECS0073	Control Systems	3-0-0	3	1156
	PC/DC	EEMM0074	Microprocessors and Microcontrollers	3-0-0	3	1157
	PC/DC	EESS0075	Signals and Systems	3-0-0	3	1158
	PE/DE	EEED0076	Electrical Machine Design	2-0-0	2	1159
		EEEW0077	Electromagnetic Waves			1160
	OE/SE/IE	EEED0078	Electronic Devices	3-0-0	3	1161
Lab	PC/DC	EEMM6042	Microprocessors and Microcontrollers Laboratory	0-0-2	1	1162
	PC/DC	EERS6043	Power Systems Laboratory - I	0-0-2	1	1190
	PC/DC	EECS6044	Control Systems Laboratory	0-0-2	1	1188
Project	PC/DC	EEMI6045	Mini Project-I	0-0-2	1	1192
Intern-ship		BTIP13	Internship Seminar		3	1192
Total Credits					24	
SEMESTER VI (Non-NEP Batch)						
Theory	PC/DC	EEPS0079	Power Systems - II	3-0-0	3	1163
	PC/DC	EEMI0080	Measurements and Instrumentation	2-0-0	2	1164
	HS/IC	MTPO0106	Production and Operations Management	3-0-0	3	
	PE/DE	EEED0082	Electrical Drives	3-0-0	3	1165
		EEHV0083	High Voltage Engineering			1166
	PE/DE	EEDS0084	Digital Control Systems	3-0-0	3	1167
		EEDP0085	Digital Signal Processing			1168
	OE/SE/IE		Embedded Systems (ECE) Numerical Methods and Optimization (MNE)	3-0-0	3	
Lab	PC/DC	EEPS6046	Power Systems Laboratory - II	0-0-2	1	
	PC/DC	EEMI6047	Measurements and Instrumentation Lab	0-0-2	1	1193

	PC/DC	EEED6048	Electronic Design Laboratory	1-0-4	3	1193
Project	PC/DC	EEMI6049	Mini Project-II	0-0-2	1	1194
Total Credits					23	
SEMESTER VII (Non-NEP Batch)						
Theory	HS/IC	MTFC0107	Financial Management and Accounting	2-0-0	2	
	PC/DC	EEAD0093	Analog and digital Communications	3-0-0	3	1169
	PE/IC	EESP0094	Power System Protection	3-0-0	3	1170
		EERE0095	Renewable Energy			1170
	OE/SE/IE		Power Plant Engineering (MNE) Introduction to Artificial Intelligence and Machine Learning (ECE) ICT for development (CSE) E commerce and cyber security (CSE) Metro Systems Engineering (CVE) Remote sensing and GIS (CVE)	3-0-0	3	
	PC/DC	EEIT6052	Industrial Training		3	
Project	PC/DC	EEMP6053	Major Project Phase-I		1	1194
Total Credits					18	
SEMESTER VIII (Non-NEP Batch)						
Theory	PE/IC	EEPQ0096	Power Quality and FACTS	3-0-0	3	1172
		EESD0116	Power System Dynamics and Control			1173
	PE/IC	EEIS0097	Industrial Electrical Systems	3-0-0	3	1174
		EECA0098	Electrical Energy Conservation and Auditing			
	OE/SE/IE		Internet of things (ECE) Bioinformatics (ECE) Cloud computing (CSE) Business Analytics (CSE) Robotics and Automation (MNE) Numerical Methods and Optimization (MNE)	3-0-0	3	
	MC/IC	PYTK0103	Essence of Indian Traditional Knowledge		NC	
Project	PC/IC	EEMP6054	Major Project Phase II and Viva		3	
Total Credits					24	
Total Programme Credits					172	

OPEN ELECTIVE COURSES OF BTECH (EEE)

Semester V						
Type	Type of Course/Category	Course Code	Course Title	L-T-P	Credits	Page No
Theory	OE/SE/IE	EEEL0096	Electrical Machines (L-T-P is different from “Electrical Machines (minor)” offered for BTECH Minor)	3-0-0	3	
		EEWE0092	Waste to Energy	3-0-0		
Semester VI						
Type	Type of Course/Category	Course Code	Course Title	L-T-P	Credits	Page No

Theory	OE/SE/IE	EEOD0099	Optoelectronic Devices	3-0-0	3	1178
		EEEL0100	Electrical and Electronics Materials			1179
Semester VII						
Type	Type of Course/Category	Course Code	Course Title	L-T-P	Credits	Page No
Theory	OE/SE/IE	EESS0075	Signals and Systems	3-0-0	3	1180
		EEOT0101	Optimization Techniques			1182
Semester VIII						
Type	Type of Course/Category	Course Code	Course Title	L-T-P	Credits	Page No
Theory	OE/SE/IE	EEGE0102	Green Energy	3-0-0	3	1182
Total Credits					12	

VALUE ADDED COURSES BY ELECTRICAL AND ELECTRONICS ENGINEERING DEPARTMENT

Semester	Course Code	Course Title	L-T-P	Credits	Page No
6	EEAR0112	Introduction to Arduino and Raspberry Pi	0-1-2	2	1195
7	EEAL0113	AutoCAD Electrical	0-1-2	2	1195
7	EEEL0114	Electrical Wiring	0-1-2	2	1196
7	EEEV0116	Introduction to Electric Vehicles	0-1-2	2	1197
8	EEPY0115	Python for Electrical Engineering	0-1-2	2	1197

MINOR COURSES BY DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

Semester	Course Code	Course Title	L-T-P	Credits	Page No
3	EEEM210T	Electrical Machines	3-1-0	4	
4	EEEEPE233T	Power Electronics and its Applications	3-0-0	3	
5		Introduction to Modern Power Systems	3-1-0	4	
6		Fundamentals of Control Systems Engineering	3-1-0	4	
7		Industrial Electrical Safety Practices	3-1-0	4	

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING**NEP Batch Syllabus (1st Sem to 4th Sem)****DETAILED SYLLABUS THEORY COURSES****EEEL100T: BASIC ELECTRICAL ENGINEERING**

(3 Credits – 45 hours) (L-T-P: 2-1-0)

(For BTech CVE and MNE) Objectives:

To understand and analyse basic electric and magnetic circuits.

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations.

COURSE OUTCOMES

Define basic terminologies related to electrical circuits and machines. (Remembering)

Explain the working principle, construction, applications of dc machines and ac machines. (Understanding)

Explain basics of converters, domestic wiring and Electrical Installations. (Understanding)

Implement network theorems to simplify and solve a complex circuit. (Applying)

Module 1: DC Circuits (10 lectures)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (15 lectures)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, R-L, R-C, R-L-C combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Electrical Machines (10 lectures)

DC Machines: Principle of operation of generators and motors, construction of DC machine, EMF and Torque Equations, Classification and applications of DC machines.

Transformer: Construction and principle of operation of a single-phase transformer, EMF equation, introduction of autotransformer.

Induction Motor: Classification and applications, Construction and principle of operation of single phase and three-phase induction motor

Module 4: Power Converters (5 lectures)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 5: Electrical Installations (5 lectures)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Readings

1. Abhijit Chakrabarti, Basic Electrical Engineering, The McGraw-Hill Companies
2. Ritu Sahdev (2024), Basic Electrical Engineering, Khanna Book Publishing Co.
3. Ashfaq Husain and Haroon Ashfaq, Basic Electrical Engineering, Dhanpat Rai & Co.
4. Hayt and Kimberly, Engineering Circuit Analysis, Tata McGraw Hill.
5. Kulshreshtha D.C. (2009), Basic Electrical Engineering, Tata McGraw Hill.
6. Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M	M		
CO 2			H	M	
CO 3				H	H
CO 4	H	H			

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	3	1	1								2	2	1	1
CO 2	2	3	3	1	1								2	3	2	2
CO 3	1	2	3	1	1								1	2	1	1
CO 4	3	3	3	2	1								2	3	3	2

Mapping of Courses to PO/PSO

Course code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4

EEEL100T	H	H	H	M	L									M	H	H	M

EEEL102T: BASIC ELECTRICAL ENGINEERING

(4 Credits – 60 hours) (L-T-P: 3-1-0) (For BTech CSE, EEE and ECE)

Objectives:

To understand and Analyse basic electric and magnetic circuits.

To study the working principles of electrical machines and power converters.

To introduce the components of low voltage electrical installations.

COURSE OUTCOMES

Describe the construction, operation, and performance characteristics of electrical machines including transformers, DC machines, and three-phase induction motors. (Remembering)

Explain the principles of electromagnetic induction and apply concepts such as self and mutual inductance in magnetic and electrical systems. (Understanding)

Identify and compare various conventional and renewable sources of electrical power generation and explain their role in modern energy systems. (Applying)

Analyze DC and AC electrical circuits using fundamental laws and apply phasor techniques to determine voltage, current, power, and energy. (Analyzing)

Module I: D. C. Circuits covering, Ohm's Law and Kirchhoff's Laws (8 hours)

Analysis of series, parallel and series-parallel circuits excited by independent voltage sources; Power and energy; Electromagnetism covering, Faradays Laws, Lenz's Law, Fleming's Rules, Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Energy stored in magnetic fields;

Module II: Single Phase and Three Phase A.C. Circuits (12 hours)

Single Phase A.C. Circuits covering, Generation of sinusoidal voltage- definition of average value, root mean square value, form factor and peak factor of sinusoidal voltage and current and phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, RL, RC and RLC circuits; Real power, reactive power, apparent power and power factor, series, parallel and series- parallel circuits; Three Phase A.C. Circuits covering, Necessity and Advantages of three phase systems, Generation of three phase power, definition of Phase sequence, balanced supply and balanced load; Relationship between line and phase values of balanced star and delta connections; Power in balanced three phase circuits, measurement of power by two wattmeter method; Effect of Damper, Flux Linkage Variation and AVR.

Module III: Transformer (6 hours)

Transformers covering, Principle of operation and construction of single phase transformers (core and shell types). EMF equation, losses, efficiency and voltage regulation; Synchronous Generators covering, Principle of operation; Types and constructional features; EMF equation.

Module IV: DC Machines (8 hours)

DC Machines covering, working principle of DC machine as a generator and a motor; Types and constructional features; EMF equation of generator, relation between EMF induced and terminal voltage enumerating the brush drop and drop due to armature reaction; DC motor working principle; Back EMF and its significance, torque equation; Types of D.C. motors, characteristics and applications; Necessity of a starter for DC motor;

Module V: Three Phase Motors (6 hours)

Module V: Three Phase Induction Motors covering; Concept of rotating magnetic field; Principle of operation, types and constructional features; Slip and its significance; Applications of squirrel cage and slip ring motors; Necessity of a starter, star-delta starter.

Module VI: Sources of Electrical Power (5 hours)

Sources of Electrical Power covering, Introduction to Wind, Solar, Fuel cell, Tidal, Geo-thermal, Hydroelectric, Thermal-steam, diesel, gas, nuclear power plants; Concept of cogeneration, and distributed generation;

Suggested Readings

1. Abhijit Chakrabarti, Basic Electrical Engineering, The McGraw-Hill Companies
2. Ritu Sahdev (2024), Basic Electrical Engineering, Khanna Book Publishing Co.
3. Nagrath I.J. and D. P. Kothari (2001), Basic Electrical Engineering, Tata McGraw Hill.

4. Hayt and Kimberly, Engineering Circuit Analysis, Tata McGraw Hill.
5. Kulshreshtha D.C. (2009), Basic Electrical Engineering, Tata McGraw Hill.
6. Rajendra Prasad (2009), Fundamentals of Electrical Engineering, Prentice Hall

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1		M	M		M	M
CO2	M		L	M	L	L
CO3	H	M		H		
CO4	H	H	L			H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	2	2	1	1	2						3	2	2	1
CO 2	3	3	3	2	2	2	2						3	3	3	3
CO 3	3	3	3	2	1	1	1						3	3	3	2
CO 4	3	3	3	2	2	2	1						3	2	3	2

Mapping of Courses to PO/PSO

Course code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EEEL102T	L	H	H	M	L	L	M						M	H	H	L

EEAE205T: ANALOG ELECTRONICS

(4 Credits - 60 hours) (L-T-P: 3-1-0)

Course Outcomes

Recall the operating principles and structural characteristics of diodes, BJTs, and MOSFETs, and their role in analog electronic circuits. (Remembering)

Explain amplifier configurations (CE/CS, CB/CG, CC/CD) and interpret small and high-frequency performance using low- and high-frequency models. (Understanding)

Design biasing circuits and single-stage amplifiers to meet given specifications, using small-signal models for performance estimation. (Applying)

Analyze multi-stage amplifier circuits, feedback configurations, and oscillators to evaluate parameters like gain, bandwidth, stability, and CMRR. (Analyzing)

Objective

To provide students with a solid foundation in analog electronic circuits through an in-depth study of semiconductor devices, amplifier configurations, frequency response, and feedback systems, while emphasizing analysis, design, and implementation skills relevant to real-world applications.

Module I: Semiconductor devices (12 hours)

Diode, BJT, MOSFET, their structures, principle of operations, electrical characteristics and their low frequency models, Amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier

Module II: Biasing schemes & Small signal analysis (12 hours)

Biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features. Small signal analysis: Estimation of voltage gain, input resistance, output resistance etc. for CE/CS, CB/CG, CC/CD amplifiers, and design procedure for particular specifications.

Module III: High frequency analysis: (6 hours)

High frequency analysis: Miller's theorem, high frequency transistor models, frequency response of single stage amplifier (CE/CS, CB/CG, CC/CD amplifiers)

Module IV: Current mirrors (6 hours)

Current mirrors: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (V_{ON}), maximum usable load, generation of current source.

Module V: Differential amplifier, Feedback and Stability: (12 hours)

Differential amplifier: Basic structure and principle of operation, calculation of differential gain, common-mode gain, CMRR and ICMR. Different feedback topologies such as voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., concept of stability.

Module VI: Operational amplifier and Oscillators (12 hours)

Design of two-stage amplifier, frequency compensation, generalized structure of multistage amplifier. Basic criteria for oscillation, Phase-shift, and Wien Bridge, oscillators, multivibrators (astable, monostable, bistable).

Suggested Readings

B. Razavi, "Fundamentals of Microelectronics", Wiley, 2013.

A. S. Sedra and K. C. Smith, "Microelectronic Circuits", OUP, 2017.

[S Salivahanan](#), N Suresh Kumar, "Electronic Devices and Circuits", McGraw Hill, 2022.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M	M	M	L	L
CO2	M	H	H	L	M	L
CO3	L	H	M	H	L	L
CO4	L	M	L	L	H	H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	1	1	1					1	1	2	3	2	3	2
CO 2	3	3	2	2	1					2	1	2	3	3	3	3
CO 3	3	3	3	2	2					1	1	2	3	3	3	3
CO 4	3	3	2	3	2					1	1	3	3	3	3	3

Mapping of Courses to PO/PSO

Course code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EEAE205T	H	H	H	M	M	L	L	L	L	L	L	M	H	H	H	H

EEIS206T: INFORMATION AND SIGNALS

(4 Credits - 60 Hours) (L:T:P - 3:1:0)

Course Objective

To develop skills for analyzing signals and systems for any given process.

COURSE OUTCOMES

After completing the course, the students will be able to-

CO1: Apply the concepts of real time systems such as notion of stability and causality into the practical field. (Applying)

CO2: Analyze different types of systems and signals using the concepts and tools. (Analyzing)

Module-I (8 hours)

Signals and Systems: signal characterization: discrete and continuous, energy, power, periodicity, finite duration. System characterization: linearity, time invariance, stability, causality, memory, invertibility.

Module-II (10 hours)

Linear Time-Invariant systems: delta functions, unit step functions, impulse response, convolution, impulse response characterization with respect to system properties such as causality.

Module-III (10 hours)

Fourier Series Representation: Eigen-function of the LTI system, Fourier series representation of periodic signals (continuous and discrete), properties of Fourier series: linearity, time shifting, time scaling, conjugation, multiplication, convolution. Parseval's relation.

Module-IV (10 hours)

Fourier Transform: convergence of Fourier transform, representation of aperiodic signals (continuous and discrete) with Fourier transform, representation of periodic signals (continuous and discrete) with Fourier transform, properties of Fourier transforms: linearity, differentiation in time and frequency, convolution, multiplication, time and frequency shifting, Parseval's relation.

Module-V (6 hours)

Sampling: sampling of a continuous signal, aliasing, Nyquist criteria, interpolation of signal from its samples.

Module-VI (8 hours)

Laplace Transform: Notion of complex frequency, Laplace transform, region of convergence, pole-zero (s-plane) plots, properties of Laplace transforms. Unilateral Laplace transform, Initial and Final value theorems, differential equations, system representations: direct, cascade, parallel forms.

Module-VII (8 hours)

Z-Transform: discrete system and notion of complex frequency, z-transform, region of convergence, pole-zero plots (z-plane), Unilateral Laplace transform, Initial and Final value theorems, difference equations, system representations: direct, cascade, parallel forms.

References:

Signals and Systems, Oppenheim, Alan V.; Willsky, Alan S.; Nawab, Hamid; with S. Hamid. Pearson Education (1998).

Digital Signal Processing, Sanjit K Mitra, Mc Graw Hill, 2008, Third Edition.

Digital Signal Processing (Principles, Algorithms, and Applications), John G. Proakis, Dimitria G. Manolakis, Prentice Hall International Inc., 1996, Third Edition.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	H		H	H	H	H
CO2	M	M	M	H	H	H	H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	3	3	3	1						1	3	3	3	2
CO 2	2	3	3	3	3								3	2	2	2

Mapping of Courses to PO/PSO

Course code	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EEIS206T	H	H	H	H	H	M	M	L	L	L	L	M	H	H	H	M

EENA207T: NETWORK ANALYSIS (THEORY)**(4 Credits - 60 hours) (L-T-P: 3-1-0)****Pre-Requisite: Basic Electrical Engineering****Objective**

The objectives of this outcome is to understand the physical laws that governs the response of electrical circuits and networks. The students obtain equations to solve circuits in steady and in transitory state through the application of mathematical tools.

Course Outcomes (COs)

The students are expected to have the ability to

Define and relate the various network theorems used for circuit analysis. (Remembering)

Analyze circuits in the sinusoidal steady-state and two-port circuit behaviour. (Understanding)

Determine the transient and steady-state response of electrical circuits. (Applying)

Evaluate graph of a network, tie-set matrix, loop currents, cut-set matrix and their node-pair potentials. (Analysing)

Module I: Network Theorems (16 lectures)

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity Theorem, Compensation Theorem, Tellegen's Theorem, Substitution Theorem, Voltage and current divider rule. Analysis with dependent current and voltage sources. Node and Mesh analysis, Source transformation, Concept of Duality and Dual Networks.

Module II: Solution of First and Second order networks (10 lectures)

Solution of first and second order differential equations for series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient response.

Module III: Sinusoidal steady state analysis (9 lectures)

Representation of sine function as rotating phasor, phasor diagrams, impedances and admittances, AC circuit analysis, Effective and RMS values, Average power and complex power. Three phase circuits. Mutually coupled circuits, Dot Convention in coupled circuits, Ideal Transformer.

Module IV: Electrical Circuit Analysis Using Laplace Transforms (11 lectures)

Review of Laplace Transforms, Analysis of Electrical Circuits using Laplace Transform for standard inputs, convolution integral, Inverse Laplace transform, transformed network with initial conditions, Transfer function representation. Poles and Zeros. Frequency response(magnitude and phase plots), Series and Parallel Resonances.

Module V: Two Port Network and Network Functions (8 lectures)

Two port networks, terminal pairs, relationship of two-port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, Interconnections of two- port networks.

Module VI: Graph Theory (6 lectures)

Graph of network, concept of tree branch, tree link. Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials.

Suggested Readings

Ravish R Singh, Network Analysis and Synthesis, Mc Graw Hill

D Roy Choudhury, Networks and Systems, New Age International

Abhijit Chakrabarti, Circuit Theory (Analysis and Synthesis), Dhanpat Rai and Co., New Delhi

ME Van Valkenburg, Network Analysis, Prentice Hall

Joseph Administer, Electric Circuits, Schaum's Outline Series

David A Bell, Electric Circuits, 6th ed., PHI

MS Shukhija and TK Nagsarkar, Circuits and Networks, Oxford University Press, 2010

William H. Hayt Jr., Jack E. Kemmerly, Steven M. Durbin, Engineering Circuit Analysis, 6/e, TMH.

K.M. Soni, Circuits & Systems, S.K. Kataria & Sons.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M	M	M	M	M
CO2	M	M	H	H	M	M

CO3	M	H	H	H	H	H
CO4	M	M	H	H	H	H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	2	1	1	1	1	1	3	3	1	3	2	2	3	2
CO 2	3	3	2	1	1	1	1	1	3	3	1	3	2	2	3	2
CO 3	3	3	2	2	2	1	1	1	3	3	1	3	3	2	3	2
CO 4	3	3	2	2	2	1	1	1	3	3	1	3	3	2	3	2

Mapping of Courses to PO/PSO

Course	P O 1	P O 2	P O 3	P O 4	P O 5	P O 6	P O 7	P O 8	P O 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EENA207 T	H	H	H	M	M	L	L	L	H	H	L	H	H	M	H	M

EEEM210T: ELECTRICAL MACHINES-I**(4 Credits - 60 hours) (L-T-P: 3-1-0)****Pre-requisite: Physics, Basic Electrical Engineering****Objective**

The objective of this course is to equip the students with a basic understanding of different DC & AC machines fundamentals; their different parts and help them to gain the skills for operating these machines. The course also aims to equip students with the ability to understand and analyse the different circuits of DC & AC machines and transformers. The instructor will provide understanding of construction, principle of operation, performance, and control of various electrical machines used in the industry.

Course Outcomes:

The students are expected to have the ability to

Compare the operations of different dc and ac electrical machines. (Understanding)

Apply their knowledge to solve mathematical problems of different electrical machines. (Applying)

Analyze the performance of different electrical machines. (Analyzing)

Select various electric machines for field applications. (Evaluating)

Module I: Magnetic Circuits and Electromechanical Energy Conversion (4 hours)

General introduction to electrical machines: Magnetic circuits, Concepts of reluctance and permeance, Faraday's law of electromagnetic induction, Lenz's Law and Fleming's rules. Principle of operation of generators and motors. Magnetic curves and their relevance.

Module II: Transformers (9 hours)

Constructional features, Principle, and operation of single-phase transformers; Ideal transformer and practical transformer, name plate rating, phasor diagrams, equivalent circuit and determination of its parameters from Open-Circuit and Short-Circuit tests; Per-Unit parameter values and its importance; Voltage Regulation, efficiency and all-day efficiency expressions and calculations. Sumpner's Test (Back-To-Back test or Regenerative test).

3-phase Transformer: As a single unit with name plate rating and as a bank of three single-phase transformers; Vector groups for various connections; Per-phase analysis; Qualitative explanation for origin of harmonic current and voltage and its suppression tertiary winding. Parallel operation conditions and load sharing of transformers.

Autotransformer: Basic constructional features; VA conducted magnetically and electrically. Comparative study with two-winding transformer.

Module III: D.C. Machines (7 hours)

D.C. Machines: Constructional features, armature windings - simple lap and wave winding; armature voltage and torque equations, armature reaction.

D.C. generators: Classifications, performance characteristics; Losses, efficiency and power flow diagram.

D.C. motors: Classifications, torque/speed characteristics of different types; Losses, efficiency and power flow diagram. Starting, speed control and braking. Testing and efficiency.

Module IV: Three-phase Induction machines (8 hours)

Three-phase Induction machines: Constructional features and types; 3-phase distributed winding production of rotating magnetic field. Concept of slip; Phasor diagram and development of equivalent circuit and derivation of torque equation, power flow diagram; Typical torque-slip characteristic and influence of different parameters on it; Methods of starting and speed control; Different types of braking circuit arrangement and qualitative explanation. No-load and blocked-rotor tests.

Module V: Single-Phase AC motors and Universal motors (5 hours)

Single-Phase induction motor: Double revolving field theory and development of equivalent circuit. Methods of starting using auxiliary winding; selection of capacitor value during starting and running.

Universal series motor: constructional features and performance characteristics.

Module VI: Synchronous machines (7 hours)

Synchronous machines: Constructional features and types; Operation of synchronous generators and motors connected to bus and phasor diagrams for normal, under and over excited conditions; Power and torque characteristics and capability curves; Parallel operation; Salient pole synchronous machine - phasor diagram and determination of synchronous reactances; starting and speed control of synchronous motors.

Suggested Readings

P. C. Sen, "Principles of Electric Machines and Power Electronics", 2nd Edition, Wiley, 2007.

A. E. Fitzgerald, C. Kingsley, Jr. and S.D. Umans, "Electrical Machinery", 7th Edition, Tata McGraw-Hill, 2014.

A. F. Puchstein and T. C. Lloyd, "Alternating-Current Machines", John Wiley and Sons, 1942.

P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	M	M	M	M	M	M
CO2	L	H	H	H	M	M
CO3	L	H	H	H	H	H
CO4	L	H	H	H	H	M

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2		1	1	1	1	1	1	1		1	2	2	1	1
CO 2	3	3	1	1	2	1	1	1	1	2	1	2	3	3	2	2
CO 3	2	3	1	3	2	1	1	1	2	2	1	2	2	2	3	2
CO 4	2	2	2	1	1	2	2	2	2	2	1	3	3	3	2	2

Mapping of Courses to PO/PSO

Course code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4

EEEM2 10T	H	H	H	H	H	M	M	M	M	L		H	H	H	H	M

INTRODUCTION TO INDIAN KNOWLEDGE SYSTEMS (2 Credits - 30 Hours) (L:T:P – 2:0:0)

Course Objectives

To introduce fundamentals of Ancient Indian Educations to understand the pattern and purpose of studying vedas, vedangas, upangas, upveda, purana & Itihasa

To help students to trace, identify and develop the ancient knowledge systems.

To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing

To build in the learners a deep rooted pride in Indian knowledge, committed to universal human right, well-being and sustainable development.

Course Outcomes

After completing the course, the students will be able to-

CO1: Identify the foundational elements of Bhāratīya civilization, including its knowledge systems, educational institutions, and philosophical traditions. (*Understanding*)

CO2: Apply traditional Indian approaches to language, logic, measurement systems, and physical reality to modern interdisciplinary contexts. (*Applying*)

CO3: Analyse the contributions of key scholars and literary figures in the development of Indian arts, sciences, and philosophy. (*Analysing*)

CO4: Evaluate the scientific principles and technological innovations from ancient India in the areas of mathematics, astronomy, medicine, sciences, technology and environmental studies. (*Evaluating*)

Module-I: Foundations of Indian Knowledge Systems and Civilisational Heritage

Bhāratīya Civilization and Development of Knowledge System (4 hours)

Genesis of the land, Antiquity of civilization, On the Trail of the Lost River, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization, Traditional Knowledge System, The Vedas, Main Schools of Philosophy, Ancient Education System, the Takṣaśilā University, the Nālandā University, Alumni, Knowledge Export from Bhārata.

Arts, Literature, and Scholars (3 hours)

Art, Music, and Dance, Naṭarāja– A Masterpiece of Indian Art, Literature, Life and works of Agastya, Lopāmudrā, Vālmīki, Patañjali, Vedavyāsa, Yājñavalkya, Gārgī, Maitreyī, Bodhāyana, Caraka, Suśruta, Jīvaka, Nāgārjuna, Kaṇāda, Patañjali, Kauṭilya, Pāṇini, Āryabhaṭa, Varāhamihira, Ādi Śaṅkarācārya, Bhāskarācārya, Mādhavācārya.

Science, Astronomy, and Mathematics (5 hours)

Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, Bhāratīya Kāla-gaṇanā, Kerala School for Mathematics and Astronomy, History and Culture of Astronomy, Sun, Earth, Moon, and Eclipses, Earth is Spherical and Rotation of Earth, Archaeoastronomy; Concepts of Zero and Pi, Number System, Pythagoras Theorem, and Vedic Mathematics.

Life, Environment, and Health (3 hours)

Ethnic Studies, Life Science in Plants, Anatomy, Physiology, Agriculture, Ecology and Environment, Āyurveda, Integrated Approach to Healthcare, Medicine, Microbiology, Medicine, Surgery, and Yoga, etc.

Module-II: Scientific Traditions and Technological Innovations in Indian Knowledge Systems

Foundation concept for Science & Technology (7 hours)

Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhyā System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeṣikan approach to physical reality, constituents of the physical reality, Pramāṇa, Saṃśaya.

Indian Science & Technology in IKS (8 hours)

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Engineering Science and Technology in the Vedic Age and Post-Vedic Records. Indian Science and Technology Heritage, sixty-four art forms and occupational skills (64 Kalas). Metals and Metal-working technology: Copper, Gold, Zinc, Mercury, Lead, Silver, Iron & Steel. Dyes and Painting Technology, Town & Planning Architecture in India, Temple Architecture, Vastu Sastra.

References:

Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.

Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.

Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.

SK Das, The education system of Ancient hindus, Gyan publication house, India.

BL Gupta, Value and distribution system in india, Gyan publication house, India.

Reshmi Ramdhoni, Ancient Indian Culture and Civilisation, Star publication, 2018.

Supriya Lakshmi Mishra, Culture and History of Ancient India (With Special Reference of Sudras), 2020.

Gambirananda, Swami, Tr. Upanishads with the Commentary of Sankarachrya. Kolkata: Advaita Ashrama publication Department, 2002.

Ranganathananda, Swami. The Message of the Upanishads. Bombay: Bharathya Vidya Bhaven, 1985.

Om Prakash, Religion and Society in Ancient India, Bhariya Vidhya Prakashan, 1985.

J Auboyer, Daily Life in Ancient India from Approximately 200 BC to AD 700, Munshi ram Manoharlal publication, 1994.

DK Chakkrabarty, Makkhan Lal, History of Ancient India (Set of 5 Volumes), Aryan book International publication, 2014.

Dr. Girish Nath Jha, Dr. Umesh Kumar Singh and Diwakar Mishra, Science and Technology in Ancient Indian Texts, DK Print World limited.

Swami BB Vishnu, Vedic Science and History - Ancient Indian's Contribution to the Modern World, gosai publication, 2015.

Chatterjee, S.C. The Nyaya Theory of Knowledge. Calcutta: University of Calcutta Press, 1950.

Dasgupta, Surendra. A History of Indian Philosophy. Delhi: Motilal Banarsidass, 1991. Vols. III & IV.

Mercier, Jean L. From the Upanishads to Aurobindo. Bangalore: Asian Trading Corporation, 2001.

M. Hiriyanna. Essentials of Indian Philosophy. London: Diane Publications, 1985.

Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan.

History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).

Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).

India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO1	H	L

CO2	H	L
CO3	H	L
CO4	M	H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	1	1	1	1		1	2	1				3	1	1	2	1
CO 2	2	2	2	1		1	2	1				3	2	1	1	1
CO 3	1					2				2		2	1		2	3
CO 4	3	3	3	2	1	1	3	2			3	3	2	2	1	1

Mapping of Courses to PO/PSO

Cour se code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	L	L		L		M	M	L			L	H	L	L	L	H

MIEM210T: ELECTRICAL MACHINES(Minor)

(4 Credits - 60 hours) (L-T-P: 3-1-0)

Pre-requisite: Physics, Basic Electrical Engineering**Objective**

The objective of this course is to equip the students with a basic understanding of different DC & AC machines fundamentals; their different parts and help them to gain the skills for operating these machines. The course also aims to equip students with the ability to understand and analyse the different circuits of DC & AC machines and transformers. The instructor will provide understanding of construction, principle of operation, performance, and control of various electrical machines used in the industry.

Course Outcomes:

The students are expected to have the ability to

Compare the operations of different dc and ac electrical machines. (Understanding)

Apply their knowledge to solve mathematical problems of different electrical machines. (Applying)

Analyze the performance of different electrical machines. (Analyzing)

Select various electric machines for field applications. (Evaluating)

Module I: Magnetic Circuits and Electromechanical Energy Conversion (4 hours)

General introduction to electrical machines: Magnetic circuits, Concepts of reluctance and permeance, Faraday's law of electromagnetic induction, Lenz's Law and Fleming's rules. Principle of operation of generators and motors. Magnetic curves and their relevance.

Module II: Transformers (9 hours)

Constructional features, Principle, and operation of single-phase transformers; Ideal transformer and practical transformer, name plate rating, phasor diagrams, equivalent circuit and determination of its parameters from Open-Circuit and Short-Circuit tests; Per-Unit parameter values and its importance; Voltage Regulation, efficiency and all-day efficiency expressions and calculations. Sumpner's Test (Back-To-Back test or Regenerative test).

3-phase Transformer: As a single unit with name plate rating and as a bank of three single-phase transformers; Vector groups for various connections; Per-phase analysis; Qualitative explanation for origin of harmonic current and voltage and its suppression tertiary winding. Parallel operation conditions and load sharing of transformers.

Autotransformer: Basic constructional features; VA conducted magnetically and electrically. Comparative study with two-winding transformer.

Module III: D.C. Machines (7 hours)

D.C. Machines: Constructional features, armature windings - simple lap and wave winding; armature voltage and torque equations, armature reaction.

D.C. generators: Classifications, performance characteristics; Losses, efficiency and power flow diagram.

D.C. motors: Classifications, torque/speed characteristics of different types; Losses, efficiency and power flow diagram. Starting, speed control and braking. Testing and efficiency.

Module IV: Three-phase Induction machines (8 hours)

Three-phase Induction machines: Constructional features and types; 3-phase distributed winding production of rotating magnetic field. Concept of slip; Phasor diagram and development of equivalent circuit and derivation of torque equation, power flow diagram; Typical torque-slip characteristic and influence of different parameters on it; Methods of starting and speed control; Different types of braking circuit arrangement and qualitative explanation. No-load and blocked-rotor tests.

Module V: Single-Phase AC motors and Universal motors (5 hours)

Single-Phase induction motor: Double revolving field theory and development of equivalent circuit. Methods of starting using auxiliary winding; selection of capacitor value during starting and running.

Universal series motor: constructional features and performance characteristics.

Module VI: Synchronous machines (7 hours)

Synchronous machines: Constructional features and types; Operation of synchronous generators and motors connected to bus and phasor diagrams for normal, under and over excited conditions; Power and torque characteristics and capability curves; Parallel operation; Salient pole synchronous machine - phasor diagram and determination of synchronous reactances; starting and speed control of synchronous motors.

Suggested Readings

P. C. Sen, "Principles of Electric Machines and Power Electronics", 2nd Edition, Wiley, 2007.

A. E. Fitzgerald, C. Kingsley, Jr. and S.D. Umans, "Electrical Machinery", 7th Edition, Tata McGraw-Hill, 2014.

A. F. Puchstein and T. C. Lloyd, "Alternating-Current Machines", John Wiley and Sons, 1942.

P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	M	M	M	M	M	M
CO2	L	H	H	H	M	M
CO3	L	H	H	H	H	H
CO4	L	H	H	H	H	M

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2		1	1	1	1	1	1	1		1	2	2	1	1
CO 2	3	3	1	1	2	1	1	1	1	2	1	2	3	3	2	2
CO 3	2	3	1	3	2	1	1	1	2	2	1	2	2	2	3	2
CO 4	2	2	2	1	1	2	2	2	2	2	1	3	3	3	2	2

Mapping of Courses to PO/PSO

Course code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EEEM210T	H	H	H	H	H	M	M	M	M	L		H	H	H	H	M

EEDE221T: DIGITAL ELECTRONICS
(4 Credits-60 hours) (L-T-P: 3-1-0)
Objective

The objectives of this course is to introduce the concept of digital and binary systems and give students the concept of digital electronics. The course also provides fundamental concepts used in the design of digital systems, the basic tools for the design and implementation of digital circuits, modules and subsystems.

Course Outcomes

1. Recall and describe fundamental concepts, number systems, Boolean algebra, and digital logic components used in digital electronics. (Remembering)
2. Explain and interpret principles of digital circuit design, logic simplification, combinational and sequential circuits, and data converters. (Understanding)
3. Apply problem-solving techniques to design and simplify digital logic circuits using Boolean algebra and Karnaugh maps. (Applying)
4. Design and implement combinational and sequential circuit. (Creating)

Module I: Digital Systems and Binary numbers: (8 hours)

Digital Systems and Binary numbers: Binary, decimal, octal, hexadecimal number systems, number base conversions, complements, signed binary numbers, binary logic.

Module II: Boolean Algebra and Logic Gates (12 hours)

Boolean Algebra and Logic Gates: Basic theorems and properties of Boolean algebra, Boolean functions, canonical and standard forms, digital logic gates and integrated circuits. Gate Level Minimization: K-Map method, POS and SOP simplifications, don't care conditions, NAND and NOR implementations.

Module III: Digital Logic Families and Introduction to HDL: (8 hours)

Digital Logic Families: CMOS logic, voltage levels, noise margin, power dissipation, fan-in and fan-out. Introduction to HDL: Basic building blocks and syntax of VHDL / Verilog, different modeling styles – structural, behavioral, writing test bench.

Module IV: Combinational Logic (10 hours)

Combinational Logic: Design and analysis of combinational circuits – adders, subtractors, multiplier, magnitude comparators, encoders, decoders and multiplexers.

Module V: Sequential Logic: (12 hours)

Sequential Logic: Design and analysis of sequential circuits – latches, flip-flops, registers and counters.

Module VI: Data Converters: (10 hours)

Data Converters: Basics of digital-to-analog and analog-to-digital conversion – principles, specifications, sample and hold circuits, performance parameters, practical applications and commonly used DAC and ADC ICs.

Suggested Readings

A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.

M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.

Floyd, Thomas L. Digital fundamentals, 10/e. Pearson Education India, 2011.

William H. Gothmann, "Digital Electronics: An Introduction to Theory and Practice", PHI.

B. Somanathan Nair, "Digital Electronics and Logic Design", PHI

G. K Kharate, "Digital Electronics", Oxford.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H	M	L	L	M
CO 2	H	H	H	M	M	M
CO 3	M	H	M	H	H	M
CO 4	L	M	H	M	M	L

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	1	1	1							1	2	1	3	3
CO 2	3	3	2	2	1		1					1	2	1	3	3
CO 3	3	3	3	3	3				1	2	2	1	3	3	3	3
CO 4	3	3	3	2	3	1	1	1	2	2	2	2	3	3	3	3

Mapping of Courses to PO/PSO

Course code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EEDE2 21T	H	H	H	M	H	L	L	L	L	L	L	M	H	H	H	H

EECS222T: CONTROL SYSTEMS
(4 Credits - 60 hours) (L-T-P: 3-1-0)
Objective

This course aims to provide students with a solid foundation in control systems, focusing on the analysis and design of various system models and feedback control strategies. Students will learn to mathematically represent mechanical, electrical, thermal, and pneumatic systems using state variable and transfer function models. The course covers closed-loop system analysis, time response, steady-state error, and disturbance rejection. Emphasis is placed on feedback control characteristics, stability criteria, sensitivity analysis, and robustness. Additionally, students will explore basic feedback control modes, frequency response analysis, and compensation techniques.

Course Outcomes

Model dynamic systems from mechanical, electrical, thermal, and pneumatic domains using both state-variable and transfer function approaches. (Applying)

Analyze and design closed-loop control systems by constructing block diagrams, signal flow graphs, and performing time-domain analysis including transient response and steady-state error calculations. (Analyzing)

Apply stability analysis techniques such as Routh-Hurwitz criterion and evaluate system stability using BIBO concepts and sensitivity analysis. (Applying)

Conduct frequency response analysis using Bode, polar, and Nyquist plots, and design lead, lag, and lead-lag compensators to improve system performance. (Analyzing)

Module I: Introduction (16 hours)

Introduction to the control problem, Control System Components: Sensors, Actuators, Computational blocks. Mathematical representation of systems, state variable model, transfer function model. Transfer function and state variable models of suitable mechanical, electrical, thermal and pneumatic systems. Linearization, Solution of state equations of LTI System. Closed loop systems, Block diagram and signal flow analysis.

Module II: Time domain analysis and basics of feedback theory (16 hours)

Time response of first and second order system, steady state error analysis. Performance specifications in the time domain, disturbance rejection. Basic Characteristics of feedback control systems: Concept of BIBO stability, Routh stability criterion. Basic Characteristics of feedback control systems: Concept of BIBO stability, Routh stability criterion.

Module III: Sensitivity analysis (4 hours)

Definition of sensitivity, effects of feedback on sensitivity, It's analysis and robustness.

Module IV: Basic modes of feedback control: (4 hours)

Basic modes of feedback control: Proportional, Integral, Derivative.

Module V: Root Locus (4 hours)

Basics of Root locus and its application.

Module VI: Frequency Domain Analysis (16 hours)

Frequency response analysis: Polar plots, Bode plots, Nyquist stability criterion. Non-minimum phase systems. Performance specifications in frequency domain, Frequency domain methods of design. Lead, lag, lead-lag compensation.

Suggested Readings

Ogata, Katsuhiko. Modern control systems. Prentice Hall, 1997.

Nise, Norman S. Control systems engineering. John Wiley & Sons, 2020.

I. J. NAGRATH, M. GOPAL, "Electronic Devices And Circuits", McGraw Hill, 2022.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M	M	M	L	L
CO2	M	H	H	L	M	L
CO3	L	H	M	H	L	L
CO4	L	M	L	L	H	H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	1	1	1								2	3	2	3
CO 2	3	3	2	2	1								3	3	3	3
CO 3	3	3	3	2	2								3	3	3	3
CO 4	3	3	2	3	2								3	3	3	3

Mapping of Courses to PO/PSO

Course code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	H	H	H	M	M	L	L	L	L	L	L	M	H	H	H	H

EEPE223T: POWER ELECTRONICS**(4 Credits - 60 hours) (L-T-P: 3-1-0)****Pre-requisite:** Physics, Basic Electrical Engineering**Objective**

The course helps to develop an in-depth understanding of the power electronics devices and circuits for current and voltage control and protection. The course helps in the learning of switching characteristics and various arrangement of power switching devices for realizing rectifier, inverter and choppers and triggering methods of SCRs.

Course Outcomes

Explain the working of different power converters such as rectifiers, choppers and inverters. (Understanding)

Identify different power electronic devices and their characteristics. (Applying)

Compare the various types of power electronics converters and application. (Evaluating)

Choose a suitable type of converter for electrical application and construct.(Creating)

Module I: Power switching devices (8 lectures)

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.

Module II: Thyristor rectifiers (12 lectures)

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.

Module III: DC-DC buck/ DC-DC boost converter (10 lectures)

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

Module IV: Single-phase/ Three-phase inverter (18 lectures)

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage. Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation.

Module V: AC to AC conversion (12 lectures)

Single phase AC static switches; transient-free switching of inductive loads; voltage regulators; cycloconverter;

Suggested Readings

- M. H. Rashid, "Power electronics: circuits, devices, and applications", Pearson Education India, 2009.
 N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
 R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
 L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2	H	M	M	M	M
CO3		H	M	H	M
CO4				M	

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1											2	1	1	
CO 2	2	2	1										2			
CO 3	1		1										1	2	1	
CO 4	1	1		1									1		2	1

Mapping of Courses to PO/PSO

Cour se code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	L	M	H	M	M	L	L						M	M	H	L

EEEF224T: ELECTROMAGNETIC FIELDS**(4 Credits - 60 hours) (L-T-P: 3-1-0)****Objective**

The objective of the course is to introduce the students to various electromagnetic field related quantities including vector differential and integral operators, electrostatics, magnetostatics and related applications.

Course Outcomes

To understand the basic laws of electromagnetism and obtain the electric and magnetic fields for simple configurations under static conditions.

To analyze time varying electric and magnetic fields.

To understand Maxwell's equation in different forms and different media.

To understand the propagation of EM waves

Module I: Review of Vector Calculus (10 lectures)

Vector algebra- addition, subtraction, components of vectors, scalar and vector multiplications, triple products, Three orthogonal coordinate systems (rectangular, cylindrical, and spherical), Vector calculus differentiation, Partial differentiation, integration, vector operator del, gradient, divergence, and curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

Module II: Static Electric Field (8 Lectures)

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications, Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

Module III: Conductors, Dielectrics and Capacitance (9 lectures)

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two-wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's, and Poisson's equations.

Module IV: Static Magnetic Fields (7 lectures)

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Module V: Magnetic Forces, Materials and Inductance (7 lectures)

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances, and mutual inductances.

Module VI: Time-Varying Fields and Maxwell's Equations (9 lectures)

Faraday's law for Electromagnetic induction, Displacement current, point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions.

Module VII: Electromagnetic Waves (10 lectures)

Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

Suggested Readings

M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.

A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.

A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.

W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	H	H	H	M	M	L
CO2	L	L	L	L	M	H	M

CO3	M	M	M	M	M	H	M
CO4	L	M	M	H	H	M	H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	2		2							1	3	2	2	1
CO 2	3	3	2	2	3							2	3	3	3	2
CO 3	3	3	3	2	3							2	3	3	3	2
CO 4	3	2	2	3								2	3	2	3	3

Mapping of Courses to PO/PSO

Cour se code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	H	H	H	L	M	L	L	L	L	L	L	M	H	H	H	H

EEDS225T: DIGITAL SIGNAL PROCESSING

(4 Credits - 60 hours) (L-T-P: 3-1-0)

Objectives

This course aims to familiarize the student with the concept of signals and systems in discrete domain. Also, the course enables one to represent signals mathematically in continuous and discrete-time, and in the frequency domain. Analysis in Z-domain along with discrete Fourier transform is introduced. Design of digital filters and application of digital signal processing is introduced.

Course Outcomes

Describe signals mathematically in continuous and discrete-time, and in the frequency domain. (Remembering).

Understanding the analytical tools such as Discrete Fourier Transforms, Fast Fourier Transforms and Transforms essential for digital signal processing. (Understanding)

Implement digital signal processing for analysis of real-life signals. (Applying)

Check digital filters for various applications. (Evaluating)

Module I: Discrete-Time Signals and Systems (14 hours)

Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling, and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Module II: Z-Transform (14 hours)

Time response of first and second order system, steady state error analysis. Performance specifications in the time domain, disturbance rejection. Basic Characteristics of feedback control systems: Concept of BIBO stability, Routh stability criterion. Basic Characteristics of feedback control systems: Concept of BIBO stability, Routh stability criterion.

Module III: Discrete Fourier Transform (10 hours)

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

Module IV: Design of Digital Filters (14 hours)

Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.

Module V: Applications of Digital Signal Processing (8 hours)

Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

Suggested Readings

S. K. Mitra, "Digital Signal Processing: A computer-based approach", McGraw Hill, 2011. Nise, Norman S. Control systems engineering. John Wiley & Sons, 2020.

A. Nagoor Kani, "Digital Signal Processing", McGraw Hill, 2011, second edition

S. Salivahanan, A. Vallavaraj, and C. Gnanapriya, Digital Signal Processing, fourth edition, McGraw Hill 2019.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	M	L	M
CO2	M	H	L	M	L
CO3	L	L	H	M	M
CO4	L	M	M	H	H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	2	2	3							2	3	2	3	1
CO 2	3	3	2	2	3							2	3	2	3	1
CO 3	3	3	2	3	3				1	2	2	3	3	3	3	23
CO 4	3	3	3	2	3	1	1	1	2	2	2	3	3	3	3	3

Mapping of Courses to PO/PSO

Cour se code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	H	H	H	L	M	L	L	L	L	L	L	M	H	H	H	H

EEEM226T: ELECTRICAL MACHINES-II

(4 Credits-60 hours) (L-T-P: 3-1-0)

Objective:

This course provides a basic understanding of AC machinery fundamentals, machine parts and helps to gain the skills for operating AC machines. The course also equips students with the ability to understand and analyse the phasor diagrams and equivalent circuits of AC Induction and Synchronous Machines.

Course Outcomes

Explain the operation of ac machines. (Understanding)

Analyze performance characteristics of ac machines. (Analysing)

Develop equivalent circuits of different ac motors and generators. (Creating).

Demonstrate basic principle of revolving magnetic field (understanding).

Module I: Fundamentals of AC machine windings (10 Hours)

Physical arrangement of windings in stator and cylindrical rotor; slots for windings; single turn coil - active portion and overhang; full-pitch coils, concentrated winding, distributed winding, winding axis, 3D visualization of the above winding types, Air-gap MMF distribution with fixed current through winding - concentrated and distributed, Sinusoidally distributed winding, winding distribution factor

Module II: Pulsating and revolving magnetic fields (10 Hours)

Constant magnetic field, pulsating magnetic field - alternating current in windings with spatial displacement, Magnetic field produced by a single winding - fixed current and alternating current Pulsating fields produced by spatially displaced windings, Windings spatially shifted by 90 degrees, Addition of pulsating magnetic

fields, Three windings spatially shifted by 120 degrees (carrying three-phase balanced currents), revolving magnetic field.

Module III: Induction Machines (16 Hours)

Construction, Types (squirrel cage and slip-ring), Torque Slip Characteristics, Starting and Maximum Torque. Equivalent circuit. Phasor Diagram, Losses and Efficiency. Effect of parameter variation on torque-speed characteristics (variation of rotor and stator resistances, stator voltage, frequency). Methods of starting, braking and speed control for induction motors. Generator operation. Self-excitation. Doubly-Fed Induction Machines.

Module IV: Single-phase induction motors (8 Hours)

Constructional features, double revolving field theory, equivalent circuit, determination of parameters. Split-phase starting methods and applications

Module V: Synchronous machines (16 Hours)

Constructional features, cylindrical rotor synchronous machine - generated EMF, equivalent circuit and phasor diagram, armature reaction, synchronous impedance, voltage regulation. Operating characteristics of synchronous machines, V-curves. Salient pole machine – two reaction theory, analysis of phasor diagram, power angle characteristics. Parallel operation of alternators - synchronization and load division.

Suggested Readings

A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.

M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.

P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.

I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H		H	H	H
CO2		L	H		H
CO3	L			H	
CO4		M	H	M	L

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	3	2	2	1	1	2						3	2	2	1
CO 2	2	3	3	2	2	2	2						3	3	3	3
CO 3	2	3	3	2	1	1	1						3	3	3	2
CO 4	2	3	3	2	2	2	1						3	2	3	2

Mapping of Courses to PO/PSO

Cour se code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	H	M	H	M	L	L	L						M	H	H	L

EEPE233T: POWER ELECTRONICS AND ITS APPLICATIONS

(3 Credits – 45 Hours) (L-T-P: 3-0-0)

Objective:

The objective of this course is to familiarize students with the fundamentals of power semiconductor devices, conversion techniques, and modern applications of power electronics. Students will learn how to analyze,

design, and apply converter circuits for use in industrial systems, renewable-energy integration, electric drives, and consumer products.

Course Outcomes:

1. Explain the characteristics and operation of power semiconductor devices used in electrical switching and control. (Understanding)
2. Analyze AC–DC, DC–DC, DC–AC, and AC–AC converter circuits and their performance. (Analyzing)
3. Evaluate and design power electronic converters for industrial, renewable-energy, and transportation applications. (Evaluating/Creating)
4. Apply power electronics principles in motor control, power supplies, and energy systems. (Applying)
5. Assess protection, thermal management, and control strategies to ensure safe and efficient operation of power electronic systems. (Evaluating)

Module I: Power Semiconductor Devices (12 hours)

Introduction to Power Electronics and its role in modern systems. Characteristics, operations, and switching behaviour of Power Diodes, Schottky Diodes, SCR, TRIAC, DIAC, BJT, Power MOSFET, IGBT, GTO. Triggering circuits and commutation methods. Safe Operating Area (SOA), dv/dt and di/dt protection. Thermal modelling, heat sinks, snubber circuits.

Module II: AC–DC and DC–DC Converters (12 hours)

AC–DC Converters: Single-phase & three-phase controlled rectifiers, half/fully-controlled converters, harmonics and power factor considerations DC–DC Converters: Buck, boost, buck-boost; PWM control; continuous & discontinuous conduction modes; basic design considerations.

Module III: DC–AC and AC–AC Converters (12 hours)

DC–AC Converters (Inverters): Single-phase & three-phase inverters, SPWM & SVM basics, harmonic reduction. AC–AC Converters: AC voltage controllers, cycloconverters, introduction to matrix converters

Module IV: Applications of Power Electronics (9 hours)

SMPS and UPS basics. Electric drives: DC, induction motor, BLDC/PMSM drives. Renewable energy integration: PV inverters, MPPT basics, wind converters. Electric vehicle power electronics: chargers, motor controllers. HVDC overview, protection, EMI/EMC, gate drivers

Suggested Readings

M. H. Rashid, Power Electronics: Devices, Circuits and Applications, Pearson.

Ned Mohan, Undeland & Robbins, Power Electronics: Converters, Applications and Design, Wiley.

Daniel W. Hart, Power Electronics, McGraw Hill.

NPTEL: Power Electronics (IIT Kharagpur / IIT Madras).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2		H	H	
CO3		M	H	M
CO4				H
CO5	M			H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO1	H	H	M													

CO2	M	H	H	M												
CO3	M	M	H	H												
CO4	M	M	H	H	H											
CO5	M	M	H	M												

Mapping of Courses to PO/PSO

Cour se code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	H	H	H	H	H	M	L	M	M	L	H	H	H	H	H	M

Non-NEP Batch Syllabus (5th Sem to 8th Sem)**EEPS0117: POWER SYSTEM- I****(3 Credits-45 hours) (L-T-P: 3-0-0)****Course Outcomes**

1. List the various components used in a power system. (Remembering)
2. Different protection schemes used to prevent faults in power system. (Understanding)
3. Identify suitable protection scheme used for a particular type of fault. (Applying)
4. Find various performance parameters of a power system by using given data. (Analyzing)

Objective: This is the basic course, which aims to make students aware of the basic concepts of electrical power systems and spells out the various components of an electrical power system. This course is the stepping-stone to make students understand how to model and analyze the power system under steady state operating conditions, under faulted conditions and the transient behavior of power systems whenever it is subjected to a fault.

Module 1: Basic Concepts (10 hours)

Evolution of Power Systems and Present-Day Scenario. Structure of a power system: Bulk Power Grids and Micro-grids. Synchronous Grids and Asynchronous (DC) interconnections. Generation: Conventional and Renewable Energy Sources. Distributed Energy Resources. Energy Storage. Transmission and Distribution Systems: Line diagrams, transmission and distribution voltage levels and topologies (meshed and radial systems). Review of Three-phase systems. Analysis of simple three-phase circuits. Power Transfer in AC circuits and Reactive Power.

Module 2: Power System Components (18 hours)

Overhead Transmission Lines and Cables: Electrical and Magnetic Fields around conductors, Corona. Parameters of lines and cables. Capacitance and Inductance, calculations for simple configurations. Sinusoidal Steady state representation of Lines: Short, medium and long lines. Characteristics of transmission lines. Surge Impedance Loading.

Causes and effects of faults: Review of per unit system and symmetrical components. Symmetrical three-phase faults. Asymmetrical faults, short circuit and open circuit conditions.

Steady-state performance characteristics. Real and Reactive Power Capability Curve of generators. Loads: Types, Voltage and Frequency Dependence of Loads.

Module 3: Over-Voltages and Insulation Requirements (5 hours)

Generation of Over-voltages: Lightning and Switching Surges. Protection against Over-voltages, Insulation Coordination. Propagation of Surges.

Module 4: Fault Analysis (6 hours)

Method of Symmetrical Components (positive, negative and zero sequences). Balanced and Unbalanced Faults. Representation of generators, lines and transformers in sequence networks. Computation of Fault Currents. Neutral Grounding.

Module 5: Introduction to Protection Systems (6 hours)

Switchgear: Types of Circuit Breakers. Attributes of Protection schemes, Back-up Protection. Protection schemes (Over-current, directional, distance protection, differential protection) and their application.

Suggested Readings

C.L. Wadhwa, "Electrical Power systems", (5th Edition) New Age International Publishers.
 D.P. Kothari, I.J. Nagrath, "Power System Engineering", Second edition, Tata McGraw Hill.
 W.D. Stevenson Jr., Elements of Power System Analysis, Mc Graw Hill.
 V.K Mehta, Rohit Mehta, "Principles of Power Systems", S. Chand.
 Leon Freris, David Infield, "Renewable Energy in Power Systems", Wiley, A John Wiley & Sons, Ltd, Publication.
 Ashfaq Husain, "Electrical Power systems", (5th Edition) CBS Publishers.
 B. R. Gupta, "Generation of Electrical Energy", S. Chand & Co. Ltd. N. Delhi
 O. I. Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.
 A. R. Bergen and V. Vittal, "Power System Analysis", Pearson Education Inc., 1999.
 B. M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M			
CO 2			M		H
CO 3				L	H
CO 4		H		M	

EECS0073: CONTROL SYSTEMS**(3 Credits - 45 hours) (L-T-P: 3-0-0)****Course Outcomes**

Define feedback and feed-forward control architecture. (Remembering)
 Illustrate the concepts related to the operation analysis and stabilization of closed loop and open loop control systems using various control techniques. (Understanding)
 Apply block diagram representations for simplifying complex control systems. (Applying)
 Examine different controllers based on empirical tuning rules. (Analysing)

Objective

This course aims to familiarize the student with the concept mathematical modelling and analysis of Linear Time-Invariant (LTI) systems. Also, the course enables one to understand the concept of stability and its assessment for linear-time invariant systems. Design of simple feedback controllers is introduced. Mathematical modelling techniques like transfer function and state-space representations are introduced.

Module I: Introduction to Control Problem (5 lecture)

Industrial Control examples. Mathematical models of physical systems. Control hardware and their models. Transfer function models of linear time-invariant systems. Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback. Block diagram algebra.

Module II: Time Response Analysis (10 lecture)

Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Concept of Stability. Routh-Hurwitz Criteria. Relative Stability analysis. Root-Locus technique. Construction of Root-loci.

Module III: Frequency-Response Analysis (10 lecture)

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion. Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response.

Module IV: Introduction to Controller Design (10 lecture)

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems. Root-loci method of feedback controller design. Design specifications in frequency-domain. Frequency-domain methods of design. Application of Proportional, Integral and Derivative Controllers, Lead and Lag compensation in designs. Analog and Digital implementation of controllers.

Module V: State Variable Analysis (10 lecture)

Concepts of state variables. State space model. Diagonalization of State Matrix. Solution of state equations. Eigenvalues and Stability Analysis. Concept of controllability and observability. Pole-placement by state feedback. Discrete-time systems. Difference Equations. State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

Suggested Readings

M. Gopal, "Control Systems: Principles and Design", McGraw Hill Education, 1997.

B. C. Kuo, "Automatic Control System", Prentice Hall, 1995.

K. Ogata, "Modern Control Engineering", Prentice Hall, 1991.

I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2	H	M		
CO 3			H	M
CO 4			H	

EEMM0074: MICROPROCESSORS AND MICROCONTROLLERS

(3 Credits - 45 hours) (L-T-P : 3-0-0)

Course Outcomes

List the various functional blocks of microprocessors and microcontrollers. (Remembering)

Explain the operation and configuration of the various functional blocks and pins of 8051 microcontroller. (Understanding)

Explain the functions of the assembly language instructions of 8051 microcontroller. (Understanding)

Make use of 8051 assembly language instructions to write programs for a given application. (Applying)

Design microcontroller based system for simple applications. (Creating)

Objective

This course provides an in-depth understanding of the architecture and operation of microprocessors and microcontroller, assembly language programming and microcontroller interfacing techniques. The students will be able to design and implement microcontroller-based systems in both hardware and software and can apply this knowledge to more advanced structures.

Module I: Fundamentals of Microprocessors (6 lecture)

Fundamentals of microprocessor architecture. 8-bit microprocessor and microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

Module II: The 8051 Architecture (9 lecture)

Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

Module III: Instruction Set and Programming (8 lecture)

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

Module IV: Timer, Serial Port and Interrupt Programming (10 lecture)

SFRs of Timers, Timer programming in assembly language and C, RS232 basics, Synchronous and asynchronous communication, SFRs for Serial Communication, Serial Port programming in assembly language and C, Interrupts of 8051, Interrupt programming in assembly language and C.

Module V: External Interfacing and Applications (12 lecture)

External memory interfacing, LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, ADC and DAC interfacing, sensors interfacing.

Suggested Readings

- M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2007.
 K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004.
 R. Kamal, "Embedded System", McGraw Hill Education, 2009.
 R. S. Gaonkar, "Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996.
 D. A. Patterson and J. H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013.
 D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 1991.
 Relevant datasheets.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	H	H	M		
CO 3		H		H	M
CO 4			M	H	
CO 5				H	H

EESS0075: SIGNALS AND SYSTEMS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, students will be able to:

Define the basic terms related to continuous and discrete time LTI systems. (Remembering)

Classify the signals and systems into continuous-discrete, time varying-time invariant and linear-nonlinear types. (Understanding)

Make use of Fourier, Laplace and z-Transforms techniques in analysis of signals and systems. (Applying)

Examine the signals and systems by using the results of the transform techniques. (Analysing)

Estimate the continuous time equivalence of a discrete signal by applying reconstruction techniques. (Evaluating)

Objective

The Objective of the course is to acquaint the students with the various types of signals, which form the basis of electronic communication. The course also is intended to provide the theoretical background necessary to understand the working of any signal processing system and apply the techniques.

Module I: Introduction to Signals and Systems (10 hours)

Signals and systems as seen in everyday life and in various branches of engineering and science.

Signal properties: periodicity, absolute integrability, determinism and stochastic character.

Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals;

Continuous and discrete time signals, continuous and discrete amplitude signals.

System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

Module II: Behaviour of Continuous and Discrete-Time LTI Systems (12 hours)

Impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations.

State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role.

Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

Module III: Fourier, Laplace and Z-Transforms (17 hours)

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behaviour.

The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Module IV: Sampling and Reconstruction (6 hours)

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems.

Suggested Readings

A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.

J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.

H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.

S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.

A. V. Oppenheim and R. W. Schaffer, "Discrete-Time Signal Processing", Prentice Hall, 2009.

M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.

B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2	M	H		
CO 3			H	M
CO 4			H	L
CO 5			L	H

EEED0076: ELECTRICAL MACHINE DESIGN

(2 Credits - 30 hours) (L-T-P: 2-0-0)

Course Outcomes

Select proper materials for the design of electrical machines. (Remembering)

Design transformer, induction motor and synchronous machine. (Creating)

Execute software programs for designing electrical machines. (Applying)

Module I: Introduction (6 Lectures)

Major considerations in electrical machine design, electrical engineering materials, space factor, choice of specific electrical and magnetic loadings, thermal considerations, heat flow, temperature rise, rating of machines.

Module II: Transformers (6 Lectures)

Sizing of a transformer, main dimensions, kVA output for single and three-phase transformers, window space factor, overall dimensions, operating characteristics, regulation, no-load current, temperature rise in transformers, design of cooling tank, methods for cooling of transformers.

Module III: Induction Motors (6 Lectures)

Sizing of an induction motor, main dimensions, length of air gap, rules for selecting rotor slots of squirrel cage machines, design of rotor bars & slots, design of end rings, design of wound rotor, magnetic leakage calculations, leakage reactance of poly-phase machines, magnetizing current, short circuit current, circle diagram, operating characteristics.

Module IV: Synchronous Machines (6 Lectures)

Sizing of a synchronous machine, main dimensions, design of salient pole machines, short circuit ratio, shape of pole face, armature design, armature parameters, estimation of air gap length, design of rotor, design of damper winding, determination of full load field mmf, design of field winding, design of turbo alternators, rotor design.

Module V: Computer Aided Design (CAD) (6 Lectures)

Limitations (assumptions) of traditional designs, need for CAD analysis, synthesis and hybrid methods, design optimization methods, variables, constraints and objective function, problem formulation. Introduction to FEM based machine design. Introduction to complex structures of modern machines-PMSMs, BLDCs, SRM and claw-pole machines.

Suggested Readings

K. Sawhney, "A Course in Electrical Machine Design", Dhanpat Rai and Sons, 1970.

S. K. Sen, "Principles of Electrical Machine Design with computer programmes", Oxford and IBH Publishing, 2006.

M.G. Say, "Theory & Performance & Design of A.C. Machines", ELBS London.

R.K. Agarwal, "Electrical Machine Design

Rajini, V.S. Nagarajan "Electrical machine design", Pearson Education, 2018

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	L	L	L	
CO 2		H	H	H	
CO 3					H

EEEW0077: ELECTROMAGNETIC WAVES

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Course Outcomes

Relate the Electromagnetic Field quantities with the behaviour of Electromagnetic Waves. (Understanding)

Model Electromagnetic Wave propagating media for guided and free space propagation. (Applying)

Examine the working conditions of Transmission Lines, Waveguides and Antennae. (Analysing)

Objective

The objective of the course is to introduce the students with the study of the behaviour of electromagnetic waves, which have a one-dimensional spatial dependence (plane waves). The course will also provide a basis for fundamental theoretical as well as practical concepts related to plane waves.

Module I: Transmission Lines (6 lectures)

Introduction, Concept of distributed elements, Equations of voltage and current, Standing waves and impedance transformation, Lossless and low-loss transmission lines, Power transfer on a transmission line, Analysis of transmission line in terms of admittances, Transmission line calculations with the help of Smith chart, Applications of transmission line, Impedance matching using transmission lines.

Module II: Maxwell's Equations (5 lectures)

Basic quantities of Electromagnetics, Basic laws of Electromagnetics: Gauss's law, Ampere's Circuital law, Faraday's law of Electromagnetic induction. Maxwell's equations, Surface charge and surface current, Boundary conditions at media interface.

Module III: Uniform Plane Wave (4 lectures)

Homogeneous unbound medium, Wave equation for time harmonic fields, Solution of the wave equation, Uniform plane wave, Wave polarization, Wave propagation in conducting medium, Phase velocity of a wave, Power flow and Poynting vector.

Module IV: Plane Waves at Media Interface (5 lectures)

Plane wave in arbitrary direction, Plane wave at dielectric interface, Reflection and refraction of waves at dielectric interface, Total internal reflection, Wave polarization at media interface, Brewster angle, Fields and power flow at media interface, Lossy media interface, Reflection from conducting boundary.

Module V: Waveguides (5 lectures)

Parallel plane waveguide: Transverse Electric (TE) mode, transverse Magnetic (TM) mode, Cut-off frequency, Phase velocity and dispersion. Transverse Electromagnetic (TEM) mode, Analysis of waveguide- general approach, Rectangular waveguides.

Module VI: Antennas (5 lectures)

Radiation parameters of antenna, Potential functions, Solution for potential functions, Radiations from Hertz dipole, Near field, Far field, Total power radiated by a dipole, Radiation resistance and radiation pattern of Hertz dipole, Hertz dipole in receiving mode.

Suggested Readings

R. K. Shevgaonkar, "Electromagnetic Waves", Tata McGraw Hill, 2005.
 D. K. Cheng, "Field and Wave Electromagnetics", Addison-Wesley, 1989.
 M. N.O. Sadiku, "Elements of Electromagnetics", Oxford University Press, 2007.
 A. Balanis, "Advanced Engineering Electromagnetics", John Wiley & Sons, 2012.
 A. Balanis, "Antenna Theory: Analysis and Design", John Wiley & Sons, 2005.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1		H	L	L		
CO 2			M	M	H	
CO 3	H				H	M

EECE0022/ EEED0078: ELECTRONIC DEVICES
(3 Credits - 45 hours) (L-T-P: 3-0-0)
Course Outcomes

Distinguish between the various types of transistors. (Understanding)
 Outline the principles of semiconductor Physics. (Understanding)
 Describe the mathematical models of semiconductor junctions and MOS transistors for circuits and Systems. (Applying)
 Categorize general specifications and deploy abilities of the electronic devices, and assemblies. (Analyzing)

Module I (8 Lectures)

Semiconductor materials, crystal lattices, bulk crystal growth, epitaxial growth.
 Bonding forces and energy bands in solids, charge carriers in semiconductors- electrons and holes, intrinsic and extrinsic materials; Carrier concentrations- Fermi level, temperature dependence; Drift of carriers- conductivity and mobility.
 Excess carriers in semiconductors- optical absorption, luminescence, carrier lifetime, photoconductivity; Diffusion of carriers- diffusion and recombination.

Module II (8 lectures)

PN junction formation, open circuit condition; forward bias- diffusion current, recombination and total current; Depletion layer capacitance, diffusion capacitance and dynamic resistance; I-V characteristics, and small signal switching models; Avalanche breakdown, Zener diode, Schottky diode.

Module III (8 lectures)

BJT, Construction, Operation, Amplifying Action, Common base (CB) dc characteristics, common base amplifier, common emitter (CE) characteristics, Ebers-Moll Model, Biasing, low frequency small signal model, Coupling and bypass capacitors.

Module IV (8 lectures)

Junction Field Effect Transistor (JFET), JFET amplifier; Metal Oxide Field Effect Transistor (MOSFET) - Field effect and inversion, Enhancement MOSFET, threshold voltage.

Module V (7 lectures)

Light Emitting Diodes (LED), Hetero-junction high intensity LEDs, LED characteristics.
 Solar Cells- Principles of photovoltaic devices, series and shunt resistance, solar cell materials, devices and efficiencies.

PIN diodes, photodiodes, semiconductor optical amplifiers and lasers.

Module VI (6 lectures)

Integrated circuit fabrication process: oxidation, diffusion, ion implantation, photolithography, etching, chemical vapor deposition, sputtering, twin-tub CMOS process, Ion implanted MOS transistors and Poly-Si Gates.

Suggested Readings

D. Neamen, D. Biswas, "Semiconductor Physics and Devices," McGraw-Hill Education.

NPTEL Lectures

G. Streetman, and S. K. Banerjee, "Solid State Electronic Devices," 7th edition, Pearson, 20

S. M. Sze and K. N. Kwok, "Physics of Semiconductor Devices," 3rd edition, John Wiley & Sons, 2006.

Y. Tsividis and M. Colin, "Operation and Modeling of the MOS Transistor," Oxford Univ. Press, 2011.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H	M			
CO 3					H	H
CO 4		H		H		

EEMM0074: MICROPROCESSORS AND MICROCONTROLLERS

(3 Credits - 45 hours) (L-T-P : 3-0-0)

Course Outcomes

List the various functional blocks of microprocessors and microcontrollers. (Remembering)

Explain the operation and configuration of the various functional blocks and pins of 8051 microcontroller. (Understanding)

Explain the functions of the assembly language instructions of 8051 microcontroller. (Understanding)

Make use of 8051 assembly language instructions to write programs for a given application. (Applying)

Design microcontroller based system for simple applications. (Creating)

Objective

This course provides an in-depth understanding of the architecture and operation of microprocessors and microcontroller, assembly language programming and microcontroller interfacing techniques. The students will be able to design and implement microcontroller-based systems in both hardware and software and can apply this knowledge to more advanced structures.

Module I: Fundamentals of Microprocessors (6 lecture)

Fundamentals of microprocessor architecture. 8-bit microprocessor and microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems. Overview of the 8051 family.

Module II: The 8051 Architecture (9 lecture)

Internal Block Diagram, CPU, ALU, address, data and control bus, Working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Data and Program Memory, Timing diagrams and Execution Cycles.

Module III: Instruction Set and Programming (8 lecture)

Addressing modes: Introduction, Instruction syntax, Data types, Subroutines Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, Bit inherent addressing, bit direct addressing. 8051 Instruction set, Instruction timings. Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Subroutine instructions, Bit manipulation instruction. Assembly language programs, C language programs. Assemblers and compilers. Programming and debugging tools.

Module IV: Timer, Serial Port and Interrupt Programming (10 lecture)

SFRs of Timers, Timer programming in assembly language and C, RS232 basics, Synchronous and asynchronous communication, SFRs for Serial Communication, Serial Port programming in assembly language and C, Interrupts of 8051, Interrupt programming in assembly language and C.

Module V: External Interfacing and Applications (12 lecture)

External memory interfacing, LED, LCD and keyboard interfacing. Stepper motor interfacing, DC Motor interfacing, ADC and DAC interfacing, sensors interfacing.

Suggested Readings

- M. A. Mazidi, J. G. Mazidi and R. D. McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Pearson Education, 2007.
 K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning, 2004.
 R. Kamal, "Embedded System", McGraw Hill Education, 2009.
 R. S. Gaonkar, "Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996.
 D. A. Patterson and J. H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013.
 D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 1991.
 Relevant datasheets.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	H	H	M		
CO 3		H		H	M
CO 4			M	H	
CO 5				H	H

EEPS0079: POWER SYSTEM II

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

- Describe the concept of power System economics and management. (Remembering)
 Explain the method of power system planning, operation and control. (Understanding)
 Carry out numerical analysis for solving power system problems. (Applying)
 Experiments with various load flow method, power quality issues and control of power systems. (Evaluating)

Objective

This course introduces the numerical methods for analyzing the power system in steady state and gives an understanding of the methods to control the voltage, frequency and various stability constraints in a synchronous grid also the monitoring and control and basics of economics of a power system.

Module I: Power Flow Analysis (7 hours)

Review of the structure of a Power System and its components. Analysis of Power Flows: Formation of Bus Admittance Matrix. Real and reactive power balance equations at a node. Load and Generator Specifications. Application of numerical methods for solution of non- linear algebraic equations – Gauss Seidel and Newton-Raphson methods for the solution of the power flow equations. Computational Issues in Large-scale Power Systems.

Module II: Stability Constraints in Synchronous Grids (9 hours)

Swing Equations of a synchronous machine connected to an infinite bus. Power angle curve. Description of the phenomena of loss of synchronism in a single-machine infinite bus system following a disturbance like a three--phase fault. Analysis using numerical integration of swing equations (using methods like Forward Euler, Runge-Kutta 4th order methods), as well as the Equal Area Criterion. Impact of stability constraints on Power System Operation. Effect of generation rescheduling and series compensation of transmission lines on stability.

Module III: Control of Frequency and Voltage (9 hours)

Turbines and Speed-Governors, Frequency dependence of loads, Droop Control and Power Sharing. Automatic Generation Control. Generation and absorption of reactive power by various components of a Power

System. Excitation System Control in synchronous generators, Automatic Voltage Regulators. Shunt Compensators, Static VAR compensators and STATCOMs. Tap-Changing Transformers. Power flow control using embedded dc links, phase shifters.

Module IV: Monitoring and Control (10 hours)

Overview of Energy Control Centre Functions: SCADA systems. Phasor Measurement Units and Wide-Area Measurement Systems. State-estimation. System Security Assessment. Normal, Alert, Emergency, Extremis states of a Power System. Contingency Analysis. Preventive Control and Emergency Control.

Module V: Power System Economics and Management (10 hours)

Basic Pricing Principles: Generator Cost Curves, Utility Functions, Power Exchanges, Spot Pricing. Electricity Market Models (Vertically Integrated, Purchasing Agency, Wholesale competition, Retail Competition), Demand Side-management, Transmission and Distributions charges, Ancillary Services. Regulatory framework.

Suggested Readings

Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education, 1994.

O.I.Elgerd, "Electric Energy Systems Theory", McGraw Hill Education, 1995.

R. Bergen and V.Vittal, "Power System Analysis", Pearson Education Inc., 1999.

D. P. Kothari and I. J. Nagrath, "Modern Power System Analysis", McGraw Hill Education, 2003.

M. Weedy, B. J. Cory, N. Jenkins, J. Ekanayake and G. Strbac, "Electric Power Systems", Wiley, 2012.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1					H
CO 2	H	M	H	M	
CO 3	L	H			
CO 4	H	L	H		

EEMI0080: MEASUREMENTS AND INSTRUMENTATION

(2 Credits – 30 hours) (L-T-P: 2-0-0)

Objective

This subject is aimed at familiarizing the students with the principle, construction and uses of instruments utilized for the measurement of Current, Voltage, Resistance, Inductance, beside the measurement of passive elements.

Course Outcomes

Define various static characteristics of measurement systems. (Remembering)

Utilize the concepts of various instruments for measuring different electrical and non-electrical quantities (Applying)

Explain instrumentation systems using different sensors and transducers. (Evaluating)

Module I: Concepts Relating to Measurements and Errors (10 hours)

Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity.

Errors in Measurements. Basic statistical analysis applied to measurements: Mean, Standard Deviation, Six-sigma estimation, Cp, Cpk.

Module II: Sensors and Transducers (10 hours)

a)Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors.

b)Current and Voltage Measurements. Shunts, Potential Dividers. Instrument Transformers, Hall Sensors. Measurements of R, L and C.

Module III: Measuring Instruments (10 hours)

Digital Multimeter, True RMS meters, Clamp-on meters, Meggers. Digital Storage Oscilloscope.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		M
CO 2		H	H
CO 3		H	M

EEED0082: ELECTRICAL DRIVES**(3 credits-45 hours) (L-T-P: 3-0-0)****Course Outcomes**

Describe the characteristics of D.C motor and relate the armature voltage control. (Remembering)

Explain the characteristics of the induction motor and recount the torque speed characteristics. (Understanding)

Implement knowledge of working of chopper fed DC drive and identify the quadrant of operation. (Applying)

Interrogate the impact of rotor resistance and assume the slip-ring induction motor for speed control. (Analyzing)

Check the ability to design a three-phase voltage source inverter and define the scalar control of the induction motor. (Evaluating)

Objective

Students will be able to understand and analyze the characteristics of various a.c and d.c motors and demonstrate the speed control using the power electronics converter.

Module I: DC motor characteristics (6 hours)

Review of emf and torque equations of DC machine, evaluation of torque-speed characteristics of separately excited dc motor, change in torque-speed curve with armature voltage, armature voltage control for varying motor speed.

Module II: Chopper fed DC drive and Multi-quadrant DC drive (10 hours)

Review of dc chopper and duty ratio control, chopper fed dc motor for speed control, steady state operation of a chopper fed drive, armature current waveform and ripple, calculation of losses in dc motor and chopper. Review of motoring and generating modes operation of a separately excited dc machine, four-quadrant operation of dc machine.

Module III: Closed-loop control of DC Drive (9 hours)

Control structure of DC drive, inner current loop and outer speed loop, dynamic model of dc motor – dynamic equations and transfer functions.

Module IV: Induction motor characteristics (8 hours)

Review of induction motor equivalent circuit and torque-speed characteristic, variation of torque-speed curve with (i) applied voltage, (ii) applied frequency and (iii) applied voltage and frequency.

Module V: Scalar control and Control of slip ring induction motor (12 hours)

Review of three-phase voltage source inverter, generation of three-phase PWM signals, sinusoidal modulation, space vector theory, conventional space vector modulation; constant V/f control of induction motor, steady-state performance analysis based on equivalent circuit, slip regulation. Impact of rotor resistance of the induction motor torque-speed curve, operation of slip-ring induction motor with external rotor resistance, starting torque, slip power recovery.

Suggested Readings

G. K. Dubey, "Power Semiconductor Controlled Drives", Prentice Hall, 1989.

R. Krishnan, "Electric Motor Drives: Modelling, Analysis and Control", Prentice Hall, 2001.

G. K. Dubey, "Fundamentals of Electrical Drives", CRC Press, 2002.

W. Leonhard, "Control of Electric Drives", Springer Science & Business Media, 2001.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2				H	M
CO 3		H	M		

CO 4				H	M
CO 5		M	H		

EEHV0083: HIGH VOLTAGE ENGINEERING

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Recall the concept of generation and measurement of D. C., A.C., & Impulse voltages. (Remembering)

Understand the basic physics related to various breakdown processes in solid, liquid and gaseous insulating materials. (Understanding)

Analyze the various tests on H. V. equipment and on insulating materials, as per the standards. (Analyzing)

Evaluate the various high voltage transmission system such as HVAC, HVDC etc. (Evaluating)

Objective

The subject helps in the detailed analysis of breakdown that occurs in gaseous, liquids and solid dielectrics and information about generation and measurement of high voltage and current along with high voltage testing methods.

Module I: Breakdown in Gases (8 hours)

Ionization processes and de-ionization processes, Types of Discharge, Gases as insulating materials, Breakdown in Uniform gap, non-uniform gaps, Townsend's theory, Streamer mechanism, Corona discharge.

Module II: Breakdown in liquid and solid Insulating materials (7 hours)

Breakdown in pure and commercial liquids, Solid dielectrics and composite dielectrics, intrinsic breakdown, electromechanical breakdown and thermal breakdown, Partial discharge, applications of insulating materials.

Module III: Generation of High Voltages (7 hours)

Generation of high voltages, generation of high D. C. and A.C. voltages, generation of impulse voltages, generation of impulse currents, tripping and control of impulse generators.

Module IV: Measurements of High Voltages and Currents (7 hours)

Peak voltage, impulse voltage and high direct current measurement method, cathode ray oscillographs for impulse voltage and current measurement, measurement of dielectric constant and loss factor, partial discharge measurements.

Module V: Lightning and Switching Over-voltages (7 hours)

Charge formation in clouds, Stepped leader, Dart leader, Lightning Surges. Switching over voltages, Protection against over-voltages, Surge diverters, Surge modifiers.

Module VI: High Voltage Testing of Electrical Apparatus and High Voltage Laboratories (7 hours)

Various standards for HV Testing of electrical apparatus, IS, IEC standards, Testing of insulators and bushings, testing of isolators and circuit breakers, testing of cables, power transformers and some high voltage equipment, High voltage laboratory layout, indoor and outdoor laboratories, testing facility requirements, safety precautions in H. V. Labs.

Suggested Readings

M. S. Naidu and V. Kamaraju, "High Voltage Engineering", McGraw Hill Education, 2013.

C. L. Wadhwa, "High Voltage Engineering", New Age International Publishers, 2007.

D. V. Razevig (Translated by Dr. M. P. Chourasia), "High Voltage Engineering Fundamentals", Khanna Publishers, 1993.

E. Kuffel, W. S. Zaengl and J. Kuffel, "High Voltage Engineering Fundamentals", Newnes Publication, 2000.

R. Arora and W. Mosch "High Voltage and Electrical Insulation Engineering", John Wiley & Sons, 2011.

Various IS standards for HV Laboratory Techniques and Testing.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		H	M		
CO 2		H				H
CO 3				H	H	

CO 4				H		H

EEDS0084: DIGITAL CONTROL SYSTEMS (3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Name different methods available for stability analysis of a system in the digital domain. (Remembering)

Classify various stability states of a system. (Understanding)

Model a system in a discrete domain. (Applying)

Analyse performance of digital controllers and systems. (Analysing).

Objective

This course aims to familiarize the student with the concept of system analysis and design in discrete-domain. Also, the course enables one to understand the concept of discrete representation of LTI systems, design and analyse digital controllers. Design of state feedback and output feedback controllers are introduced.

Module I: Discrete Representation of Continuous Systems (6 hours)

Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.

Module II: Discrete System Analysis (6 hours)

Z-Transform and Inverse Z Transform for analysing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time-response of discrete time system.

Module III: Stability of Discrete Time System (5 hours)

Stability analysis by Jury test. Stability analysis using bilinear transformation. Design of digital control system with dead beat response. Practical issues with dead beat response design.

Module IV: State Space Approach for Discrete Time Systems (10 hours)

State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reachability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability.

Module V: Design of Digital Control System(10 hours)

Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator.

Module VI: Discrete Output Feedback Control (8 hours)

Design of discrete output feedback control. Fast output sampling (FOS) and periodic output feedback controller design for discrete time systems.

Suggested Readings

K. Ogata, "Digital Control Engineering", Prentice Hall, Englewood Cliffs, 1995.

M. Gopal, "Digital Control Engineering", Wiley Eastern, 1988.

G. F. Franklin, J. D. Powell and M. L. Workman, "Digital Control of Dynamic Systems", Addison-Wesley, 1998.

C. Kuo, "Digital Control System", Holt, Rinehart and Winston, 1980.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1		M	H	H	L	
CO 2			H	H		
CO 3				M	H	M
CO 4	H	H	H			

EEDP0085: DIGITAL SIGNAL PROCESSING
(3 Credits - 45 hours) (L-T-P: 3-0-0)
Course Outcomes

Describe signals mathematically in continuous and discrete-time, and in the frequency domain. (Remembering).

Understanding the analytical tools such as Discrete Fourier Transforms, Fast Fourier Transforms and Z-Transforms essential for digital signal processing. (Understanding)

Implement digital signal processing for analysis of real-life signals. (Applying)

Check digital filters for various applications. (Evaluating)

Objective

This course aims to familiarize the student with the concept of signals and systems in discrete domain. Also, the course enables one to represent signals mathematically in continuous and discrete-time, and in the frequency domain. Analysis in Z-domain along with discrete Fourier transform is introduced. Design of digital filters and application of digital signal processing is introduced.

Module I: Discrete-Time Signals and Systems (6 hours)

Discrete time signals and systems: Sequences; representation of signals on orthogonal basis; Representation of discrete systems using difference equations, Sampling and reconstruction of signals - aliasing; Sampling theorem and Nyquist rate.

Module II: Z-Transform (6 hours)

Z-Transform, Region of Convergence, Analysis of Linear Shift Invariant systems using Z-Transform, Properties of Z-Transform for causal signals, Interpretation of stability in Z-domain, Inverse Z- transforms.

Module III: Discrete Fourier Transform (10 hours)

Frequency Domain Analysis, Discrete Fourier Transform (DFT), Properties of DFT, Convolution of signals, Fast Fourier Transform Algorithm, Parseval's Identity, Implementation of Discrete Time Systems.

Module IV: Design of Digital Filters (15 hours)

Design of FIR Digital filters: Window method, Park-McClellan's method. Design of IIR Digital Filters: Butterworth, Chebyshev and Elliptic Approximations; Low-pass, Band-pass, Band-stop and High-pass filters. Effect of finite register length in FIR filter design. Parametric and non-parametric spectral estimation. Introduction to multi-rate signal processing.

Module V: Applications of Digital Signal Processing (8 hours)

Correlation Functions and Power Spectra, Stationary Processes, Optimal filtering using ARMA Model, Linear Mean-Square Estimation, Wiener Filter.

Suggested Readings

S. K. Mitra, "Digital Signal Processing: A computer-based approach", McGraw Hill, 2011.

A.V. Oppenheim and R. W. Schaffer, "Discrete Time Signal Processing", Prentice Hall, 1989.

J. G. Proakis and D.G. Manolakis, "Digital Signal Processing: Principles, Algorithms and Applications", Prentice Hall, 1997.

L. R. Rabiner and B. Gold, "Theory and Application of Digital Signal Processing", Prentice Hall, 1992

J. R. Johnson, "Introduction to Digital Signal Processing", Prentice Hall, 1992.

D. J. DeFatta, J. G. Lucas and W. S. Hodgkiss, "Digital Signal Processing", John Wiley & Sons, 1988.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H		H		
CO 2	H	H	H	M	
CO 3				M	H
CO 4			M	H	

EEAD0093: ANALOG AND DIGITAL COMMUNICATIONS
(3 Credits - 45 hours) (L-T-P: 3-0-0)
Course Outcomes

Define different modulation techniques. (Remembering)

Apply probability and random process principles for noise analysis in communication channels. (Applying)

Analyze and compare different analog modulation schemes for their efficiency and bandwidth. (Analysing)

Estimate the inter symbol interference in digital modulation schemes. (Evaluating)

Objective

This course aims to familiarize the students with the concepts of communication systems. The course enables one to understand different modulation techniques both in analog and digital domains. Also, the course enables one to understand the behaviour of a communication channel and errors associated.

Module I: Review of Signals and Systems and Analog Modulation (10 hours)

Review of signals and systems, Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals.

Module II: Review of Probability and Random Process and Noise in Different Modulation Schemes (6 hours)

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and De-emphasis, Threshold effect in angle modulation.

Module III: Pulse Data Communication (8 hours)

Pulse modulation. Sampling process. Pulse Amplitude and Pulse code modulation (PCM), Differential pulse code modulation. Delta modulation, Noise considerations in PCM, Time Division multiplexing, Digital Multiplexers.

Module IV: Signal Detection (6 hours)

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations.

Module V: Digital Modulation (15 hours)

Baseband Pulse Transmission- Inter symbol Interference and Nyquist criterion. Pass band Digital Modulation schemes- Phase Shift Keying, Frequency Shift Keying, Quadrature Amplitude Modulation, Continuous Phase Modulation and Minimum Shift Keying. Digital Modulation trade-offs. Optimum demodulation of digital signals over band-limited channels- Maximum likelihood sequence detection (Viterbi receiver). Equalization Techniques. Synchronization and Carrier Recovery for Digital modulation.

Suggested Readings

Haykin S., "Communications Systems", John Wiley and Sons, 2001.

Proakis J. G. and Salehi M., "Communication Systems Engineering", Pearson Education, 2002.

Taub H. and Schilling D.L., "Principles of Communication Systems", Tata McGraw Hill, 2001.

Wozencraft J. M. and Jacobs I. M., "Principles of Communication Engineering", John Wiley, 1965.

Barry J. R., Lee E. A. and Messerschmitt D. G., "Digital Communication", Kluwer Academic Publishers, 2004.

Proakis J.G., "Digital Communications", 4th Edition, McGraw Hill, 2000.

H P Hsu, "Analog and Digital Communications", Special Indian Edition 2006, Tata McGraw Hill

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		M
CO 2		H	M	M	
CO 3	H				
CO 4	M				H

EESP0094: POWER SYSTEM PROTECTION
(3 Credits - 45 hours) (L-T-P: 3-0-0)
Course Outcomes

Recall the basic concepts of CT, PT, relays, CB and power system protection attributes. (Remembering)
 Summarize the different components of a protection system. (Understanding)
 Develop the understanding of digital protection basic principles. (Applying)
 Analyse the various protection schemes for different power system components. (Analysing)
 Evaluate fault current due to different types of fault in a network. (Evaluating)

Objective

The objective of this course is to introduce the students to power system protection problems and the basic concepts of its modeling and analysis. This course introduces the basic theory, construction, usage of current and voltage transformers, relays and circuit breakers. It covers the protection systems used for electric machines, transformers, bus-bars, overhead and underground lines, over-voltages, and digital protection.

Module I: Introduction and Components of a Protection System (8 hours)

Principles of Power System Protection, Relays, Instrument transformers, Circuit Breakers.

Module II: Faults and Over-Current Protection (8 hours)

Review of Fault Analysis, Sequence Networks. Introduction to Over-current Protection and over-current relay coordination.

Module III: Equipment Protection Schemes (12 hours)

Directional, Distance, Differential protection. Transformer and Generator protection. Bus-bar Protection, Bus Bar arrangement schemes. Feeder Protection. Earth fault relays.

Module IV: Digital Protection (8 hours)

Comparators, Introduction and block diagram of numerical relay, Computer-aided protection, Sampling Theorem.

Module V: System Protection and Simulation of Protection Schemes (9 hours)

Effect of Power Swings on Distance Relaying. System Protection Schemes. Under-frequency, Under-voltage and df/dt relays, Out-of-step protection, Synchro-phasors, Simulation of transients.

Suggested Readings

J. L. Blackburn, "Protective Relaying: Principles and Applications", Marcel Dekker, New York, 1987.
 Y. G. Paithankar and S. R. Bhide, "Fundamentals of power system protection", Prentice Hall, India, 2010.
 G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", John Wiley & Sons, 1988.
 G. Phadke and J. S. Thorp, "Synchronized Phasor Measurements and their Applications", Springer, 2008.
 D. Reimert, "Protective Relaying for Power Generation Systems", Taylor and Francis, 2006.
 P. M. Anderson, "Power System Protection", Wiley-IEEE Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	H	H	M		
CO 3		H		H	M
CO 4			M	H	
CO 5				H	H

EERE0095: RENEWABLE ENERGY SYSTEMS
(3 Credits - 45 hours) (L-T-P: 3-0-0)
Course Outcomes

Choose the most suited energy generation systems for potential locations of applications. (Remembering)
 Understand the basic physics of wind and solar power system.(understanding)
 Identify the potential fields of renewable energy applications. (Applying)
 Examine the power electronic interfaces for renewable energy systems. (Analyzing)

Objective:

The objective of this course is to understand and analyze the importance and potential of renewable energy, study the working principle and mechanism of the different renewable energy sources and to introduce the different renewable energy sources and its application in the current context

Module I: Physics of Wind Power (6 hours)

History of wind power, Indian and Global statistics, Wind physics, Betz limit, Tip speed ratio, stall and pitch control, Wind speed statistics-probability distributions, Wind speed and power-cumulative distribution functions.

Module II: Wind generator topologies (6 hours)

Review of modern wind turbine technologies, Fixed and Variable speed wind turbines, Power electronic converters. Generator-Converter configurations, Converter Control.

Module III: The Solar Resource (5 hours)

Introduction, solar radiation spectra, solar geometry, Earth Sun angles, observer Sun angles, solar day length, Estimation of solar energy availability.

Module IV: Solar Photovoltaic (10 hours)

Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array, Power Electronic Converters for Solar Systems, Maximum Power Point Tracking (MPPT) algorithms. Converter Control.

Module V: Network Integration Issues (10 hours)

Overview of grid code technical requirements. Voltage and frequency operating limits, solar PV and wind farm behavior during grid disturbances. Power quality issues. Power system interconnection experiences in the world. Hybrid and isolated operations of solar PV and wind systems, Integration in Smart Grid System.

Module VI: Solar Thermal Power Generation (2 hours)

Technologies, Fresnel reflector, solar pond, elementary analysis.

Module VII: Micro Hydel Generation (3 hours)

Operating principles. Power and Efficiency of Micro Hydel plant. Control, Automation and Monitoring in a Small Hydro Plant. Components of a microhydel power plant, Load balancing.

Module VIII: Bioconversion (3 hours)

Biomass, physical and biological thermal methods of bioconversion. Solid fuels, ethanol, methanol, vegetable oils. Biomass fuels in IC engines. Alcohol fuels, vegetable oils, producer gas.

Suggested Readings

- T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
 G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
 G.D. Rai, Non-conventional energy sources, Khanna publishers.
 S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.
 H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems", John Wiley and Sons Ltd., 2006.
 G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
 J.A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.

Mapping of COs to Syllabus

Course Out-comes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7	Module 8
CO 1	M	M						
CO 2			M			H		
CO 3				L	H			
CO 4				H	M			

EEPQ0096: POWER QUALITY AND FACTS
(3 Credits - 45 hours) (L-T-P: 3-0-0)
Course Outcomes

List the effect of shunt and series reactive compensation. (Remembering)
 Explain the working principles of FACTS devices. (Understanding)
 Compare performance of various FACTS devices. (Analyzing)
 Experiment with various FACTS devices to mitigate power quality issues. (Evaluating)

Objective

This course gives an introduction to the power quality and application of Flexible Ac Transmission Systems to enhance controllability and power transfer capability in ac systems and involves applications of power electronics devices in power systems to improve reliability of power supply and opens up new opportunities for controlling power and enhancing the usable capacity of present, as well as new and upgraded lines.

Module I: Series/Shunt Reactive Power Compensation (4 hours)

Basics of AC Transmission. Analysis of uncompensated AC transmission lines. Passive Reactive Power Compensation. Shunt and series compensation at the mid-point of an AC line. Comparison of Series and Shunt Compensation.

Module II: Thyristor-based Flexible AC Transmission Controllers (8 hours)

Description and Characteristics of Thyristor-based FACTS devices: Static VAR Compensator (SVC), Thyristor Controlled Series Capacitor (TCSC), Thyristor Controlled Braking Resistor and Single Pole Single Throw (SPST) Switch, Configurations/Modes of Operation, Harmonics and control of SVC and TCSC, Fault Current Limiter.

Module III: Voltage Source Converter based FACTS controllers (12 hours)

Voltage Source Converters (VSC): Six Pulse VSC, Multi-pulse and Multi-level Converters, Pulse-Width Modulation for VSCs, Selective Harmonic Elimination, Sinusoidal PWM and Space Vector Modulation. FACTS controller: Principle of Operation, operation of STATCOM, Reactive Power Control: Type I and Type II controllers, Static Synchronous Series Compensator (SSSC) and Unified Power Flow Controller, Principle of Operation and Control. Working principle of Interphase Power Flow Controller, Other Devices: GTO Controlled Series Compensator.

Module IV: Application of FACTS (8 hours)

Application of FACTS devices for power-flow control and stability improvement, Simulation example of power swing damping in a single-machine infinite bus system using a TCSC, Simulation example of voltage regulation of transmission mid-point voltage using a STATCOM.

Module V: Power Quality Problems in Distribution Systems (8 hours)

Power Quality problems in distribution systems: Transient and Steady state variations in voltage and frequency. Unbalance, Sags, Swells, Interruptions, Wave-form Distortions: harmonics, noise, notching, dc-off-sets, fluctuations. Flicker and its measurement. Tolerance of Equipment: CBEMA curve. Reactive Power Compensation, Harmonics and Unbalance mitigation in Distribution Systems using DSTATCOM and Shunt Active Filters. Synchronous Reference Frame Extraction of Reference Currents. Current Control Techniques in for DSTATCOM.

Module VI: Dynamic Voltage Restorer and Unified Power Quality Conditioner (6 hours)

Voltage Sag/Swell mitigation: Dynamic Voltage Restorer – Working Principle and Control Strategies, Series Active Filtering, Unified Power Quality Conditioner (UPQC): Working Principle. Capabilities and Control Strategies.

Suggested Readings

- N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.
 K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International (P) Ltd. 2007.
 T. J. E. Miller, "Reactive Power Control in Electric Systems", John Wiley and Sons, New York, 1983.
 R. C. Dugan, "Electrical Power Systems Quality", McGrawHill Education, 2012.
 G. T. Heydt, "Electric Power Quality", Stars in a Circle Publications, 1991

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H	M	M		

CO 2		M	M	M		M
CO 3		M	M	L		L
CO 4		L	M	L	H	M

EESD0116: POWER SYSTEM DYNAMICS AND CONTROL (3 Credits – 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Define basic terminologies and problems related to power system dynamics. (Remembering)

Understand the problem of power system stability and its impact on the system. (Understanding)

Model different power system components for the study of stability. (Applying)

Analyse steady-state and transient power system dynamics and use numerical integration methods. (Analysing)

Explain the Angular stability analysis in Single Machine Infinite Bus System and in multi-machine systems, frequency and voltage stability, methods to improve stability. (Evaluating)

Objective

The objective of this course is to introduce the students to power stability problems and the basic concepts of modeling and analysis of dynamical systems. Modeling of power system components - generators, transmission lines, excitation and prime mover controllers - is covered in detail. Stability of single machine and multi-machine systems is analyzed using small-signal analysis techniques. The impact of stability problems on power system planning and operation is also brought out.

Module I: Introduction to Power System Operations (3 hours)

Introduction to power system stability. Introduction to Power System Control. Power system stability problem- basic concepts and definitions- rotor angle stability, voltage stability and voltage collapse, classification of stability. Design and operating criteria for stability.

Module II: Analysis of Power System Dynamics and Numerical Methods (5 hours)

Swing Equation. Analysis of Steady State. Analysis of Transient Stability. Equal Area Criterion. Analysis using Numerical Integration Techniques- Euler Method, Modified Euler method, Runge-Kutta method. Numerical approximation of solutions, A-Stability. Numerical stability of explicit integration methods, Stiffness in transient stability. Implicit integration methods.

Module III: Modeling of Synchronous Machines and Associated Controllers (12 hours)

Modeling of synchronous machine: Physical Characteristics. Rotor position dependent model. D-Q Transformation. Model with Standard Parameters. Steady State Analysis of Synchronous Machine. Short Circuit Transient Analysis of a Synchronous Machine. Synchronization of Synchronous Machine to an Infinite Bus. Modeling of Excitation and Prime Mover Systems. Physical Characteristics and Models. Excitation System Control. Automatic Voltage Regulator. Prime Mover Control Systems. Speed Governors.

Module IV: Modeling of other Power System Components (10 hours)

Modeling of Transmission Lines and Loads. Transmission Line Physical Characteristics. Transmission Line Modeling. Load Models - induction machine model. Frequency and Voltage Dependence of Loads. Other Subsystems – HVDC and FACTS controllers, Wind Energy Systems.

Module V: Stability Analysis (11 hours)

Angular stability analysis in Single Machine Infinite Bus System. Angular Stability in multi-machine systems – Intra-plant, Local and Inter-area modes. Frequency Stability: Centre of Inertia Motion. Load Sharing: Governor droop. Single Machine Load Bus System: Voltage Stability. Introduction to Torsional Oscillations and the SSR phenomenon. Stability Analysis Tools: Transient Stability Programs, Small Signal Analysis Programs.

Module VI: Enhancing System Stability (4 hours)

Planning Measures. Stabilizing Controllers (Power System Stabilizers). Operational Measures- Preventive Control. Emergency Control.

Suggested Readings

K. R. Padiyar, "Power System Dynamics, Stability and Control", B. S. Publications, 2002.

P. Kundur, "Power System Stability and Control", McGraw Hill, 1995.

P. Sauer and M. A. Pai, "Power System Dynamics and Stability", Prentice Hall, 1997.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2		H	M		H	L
CO 3			H	H	L	
CO 4		H		M	H	
CO 5	M				H	H

EEIS0097: INDUSTRIAL ELECTRICAL SYSTEMS

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Course Outcomes

List the various components and define the various terminologies used in residential, commercial and industrial electrical systems. (Remembering)

Explain the construction, operations and application of various electrical components used and different methods employed in design of residential, commercial and industrial electrical systems. (Understanding)

Determine the ratings of various components used in residential, commercial and industrial electrical systems. (Applying)

Design residential, commercial and industrial electrical systems for a given problem. (Creating)

Objective

The objective of this course is to introduce the students to electrical wiring systems for residential, commercial and industrial consumers. The various concepts related to illumination systems for residential and commercial premises will be studied. Industrial Electrical System Automation is covered in detail.

Module I: Electrical System Components (8 hours)

LT system wiring components, selection of cables, wires, switches, distribution box, metering system, Tariff structure, protection components- Fuse, MCB, MCCB, ELCB, inverse current characteristics, symbols, single line diagram (SLD) of a wiring system, Contactor, Isolator, Relays, MPCB, Electric shock and Electrical safety practices

Module II: Residential and Commercial Electrical Systems (8 hours)

Types of residential and commercial wiring systems, general rules and guidelines for installation, load calculation and sizing of wire, rating of main switch, distribution board and protection devices, earthing system calculations, requirements of commercial installation, deciding lighting scheme and number of lamps, earthing of commercial installation, selection and sizing of components.

Module III: Illumination Systems (8 hours)

Understanding various terms regarding light, lumen, intensity, candle power, lamp efficiency, specific consumption, glare, space to height ratio, waste light factor, depreciation factor, various illumination schemes, Incandescent lamps and modern luminaries like CFL, LED and their operation, energy saving in illumination systems, design of a lighting scheme for a residential and commercial premises, flood lighting.

Module IV: Industrial Electrical Systems I (8 hours)

HT connection, industrial substation, Transformer selection, Industrial loads, motors, starting of motors, SLD, Cable and Switchgear selection, Lightning Protection, Earthing design, Power factor correction – kVAR calculations, type of compensation, Introduction to PCC, MCC panels. Specifications of LT Breakers, MCB and other LT panel components.

Module V: Industrial Electrical Systems II (6 hours)

DG Systems, UPS System, Electrical Systems for the elevators, Battery banks, Sizing the DG, UPS and Battery Banks, Selection of UPS and Battery Banks.

Module VI: Industrial Electrical System Automation (7 hours)

Study of basic PLC, Role of in automation, advantages of process automation, PLC based control system design, Panel Metering and Introduction to SCADA system for distribution automation.

Suggested Readings

S. L. Uppal and G.C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.

K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.

Web site for IS Standards.

H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M	H	M	M	M
CO2	L	H	H	H	H	H
CO3	M	H	H	M	M	L
CO4	L	H	H	H	M	L

EECA0098: ELECTRICAL ENERGY CONSERVATION AND AUDITING

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Apply the concept of energy management to improve energy efficiency in different electrical systems. (Applying)

Analyze the concepts of different energy efficient devices. (Analyzing)

Choose the appropriate energy conservation methodology for a particular energy source. (Evaluating)

Adapt new and efficient methodology to auditing. (Creating)

Objective

The objective of the course is to introduce energy conservation methodologies and importance of energy audit, measurement, energy performance diagnosis and analysis and carryout financial analysis and cost prediction for energy saving. The course also addresses the energy management issues in various sectors.

Module I: Energy Scenario (6 hours)

Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance, restructuring of the energy supply sector, energy strategy for the future, air pollution, climate change. Energy Conservation Act-2001 and its features.

Module II: Basics of Energy and its various forms (7 hours)

Electricity tariff, load management and maximum demand control, power factor improvement, election & location of capacitors, Thermal Basics-fuels, thermal energy contents of fuel, temperature & pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity & heat transfer, units and conversion.

Module III: Energy Management & Audit (6 hours)

Definition, energy audit, need, types of energy audit. Energy management (audit) approach understanding energy costs, benchmarking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments. Material and Energy balance: Facility as an energy system, methods for preparing process flow, material and energy balance diagrams.

Module IV: Energy Efficiency in Electrical Systems (7 hours)

Electrical system: Electricity billing, electrical load management and maximum demand control, power factor improvement and its benefit, selection and location of capacitors, performance assessment of PF capacitors, distribution and transformer losses. Electric motors: Types, losses in induction motors, motor efficiency, factors affecting motor performance, rewinding and motor replacement issues, energy saving opportunities with energy efficient motors.

Module V: Energy Efficiency in Industrial Systems (8 hours)

Compressed Air System: Types of air compressors, compressor efficiency, efficient compressor operation, Compressed air system components, capacity assessment, leakage test, factors affecting the performance and savings opportunities in HVAC, Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities, assessment of cooling towers.

Module VI: Energy Efficient Technologies in Electrical Systems (8 hours)

Maximum demand controllers, automatic power factor controllers, energy efficient motors, soft starters with energy saver, variable speed drives, energy efficient transformers, electronic ballast, occupancy sensors, energy efficient lighting controls, energy saving potential of each technology.

Suggested Readings

Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-1, General Aspects (available online).

Guide books for National Certification Examination for Energy Manager / Energy Auditors Book-3, Electrical Utilities (available online).

S. C. Tripathy, "Utilization of Electrical Energy and Conservation", McGraw Hill, 1991.

Success stories of Energy Conservation by BEE, New Delhi (www.bee-india.org).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	L		H			
CO 2					H	H
CO 3		L		M	L	M
CO 4	L		H	L		

EEEL0096: ELECTRICAL MACHINES**Course Outcomes(3 Credits - 45 hours) (L-T-P: 3-0-0)**

Explain principle of operation of various electrical machines. (Understanding)

Identify different types of dc and ac machines. (Applying)

Classify different types of dc and ac machines. (Analyzing)

Compare the performances in terms of losses, efficiency, and regulation of different types of dc and ac machines. (Evaluating)

Objective

This course on Electrical Machines, generally offered for students who do not major in Electrical Engineering, is an introductory course in electro-mechanical energy conversion devices. This course gives an introduction to DC as well as AC machines and transformers, to enable the students to use this knowledge for applying to situations arising in their disciplines.

Module I: D.C. Machines (15 hours)

Operating principle, generator & motor action, construction, types of excitation, emf & torque equations, power stages & efficiency. Commutation & Armature Reaction, characteristics & application of d.c generators, starting & speed control of d.c motors, characteristics & applications of d.c motors, electric braking.

Design of D.C Machines: Output equation, Main dimensions, Armature design, Armature windings, Design of commutator and brushes, Design of Field systems, Design of interpoles.

Module II: Transformers (10 hours)

Operating principle, classification, construction, emf equation, phasor diagrams, equivalent circuit model, losses & efficiency, voltage regulation, polarity test, autotransformers, three-phase transformer connections, & instrument transformers.

Module III: Induction Machines (10 hours)

Three-phase induction motors. Principle of operation, construction, types. Rotating magnetic field, emf equation of an AC Machine, torque developed in an induction motor, equivalent circuit model, torque-speed characteristics, starting & speed control. Single phase induction motors, starting, application.

Module IV: Synchronous Machines (10 hours)

Construction, types & operating principle of synchronous generator, A.C armature windings, equivalent circuit, phasor diagrams, voltage regulation, parallel operation, synchronization, Power Angle characteristics, effect of field excitation change. Synchronous Motor, principle, starting, hunting, damper windings. Special Purpose Motors: Stepper Motor, Universal Motor, shaded-pole Motor.

Suggested Readings

Fitzgerald, Kingslay and Umans, "Electric Machinery", Tata McGraw-Hill.

Chapman, "Electric Machinery Fundamentals", McGraw-Hill Higher Education.

Nagrath and Kothari, "Electric Machines", Tata McGraw-Hill.

Guru and Hiziroglu, "Electric Machinery and Transformer, Oxford University press.

P.S. Bimbhra, "Electric Machinery", Khanna Publishers.

Vincent Deltoro, "Basic Electric Machines", Prentice Hall.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	M	M	M	M
CO 3	M	M	M	M
CO 4	H	H	H	H

EEWE0092: WASTE TO ENERGY

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Select the appropriate method for Biomass pyrolysis, biomass gasification and biomass combustion for waste to energy conversion. (Remembering)

Explain waste management systems with respect to its physical properties, and associated critical considerations in view of emerging technologies. (Understanding)

Implement energy conversion system for conversion of waste to electrical energy. (Applying)

Design cooking stoves, digester, gasifier. (Creating)

Objective

The objective of this course is to introduce different sources, processes to carry on waste to energy conversion. The students will be able to design different systems and devices for converting waste materials to useful energy.

Module I: Introduction to Energy from waste (9 hours)

Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW, Conversion devices, Incinerators, gasifiers, digestors.

Module II: Biomass Pyrolysis (9 hours)

Pyrolysis, Types, slow, fast, Manufacture of charcoal, Methods, Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Module III: Biomass Gasification (9 hours)

Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation, Gasifier burner arrangement for thermal heating, Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.

Module IV: Biomass Combustion (9 hours)

Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation, Operation of all the above biomass combustors.

Module V: Biogas (9 hours)

Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system, Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, Direct combustion, Types of biogas Plants, Applications, Alcohol production from biomass, Bio-diesel production, Urban waste to energy conversion, Biomass energy programme in India.

Suggested Readings:

Ashok V. Desai, "Non Conventional Energy", Wiley Eastern Ltd., 1990.

K. C. Khandelwal and S. S. Mahdi, "Biogas Technology - A Practical Hand Book - Vol. I & II", Tata McGraw Hill Publishing Co. Ltd., 1983.

D. S. Challal, "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.

C. Y. WereKo-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1996.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	H	H	H	
CO 2	H	M	M	M	M
CO 3			H	H	
CO 4				H	M

EEOD0099: OPTOELECTRONIC DEVICES

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Describe and show the working of basic optoelectronics devices such as optical sources, detectors, optical amplifiers and connectors, etc. (Remembering)

Explain the nature and performances of various types of optical sources, photodetectors, connectors and couplers (Understanding)

Implement mathematical models to compute the efficiencies and other parameters related to optoelectronic sources, detectors and amplifiers. (Applying)

Check the performance characteristics of optical sources, detectors, optical amplifiers and other optoelectronics components. (Evaluating)

Objective

The course is intended to give the students an exposure to the design criteria for semiconductor optical sources including light emitting diodes and laser diodes, optical detectors, amplifiers and connectors for a variety of applications.

Module I: Sources (15 hours)

Light Emitting Diodes (LEDs), LED Structures, LED types, Fabrication of LED, Light Source Materials, Internal Quantum Efficiency, Modulation Capacity, Transient Response, Power– Bandwidth Product, Laser Diodes, Laser Diode Modes and Threshold Conditions, Single mode operation, Mode locking, Q-switching, Holography, Resonant Frequencies, Laser Diode Structures and Radiation Patterns, Single Mode Lasers, Modulation of Laser Diodes, Temperature Effects, Light Source Linearity, Modal Partition and Reflection Noise.

Module II: Detectors (10 hours)

PIN Photo-Detector, Avalanche Photodiodes, Photo-Detector Noise, Noise Sources, Signal-to-Noise Ratio, Depletion Layer Photocurrent, Response Time, Avalanche Multiplication Noise, Temperature Effects on Avalanche Gain, Photodiode Materials.

Module III: Amplifiers and Switches (10 hours)

Optical Amplifiers, Semiconductor Laser Amplifiers, Fiber Amplifiers, Rare Erbium Doped Fiber Amplifiers, Raman Fiber Amplifiers, Brillouin Fiber Amplifiers, Amplifier Gain, Noise Figure, Bandwidth, Photonic Switching, Integrated Optical Switches.

Module IV: Connectors and Couplers (10 hours)

Cylindrical Ferrule Connector, Bi-Conical Ferrule Connectors, Double Eccentric Connectors, Duplex Fiber Connectors, Expanded Beam Connectors, Beam Splitter, Three Port Couplers, Four Port Couplers, Directional Couplers, Star Couplers, Lenses for Coupling Improvement.

Suggested Readings

J. Wilson, J.F.B. Hawkes, "Optoelectronics - An Introduction", Prentice Hall of India Private Limited.
G. Keiser, "Optical Fiber Communications", McGraw Hill.
D.K. Mynbaev and L.L. Scheiner, "Fiber Optic Communications Technology", Pearson.
S.K. Sarkar, "Optical Fibers and Fiber Optic communication system", S. Chand and Co.
J.C. Palais, "Fiber Optic Communications", Pearson.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		H	H
CO 2	H	H	M	H
CO 3	H	H	M	L
CO 4	H	H	M	

EEEL0100: ELECTRICAL AND ELECTRONICS MATERIALS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Describe basic terminologies related to properties of materials used in electrical engineering. (Remembering)
Explain the electrical and thermal characteristics of conducting, semiconducting, insulating and magnetic materials for the manufacturing of electrical machines and electronic components. (Understanding)
Implement advanced studies in solar photovoltaic material for green and clean power generation in view of sustainable development through environmental and safety aspects. (Applying)
Compare different material behavior. (Analyzing)
Check the performance of different electrical materials. (Evaluating)

Objective

The objective of the course is to provide the knowledge of different electrical engineering materials and their applications in designing electrical equipment. The course also provides the study of thermal properties for the efficient design and long-life cycle of electrical equipment.

Module I: Conductors (8 hours)

Classification: High conductivity, high resistivity materials, Fundamental requirements of high conductivity materials and high resistivity materials, Mobility of electron in metals, Factors affecting conductivity and resistivity of electrical material.

Thermoelectric Effect: See back effect, Peltier effect, Thomson effect. Commonly used high conducting materials, properties, characteristics and applications of copper, aluminum, bronze, brass, High resistive materials, Constantan, platinum, nichrome, properties, characteristics, Materials used for AC and DC machines.

Module II: Semiconductors and Superconductors (8 hours)

General concepts, energy bands, Types of semiconductors: intrinsic Semiconductors, extrinsic Semiconductors. Compound semiconductor, amorphous semiconductor. Hall effect, drift, mobility, diffusion in Semiconductors. Semiconductors and their applications.

Superconductors: Superconductivity, Properties of Superconductors, Critical field, Meissner effect, Type-I and type-II Superconductors.

Module III: Dielectrics and Insulators (8 hours)

Properties of gaseous, liquid and solid dielectric, dielectric as a field medium, Electric conduction in gaseous, liquid and solid dielectric, Breakdown in dielectric materials, mechanical and electrical properties of dielectric

materials, Effect of temperature on dielectric materials, polarization, loss angle and dielectric loss. Petroleum based insulating oils, transformer oil, capacitor oils, and properties. Classification of insulation (Solid) and application in AC and DC machines. Solid electrical insulating materials, fibrous, paper boards, yarns, cloth tapes, sleeving wood, impregnation, plastics, filling and bounding materials, fibrous, film, mica, rubber, mica-based materials, ceramic materials.

Module IV: Magnetic Materials (8 hours)

Basic terms, Classification of magnetic material, diamagnetic, paramagnetic, ferromagnetic, antiferromagnetic and amorphous material. Hysteresis loop, magnetic susceptibility, coercive force, curie temperature. Magnetostriction, factors affecting permeability and hysteresis loss. Common magnetic materials, Soft and hard magnetic materials. Electric steel, sheet steel, cold rolled grain-oriented silicon steel, hot rolled grain-oriented silicon steel, hot rolled silicon steel sheet.

Module V: Insulating Materials (6 hours)

Gaseous materials-Oxide gases, electronegative gases, hydrocarbon gases; Liquid materials-mineral oils, silicon liquids, hydrocarbon liquids; Solid Materials-Paper and boards, Resins (Polymers), Rubbers-natural and synthetic, glass, ceramics, asbestos.

Module VI: Modern Engineering Materials (7 hours)

Materials for Electronic Components - Resistors, Capacitors, Inductors, Relays, Bipolar transistors, Field effect transistor (FET), Integrated circuits, Power devices.

Nanotechnology – Introduction, Nano-devices, applications.

Solar/Photovoltaic Cell- Introduction, Photo-generation of charge carriers, p-n junction, Light absorbing materials: Silicon thin films, concentrating photovoltaic.

Suggested Readings

S. L. Uppal and G.C. Garg, "Electrical Wiring, Estimating & Costing", Khanna publishers, 2008.

K. B. Raina, "Electrical Design, Estimating & Costing", New age International, 2007.

S. Singh and R. D. Singh, "Electrical estimating and costing", Dhanpat Rai and Co., 1997.

S.P. Seth, "A Course in Electrical Engineering Materials", Dhanpat Rai Publishing Co Pvt Ltd.

Web site for IS Standards.

H. Joshi, "Residential Commercial and Industrial Systems", McGraw Hill Education, 2008.

A. J. Dekker, "Electrical Engineering Materials". PHI Pvt. Ltd.

C. S. Indulkar and S. Thiruvengadam, "Electrical Engineering Materials", S. Chand Publication.

G. P. Chhahotra and B.K. Bhat, "Electrical Engineering Materials", Khanna Publication, 1991.

N. Alagappan and N.T. Kumar, "Electrical Engineering Materials", 34th edition, Technical Teachers' Training Institute, Madras, Tata McGraw-Hill Education.

P.L. Kapur, "A Text Book of Electrical and Electronics Engineering Materials", 8th edition, Khanna Publishers.

S.K. Bhattacharya, "Electrical and Electronics Engineering Materials and Components", Khanna Publishers.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1		H		H		
CO 2	H	H		H		
CO 3	M	H	M	H		
CO 4	H	H	H	M	M	M
CO 5	L	H	M			H

EESS0075: SIGNALS AND SYSTEMS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

At the end of this course, students will be able to:

Define the basic terms related to continuous and discrete time LTI systems. (Remembering)

Classify the signals and systems into continuous-discrete, time varying-time invariant and linear-nonlinear types. (Understanding)

Make use of Fourier, Laplace and z-Transforms techniques in analysis of signals and systems. (Applying)
Examine the signals and systems by using the results of the transform techniques. (Analysing)
Estimate the continuous time equivalence of a discrete signal by applying reconstruction techniques. (Evaluating)

Objective

The Objective of the course is to acquaint the students with the various types of signals, which form the basis of electronic communication. The course also is intended to provide the theoretical background necessary to understand the working of any signal processing system and apply the techniques.

Module I: Introduction to Signals and Systems (10 hours)

Signals and systems as seen in everyday life and in various branches of engineering and science.

Signal properties: periodicity, absolute integrability, determinism and stochastic character.

Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals;

Continuous and discrete time signals, continuous and discrete amplitude signals.

System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability. Examples.

Module II: Behaviour of Continuous and Discrete-Time LTI Systems (12 hours)

Impulse response and step response, convolution, input-output behaviour with aperiodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations.

State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role.

Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.

Module III: Fourier, Laplace and Z-Transforms (17 hours)

Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem.

Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behaviour.

The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.

Module IV: Sampling and Reconstruction (6 hours)

The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems.

Suggested Readings

A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.

J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.

H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.

S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.

A. V. Oppenheim and R. W. Schaffer, "Discrete-Time Signal Processing", Prentice Hall, 2009.

M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.

B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2	M	H		
CO 3			H	M
CO 4			H	L
CO 5			L	H

EEOT0101: OPTIMIZATION TECHNIQUES
(3 Credits - 45 hours) (L-T-P: 3-0-0)
Course Outcomes

Define and explain the importance in solving engineering problems using Linear Programming. (Remembering)

Identify and describe the various types of formulation methods like Simplex Method, Dual Simplex Method. (Understanding)

Establish the need for linear programming and classify different non-linear programming methods in solving system. (Analysing)

Evaluate the performance characteristics of genetic algorithm and particle swarm optimization. (Evaluating)

Objective

This subject introduces optimization theory and its importance in solving of engineering problems. Students can learn linear and nonlinear programming, constrained and unconstrained optimization in this subject

Module I: Introduction & Linear Programming (18 hours)

Importance in solving system engineering problems, Introduction to Linear Programming problem-Formulation, Simplex Method, Dual Simplex Method, Sensitivity Analysis, Duality in Programming.

Module II: Introduction to Nonlinear Programming (10 hours)

Unconstrained optimization-formulation of quadratic optimization problems, gradient descent and steepest descent methods, Quasi-Newton Method, Fibonacci and golden section, Quadratic Interpolation method.

Module III: Constrained Optimization (10 hours)

Direct optimization, Cutting plane methods, methods of feasible direction, analytic center cutting plane methods, Multi-objective optimization-Genetic Algorithm, Kuhn-Tucker conditions.

Module IV: Dynamic Programming (7 hours)

Principle of optimality, recursive equation approach, application to shortest route, Cargo Loading, allocation & production, schedule problems.

Suggested Readings

S. S. Rao, Optimization theory and applications, Wiley Eastern Ltd.

K. V. Mittal, Optimization methods, Wiley Eastern Ltd.

R. Fletcher, "Practical Optimization", John Wiley and Sons, New York.

M. S. Bazaraa, H. D. Sherali and C. Shetty, "Nonlinear Programming, Theory and Algorithms", John Wiley and Sons, New York.

N. A. Kheir, "System modeling and computer simulation", Marcel Decker, New York.

G.A Korn., "Interactive Dynamic System Simulation", McGraw Hill, N.Y.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2	H	L		
CO 3	M	H	M	
CO 4		M	M	H

EEGE0102: GREEN ENERGY
(3 Credits: 45 Hours) (L-T-P: 3-0-0)
Course Outcomes

List and recognize the various renewable energy resources and their importance. (Remembering)

Summarize the power generation using renewable energy resources. (Understanding)

Identify the potential fields of renewable energy applications. (Applying)

Experiments with modeling of renewable energy resources. (Evaluating)

Objective

The objective of this course is to introduce the different renewable energy resources and their applications. The course helps in understanding the importance and potential of renewable energy resources, the working principles and mechanisms of the different renewable energy sources and their analysis in the current context.

Module I: Introduction (3 hours)

Energy needs of India, classification of energy sources, energy efficiency and energy security, importance of renewable energy resources.

Module II: Solar Energy (11 hours)

Basic concepts, types of collectors, collection systems, photo voltaic (PV) technology: solar thermal effect, solar cells, characteristics of PV systems, equivalent circuit, and array design, building integrated PV system and efficiency calculations, applications.

Module III: Wind Energy (10 hours)

Wind power systems, wind speed and power relation components, turbine types, turbine rating. Choice of generators and site selection, wind energy forecasting, variable speed operation, maximum power operation.

Module IV: Bio energy (9 hours)

Bio-mass and bio-gas: principles of bio-conversion, bio-gas digesters types, gas yield, and combustion characteristics, fermentation and wet processes, applications-utilization for cooking.

Module V: Other renewable energy Resources (12 hours)

Hydro energy, Geothermal energy, ocean thermal energy, wave energy, Tidal energy, waste to energy, heat to energy, Fuel cells: types and applications.

Suggested Readings

- T. Ackermann, "Wind Power in Power Systems", John Wiley and Sons Ltd., 2005.
 G. M. Masters, "Renewable and Efficient Electric Power Systems", John Wiley and Sons, 2004.
 G.D. Rai, Non-conventional energy sources, Khanna publishers.
 S. P. Sukhatme, "Solar Energy: Principles of Thermal Collection and Storage", McGraw Hill, 1984.
 H. Siegfried and R. Waddington, "Grid integration of wind energy conversion systems", John Wiley and Sons Ltd., 2006.
 G. N. Tiwari and M. K. Ghosal, "Renewable Energy Applications", Narosa Publications, 2004.
 J. A. Duffie and W. A. Beckman, "Solar Engineering of Thermal Processes", John Wiley & Sons, 1991.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	L	L	L	L	L
CO 2		M	M	M	
CO 3		H	H	L	L
CO 4		H	H		

LABORATORY COURSES

**EEEL101L: BASIC ELECTRICAL ENGINEERING LABORATORY
(1 Credit- 30 hours) (L-T-P: 0-0-2)**

Course Outcomes

Find different parameters related to basic electrical circuits. (Remembering)

Explain the procedure for performing experiments related to DC and AC circuits. (Understanding)

Identify various rotating AC and DC machines. (Applying)

Compare the theoretical prediction with experimental results. (Analyzing)

Check errors and correction of meters by calibration (Evaluating)

Construct a circuit to perform a particular experiment. (Creating)

List of experiments:

Calibration of a Voltmeter.

Calibration of an Ammeter.

Calibration of milliammeter as a voltmeter.

Calibration of a millivoltmeter as an ammeter.

Verification of Thevenin's theorem.

Resonance in series RLC circuit

Reversal of direction of rotation of 3-phase induction motor by changing phase sequence.

Different types of Connections of the transformer.

Demonstration of DC and AC machines.

Demonstration of LT switchgear.

Mapping of COs to Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10
CO 1	H	H	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	M	M	M	M	M
CO 3				L		L	L	L	L	L
CO 4	M	M	M	M	H	H	H	H	H	H

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	3	2	2	1	1	2						3	2	2	1
CO 2	3	3	3	2	2	2	2						3	3	3	3
CO 3	3	3	3	2	1	1	1						3	3	3	2
CO 4	3	3	3	2	2	2	1						3	2	3	2

Mapping of Courses to PO/PSO

Course code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EEEL101L	L	H	H	M	L	L	M						M	H	H	L

EEEM206P: ELECTRICAL MACHINES-I LABORATORY

(1 Credit - 15 hours) (L-T-P: 0-0-2)

Pre-requisite: Basic Electrical Engineering, Electrical Machines-I Theory

Objective

This course aims to familiarize the students with hands-on experiments on different electrical machines and help them to gain the skills for these machines. The instructor will provide understanding of construction, principle of operation, performance, and control of various electrical machines used in the industry.

Course Outcomes

Recall and relate their theoretical knowledge of various electrical machines for different applications. (Remembering)

Explain the experimental procedure and demonstrate their ability to perform experiments related to different electrical machines. (Understanding)

Utilize different machines for different applications, e.g., speed control, voltage control, load tests etc. (Applying)

Evaluate the performance and various operating parameters of different electrical machines. (Evaluating)

List of Experiments:

Experiment to determine self and mutual inductances of two coupled-inductors

Open-circuit and short-circuit tests on single phase transformer and determination of parameters, regulation and efficiency of transformer

Parallel Operation of Two Single Phase Transformers

Determination of the characteristic of a DC Shunt Generator

Determination of equivalent circuits parameters of a Three Phase Induction Motor

Determination of efficiency of DC machine through Hopkinson's Test

(a) Scott Connection of Two Single phase Transformers (b) Vector group test

Determination of OCC, SCC and ZPF characteristics of a 3-phase Synchronous Machine

Synchronization and V-curve of a Synchronous Machine

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2		1	1	1			1	1		1	2	1	1	1
CO 2	2	2		3	2	1	1	1	2	2		2	2	2	2	1
CO 3	3	2	2	2	3	1	1	1	2	2		2	3	2	3	2
CO 4	2	3	1	3	2	1	1	1	2	2		2	3	2	3	2

Mapping of Courses to PO/PSO

Course Code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EEEM206P	H	H	L	H	M	L	L	L	M	M		M	H	M	H	M

EENA205P: NETWORK ANALYSIS (LABORATORY)

(1 Credits: 30 hours) (L-T-P:0-0-2)

Pre-requisite: Basic Electrical Engineering Lab

Objective

The primary objectives of a Network Analysis lab are to provide students with a practical understanding of electrical circuits and networks, enabling them to analyze, design, and simulate them using both theoretical knowledge and experimental skills.

COURSE OUTCOMES

The students are expected to have the ability to

Apply circuit theorems such as Superposition, Millman's, and Reciprocity to verify the behavior of electrical networks using both hardware and simulation tools.(Applying)

Analyze the transient response of R-L, R-C, and R-L-C circuits using experimental setups and interpret the impact of component values on circuit performance.(Analyzing)

Measure and interpret frequency response characteristics of LP and HP filters, and *demonstrate* the ability to measure power in a three-phase system using the two-wattmeter method. (Analyzing)

Determine the Z and Y parameters of two-port networks and *evaluate* their significance in electrical network analysis. (Evaluating)

List of the Experiments:

Transient response in R-L and R-C Network: Simulation/ Hardware

Transient response in R-L-C Series and Parallel circuits Network: Simulation/ Hardware

Determination of Impedance (Z) and Admittance (Y) parameters of two port network

Frequency response of LP and HP Filters

Verification voltage and current division

Bridge rectifier with and without filters

Verification of Millman's theorem

Verification of Reciprocity theorem

Measurement of power in a three phase ac circuit using two watt meters method

Verification of the Network Theorem using Hardware, PSpice/Scilab

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	2	1	2	1	1	1	3	3	1	2	2	2	2	2
CO 2	3	3	2	1	2	1	1	1	3	3	1	2	2	2	3	2
CO 3	3	3	2	2	2	1	1	1	3	3	1	2	3	2	3	2
CO 4	3	2	2	2	2	1	1	1	3	3	1	2	3	2	3	2

Mapping of Courses to PO/PSO

Course Code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EENA205P	H	H	H	M	M	L	L	L	M	M	L	H	H	M	H	M

EEAE204P: ANALOG ELECTRONICS LAB

(1 Credit: 30 hours) (L-T-P: 0-0-2)

Objective: To develop practical skills in designing, simulating, and characterizing analog electronic circuits using diodes, BJTs, MOSFETs, and op-amps (741).

List of Experiments:

Design a test circuit to measure forward/reverse bias characteristics of silicon diode. Extract threshold voltage (V_f), reverse saturation current (I_s), and breakdown voltage from plotted I-V curves. (CO3: Measurement circuit design, CO4: Parameter extraction)

Design a circuit to plot IC vs VCE curves for 2N2222 BJT at three different base currents (20 μ A, 40 μ A, 60 μ A). (CO3: Biasing design, CO4: Parameter calculation)

Design and construct a common-emitter amplifier using NPN BJT to achieve voltage gain of (CO3: Design to spec, CO4: Analyze gain/BW)

Design a common-source amplifier with IRF510 MOSFET. (CO3: Design biasing, CO4: Evaluate linearity)

Implement an inverting amplifier using 741 opamp. (CO3: Component selection, CO4: Test CMRR)

Design non-inverting amplifier using 741 opamp. (CO3: Component selection, CO4: Test CMRR)

Build a differential pair and measure CMRR. (CO3: Balanced design, CO4: CMRR evaluation)

Create symmetrical clipping circuit using 1N4148 diodes. (CO3: Clipping level design, CO4: Distortion measurement)

Design 5.1V regulator maintaining output within 5% for line (9-12V) and load (5-20mA) variations. Measure line/load regulation. (CO3: Zener selection, CO4: Regulation analysis)

Construct balanced modulator. (CO3: Diode matching, CO4: Modulation analysis)

Simulate a half-wave rectifier with $\leq 2\%$ error using 741 and diode. Measure rectification accuracy up to 10kHz and output impedance. (CO3: Opamp-diode integration, CO4: Precision evaluation)

Simulate a 2nd-order Butterworth LPF ($f_c = 1\text{kHz} \pm 5\%$) using 741. Validate cutoff frequency and measure stopband attenuation at 5kHz. (CO3: Filter design, CO4: Freq. Response)

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 3	3	3	3	2	2					1	1	2	3	3	3	2
CO 4	3	3	2	3	3					2	1	2	3	3	3	2

Mapping of Courses to PO/PSO

Course code	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
EEAE204P	H	H	H	H	H	L	L	L	L	M	L	M	H	H	H	M

DIGITAL ELECTRONICS LAB

(1 Credit - 30 hours) (L-T-P: 0-0-2)

Objective

This course will enable students to get practical experience in design, realization and verification of Demorgan's Theorem, SOP, POSforms. They will be able to realize Full/Parallel Adders, Subtractors, Multiplexer, Demultiplexers, Decoders, Flip-Flops, Shift registers and counters using logic gates.

Course Outcomes

Demonstrate the truth table of various expressions and combinational circuits using logic gates. (Understanding)

Identify different components of digital electronics. (Applying)

Evaluate various combinational circuits such as adders, subtractors, comparators, multiplexers and de-multiplexers. (Analyzing)

Design various combinational and sequential circuits. (Creating)

List of Experiments:

1. To verify the truth tables of the basic logic gates.
2. To verify De-morgan's Theorem for 2 variables using universal gates.
3. To verify the sum-of product and product-of-sum expressions using universal gates.
4. To design and implement a Full Adder using basic logic gates.
5. To design and implement a Full subtractor using basic logic gates.
6. To design and implement 4-bit Parallel Adder/ subtractor using IC 7483.
7. To realize 4:1 Multiplexer using gates.
8. To realize 1:8 Demux and 3:8 Decoder using IC74138.
9. To realize the following flip-flops using NAND Gates. (a) Clocked SR Flip-Flop (b) JK Flip-Flop.

10. To realize the following shift registers using IC7474 (a) SISO (b) SIPO (c) PISO (d) PIPO.
 11. To realize the Ring Counter and Johnson Counter using IC7476.
 12. To realize the Mod-N Counter using IC7490.

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	3	1	3				3	2	1	1	3	3	2	3
CO 2	3	3	3	1	3				3	3	1	1	3	3	3	3
CO 3	3	3	3	3	3				3	3	3	1	3	3	1	3
CO 4	3	3	3	2	3				3	3	3	1	3	3	1	3

Mapping of Courses to PO/PSO

Cour se code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	H	H	H	M	H	L	L	L	L	L	L	M	H	H	H	H

CONTROL SYSTEMS LABORATORY**(1 Credit - 30 hours) (L-T-P: 0-0-2)****Objective**

To enable students to model, analyze, and design feedback control systems through numerical simulation using Python libraries such as NumPy, SciPy, and Matplotlib, with emphasis on time and frequency domain analysis, system stability evaluation, and compensator design.

List of Experiments:

State-space modeling of mechanical system using Python.

Transfer function analysis of RLC circuit using Python.

Time response of second-order system using Python.

Block diagram reduction using matrix methods in Python.

Steady-state error calculation for unity feedback system using Python.

Routh-Hurwitz stability check using Python.

BIBO stability testing with impulse response using Python.

Sensitivity analysis of gain variations using Python.

Frequency response (Bode plot) using Python.

Design and visualization of lead-lag compensators using Python.

Mapping of COs to PO/PSO

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	3	2	1	1	1				1	1	2	3	2	3	2	3
CO 2	3	3	2	2	1				2	1	2	3	3	3	3	3
CO 3	3	3	3	2	2				1	1	2	3	3	3	3	3

CO 4	3	3	2	3	2				1	1	3	3	3	3	3	3

Mapping of Courses to PO/PSO

Cour se code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	H	H	H	M	M	L	L	L	L	L	L	M	H	H	H	H

POWER ELECTRONICS LABORATORY**(1 Credit –30 hours) (L-T-P: 0-0-2)****Pre-requisite:** Physics, Basic Electrical Engineering**Objective**

The objective of the course is to analyse the various characteristics of the power electronics devices, design and test various arrangements of power devices-based rectifiers and inverters and choppers under power electronics systems.

Course Outcomes

1. Define different power electronics components. (Remembering).
2. Construct various firing circuits of SCR.(Creating)
3. Determine the V-I characteristics of different types of power electronics switches. (Evaluating)
4. Design circuits for AC to DC, DC to DC and DC to AC conversions. (Creating)

List of Experiments:

Study of R, RC and UJT firing circuits.
 Study UJT firing circuits.
 Study of V-I characteristics of SCR.
 Determination of Holding current and Latching current of SCR.
 Single phase half-wave controlled rectifier
 Single phase full-wave controlled bridge rectifier.
 Study of V-I characteristics of MOSFET.
 Study of UJT firing circuit.
 Study of BUCK converter.
 Study of BOOST converter.
 Study of BUCK-BOOST converter.
 Study of Single-phase square wave inverter.
 Study of PWM inverter.

Suggested Readings

M.R. Rashid, Power Electronic Circuits, Devices and Applications, Third Edition, PHI.
 N. Mohan, T.M. Underlone and W.P. Robbins, Power Electronic Converters, Applications and Design, John Wiley and Sons.

Mapping of COs to PO/PSO

CO s	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
CO 1	2	1											2	1	1	
CO 2	2	1	2										1			
CO 3	1	2	1										1	2	1	
CO 4	1	1		1									2		2	1

Mapping of Courses to PO/PSO

Cour se code	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
	M	M	H	M	L	L	L						H	M	H	M

EEMM6042: MICROPROCESSOR AND MICROCONTROLLER LAB**(1 Credits - 30 hours) (L-T-P: 0-0-2)****Course Outcomes**

Demonstrate the usage of Keil software in writing, compiling and debugging 8051 programs (Understanding)

Make use of the 8051 assembly language instructions to write programs for a given problem. (Applying)

Examine the output of each line of an 8051 program code. (Analysing)

List of Experiments

Interfacing of 8051 development kit to PC and programmer.

Data transfer operation from registers and internal data memory.

Addition and subtraction of two 8 bit numbers.

Addition of two 16-bit numbers.

Addition of an array of 8-bit numbers.

Subtraction of two 16-bit numbers.

Multiplication and division of two 8-bit numbers.

Multiplication of two 16-bit numbers.

Interfacing of LEDs and Switches.

Interfacing of seven segment displays.

Interfacing of 16 x 2 LCD.

Interfacing of ADC.

Mapping of COs to Syllabus

Course Out- comes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	H											
CO 2		H	H	H	H	H	H	H	H	H	H	H
CO 3		H	H	H	H	H	H	H	M	M	M	M

EERS6043: POWER SYSTEMS LABORATORY-I**(1 Credit: 30 hours) (L-T-P: 0-0-2)****Course Outcomes**

Recall the basic concept of programming language. (Remembering)

Demonstrate the ability to model and simulate the compensation techniques in transmission line. (Understanding)

Develop simple model for power system protection. (Applying)

Find various performance parameters of a power system by using given data. (Analyzing)

Experiments with Solar PV cell and formulate the I-V and P-V characteristics of PV panels. (Evaluating)

Objective

This course is the stepping-stone to make students understand how to model and analyze the power system under steady state operating condition, under faulted conditions and the transient behavior of power system whenever it is subjected to a fault.

List of Experiments:

Introduction to simulation software.

To Study the Ferranti Effect of a transmission line/cable.

Reactive power compensation (capacitive/ inductive)

Computation of inductance for overhead transmission line.

Computation of capacitance for overhead transmission line.

Fault current calculation for single line to ground fault.

Computation of power from solar generation.

To Study the over-current relay and the effect of PSM and TSM.

To study the differential Protection of a three-phase delta-delta connected transformer.

Suggested Readings

C.L. Wadhwa, "Electrical Power systems", 5th Edition, New Age International Publishers.

D.P. Kothari, I.J. Nagrath, "Power System Engineering", Second edition, Tata McGraw Hill.

V.K Mehta, Rohit Mehta, "Principles of Power Systems", S. Chand.

Ashfaq Husain, "Electrical Power systems", 5th Edition, CBS Publishers.

R. Gupta, "Generation of Electrical Energy", S. Chand & Co. Ltd. N. Delhi

Leon Freris, David Infield, "Renewable Energy in Power Systems", Wiley, A John Wiley & Sons, Ltd, Publication, 2012.

Mapping of COs to Experiments

Course Outcomes	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9
CO 1	H	H	L						
CO 2			H						
CO 3								H	H
CO 4				H	H	H			
CO 5							H		

EECS6044: CONTROL SYSTEMS LABORATORY

(1 Credit - 30 hours) (L-T-P: 0-0-2)

Course Outcomes

Recall different SciLab functions used in control system analysis. (Remembering)

Understand and simulate the transfer function of a system. (Understanding)

Develop SciLab code for control system analysis. (Applying)

Analyse stability of system with pole-zero map. (Analyzing)

Determine the transient and steady-state of a system. (Evaluating)

Objective

This course aims to familiarize different concepts of control systems with SciLab simulations.

List of experiments:

Part I:

Basics of Scilab

Introduction to SciLab: variables, loop, functions etc.

Matrix operations

Plotting

Introduction to Xcos

Part II:

Concepts of control systems simulation with Scilab

(Any seven experiments from the following list)

To study transfer function of first order and second order systems with SciLab simulations.

To Study the block diagram reduction techniques with SciLab simulations.

To Study the pole-zero plotting with SciLab simulations.

To Study the time-response of a first order system with SciLab simulations.

To Study the time-response of a second order system with SciLab simulations.

To Study the Bode diagram of different systems with SciLab simulations.

To Study the Nyquist diagram of different systems with SciLab simulations.

Transfer function to state-space and state-space to transfer conversion with SciLab simulations.

Speed control of a DC motor with SciLab simulations.

Mapping of COs to Syllabus

Course Outcomes	Expt 1	Expt 2	Expt 3	Expt 4	Expt 5	Expt 6	Expt 7	Expt 8	Expt 9
CO 1	H	H	H	H	H	H	H	H	H
CO 2	H	H						H	
CO 3			H	H	H				
CO 4			H						
CO 5				H	H				

EEMI6045: MINI PROJECT-I (1 Credit)

Course Outcomes

Use different components to make the circuits used in the projects. (Applying)
Examine a designed circuit for expected output. (Analyzing)
Experiment with the designed circuits for the expected results. (Evaluating)
Design circuits to obtain desired output. (Creating)

BTIP13: INTERNSHIP SEMINAR (3 Credits)

Course Outcomes

Relate theory and practical with real life examples. (Remembering)
Explain the engineering processes involved in the industry. (Understanding)
Identify the importance of learning the practical aspects of engineering education. (Applying)
Analyse application of the theory into the practical field. (Analysing)
Value the engineering education and its utility. (Evaluating)
Discuss the actual technological advancements in the industry. (Creating)

EEPS6046: POWER SYSTEMS LABORATORY-II (1 Credits -30 hours) (L-T-P: 0-0-2)

Course Outcomes

Find Y-bus parameters. (Remembering)
Apply knowledge of Y- bus matrix for load flow problem. (Applying)
Analyze load-frequency control in Power System. (Analysing)
Compare performance of series and shunt compensation. (Evaluating)

Experiments

Formation of Y-bus matrix using programming language.
Load flow analysis using Gauss seidel Method.
Load flow analysis using Newton Raphson Method.
Series compensation.
Shunt compensation.
Automatic Load Frequency control.
Automatic Voltage Regulator.
Contingency analysis of the power system.
Application of various numerical methods for power system analysis.
Generation of V-I and V-P characteristics of Solar PV Power Plant.

Mapping of COs to Syllabus

Course Out-comes	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt.10
CO 1	H									
CO 2		H	M	H			H	H	H	H
CO 3					M	H	M			
CO 4					H	H				

EEMI6047: MEASUREMENTS AND INSTRUMENTATION LAB
(1 Credits - 30 hours) (L-T-P: 0-0-2)
Course Outcomes

At the end of the course, students will be able to

Select the electrical measuring instruments for determining a particular electrical parameter. (Remembering)

Make use of statistical data analysis and computerized data analysis to determine an unknown electrical parameter. (Applying)

Decide the best methods to determine an electrical parameter. (Evaluating)

List of Experiments:

Measurement of a batch of resistors and estimating statistical parameters.

Measurement of L using a bridge technique as well as LCR meter.

Measurement of C using a bridge technique as well as LCR meter.

Measurement of High resistance and Insulation resistance using Megger.

Usage of DSO for steady state periodic waveforms produced by a function generator.

Download of one-cycle data of a periodic waveform from a DSO and use values to compute the RMS values using a C program.

Usage of DSO to capture transients like a step change in R-L-C circuit.

Current Measurement using Shunt, CT, and Hall Sensor

Measurement of medium resistance using Wheatstone's bridge.

Measurement of three-phase real power using two wattmeter method.

Measurement of three-phase reactive power using two wattmeter method.

Study of smart energy meter.

Measurement of earth resistance using earth tester megger

Mapping of COs to Syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13
CO 1	H	H	H	H	L	L	L	L	H	H	H	L	L
CO 2	H	H	H	H	M	M	M	L	H	H	H	L	M
CO 3	H	H	H	H	M	M	M	H	H	H	H	H	H

EEED6055: ELECTRONIC DESIGN LABORATORY
(3 Credits - 45 hours) (L-T-P: 1-0-4)
Course Outcomes

Recall the basic concepts of electrical and electronics measurements. (Remembering)

Classify various OpAmp based amplifiers. (Understanding)

Estimate the output of different electronic components used in the electronic system design. (Evaluating)

Create an electronic system. (Creating)

Objective

This course aims to familiarize the students with the concepts of practical measurement and instrumentation system. The course enables one to understand the concept of data acquisition with popular development boards such as Arduino. At the end of the course, students should be able to design basic electronic systems.

Theory: Electronics Design Concepts (15 hours)

Basic concepts on measurements; Noise in electronic systems; Sensors and signal conditioning circuits; Introduction to electronic instrumentation and PC based data acquisition; Electronic system design, Analog system design. Interfacing of analog and digital systems, Embedded systems, Electronic system design employing microcontrollers, CPLDs, and FPGAs, PCB design and layout; System assembly considerations.

List of Experiments:

To study different temperature sensors.

Study of OpAmp based amplifiers.

Study of instrumentation amplifier.

Study of Arduino microcontroller development board for designing of embedded systems.

Data acquisition using Arduino microcontroller development board.

Group projects involving various electronic hardware.

Suggested Readings

- A. S. Sedra and K. C. Smith, "Microelectronic circuits", Oxford University Press, 2007.
 2 P. Horowitz and W. Hill, "The Art of Electronics", Cambridge University Press, 1997.
 H.W. Ott, "Noise Reduction Techniques in Electronic Systems", Wiley, 1989.
 W.C. Bosshart, "Printed Circuit Boards: Design and Technology", Tata McGraw Hill, 1983.
 G.L. Ginsberg, "Printed Circuit Design", McGraw Hill, 1991.

Mapping of COs to Syllabus

Course comes	Out-	Experi- ment1	Experiment 2	Experiment 3	Experiment 4	Experiment 5	Experiment 6
CO 1		H	M				
CO 2				M		H	
CO 2				M		H	
CO 3					L	H	

EEMI6049: MINI PROJECT-II

Course Outcomes

- Recall the benefits of using microcontrollers and microprocessors in circuits. (Remembering)
 Identify suitable controllers and processors among the different controllers and processors available for their work. (Applying)
 Compare the difference between the circuits using controllers and those not using it. (Analysing)
 Construct a fully automotive circuit depending upon their requirement. (Creating)

EEMP6053: MAJOR PROJECT PHASE-I (1 Credit)

Course Outcomes

- Find different areas of research in the field of electrical engineering. (Remembering)
 Explain the importance of research in the chosen topic of interest. (Understanding)
 Apply theoretical knowledge to find out an appropriate topic of importance for research in the undergraduate level. (Application)
 Analyse research work of technological importance published in various reputed national and international journals. (Analysing)
 Decide on a research problem and objective of research to be carried out within a semester. (Evaluating)
 Compile the part of project work completed this semester. (Creating)

During the last year of their study, B. Tech. students are required to take up a major project. This may be an individual project or a group project. The Major Project is an integral learning experience that encourages students to break away from the compartmentalization of the different courses they have studied during the three years of their study and aims to provide opportunities to explore the interrelationships and interconnectedness of the various courses and gather them together into a single learning experience.

The major project focuses upon the following:

Interdisciplinary: The major project provides a platform for students to apply the knowledge and skills acquired from different courses.

Collaboration: It encourages students to work in groups over an extended period of time. They clarify the task, plan their work, share the responsibilities and work towards the successful completion of the project.

Process and Product: Project work focuses on both process and product. The process would include collaboration, gathering and processing of information. The product may take the form of a working model, a complete software package, etc.

Written and Oral presentation: Project work provides students with opportunities to present their findings as a written thesis in a prescribed format and orally with an intended audience and purpose in mind.

During the first phase in the seventh semester, students are expected to choose the project, prepare a synopsis under the guidance of a project supervisor appointed by the department, present the synopsis to the

committee set up for the purpose, get approval for the synopsis and start the project work. Students are expected to submit weekly activity reports and present a progress seminar during this phase. They will also undergo a viva voce examination, in which they will be examined on all the basic areas of the discipline in which they have chosen their project.

E-resource for learning

LaTeX, www.spoken-tutorial.org

VALUE ADDED COURSES

EEAR0112: INTRODUCTION TO ARDUINO AND RASPBERRY PI (2 Credits - 30 hours) (L-T-P:0-1-2)

Course Outcomes

List the different I/O pins available on the Arduino and Raspberry Pi. (Remembering)

Execute software programs on Arduino and Raspberry Pi. (Applying)

Module I : Introduction to Arduino (15 hours)

Introduction to Arduino, Arduino boards and their specification, Arduino integrated development environment, Arduino UNO development board, Programming the Arduino boards, Interfacing LEDs, Interfacing switches, interfacing LCDs, Serial communication, Interfacing analog sensors, PWM control, DC motor interfacing, Servo motor interfacing, Stepper motor interfacing. Circuit design, programming, testing and debugging.

Module II: Introduction to the Raspberry Pi (15 hours)

Introduction to the Raspberry Pi: Features, GPIO. Linux System Administration: Overview, Files & Process, Directories, Basic commands etc. Some common Troubleshooting, Network configuration: interfaces, Configuring the Raspberry Pi: config.txt, cmdline.txt. Pi as Media Centre, Web Server etc. Introduction to python: IDLE, variables, input, loop, installing GPIO library. Hardware hacking, Pi with Arduino, IOT etc.

Suggested Readings:

Arduino Programming: Step-by-step guide to mastering arduino hardware and software by Mark Torvalds
Raspberry Pi User Guide by Gareth Halfacree and Eben Upton

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	H

EEAL0113: AUTOCAD ELECTRICAL (2 Credits: 30 hours) (L-T-P : 0-1-2)

Course Outcomes

Demonstrate methods of customizing AutoCAD Electrical symbols, circuits, and databases, title block linking, reporting tools, templates, and project files. (Understanding)

Build schematic drawings such as ladder logic and single wire and multi wire circuits, panel drawings, and PLC-I/O circuits using automated commands for symbol insertion, component tagging, wire numbering, and drawing modification. (Creating)

Objective

The main objective of this course is to learn how to use the powerful electrical drawing creation tools in the AutoCAD Electrical software.

Module I: Introduction to auto CAD Electrical (6 hours)

Introduction to Electrical CAD interface, Electrical Components and wires, Design methodologies, Project files, Accessing project files, Add a drawing to a project file, managing drawings in a project, Project manager Drawing list.

Module II: Schematic I and schematic II (6 hours)

Schematic I: Single wires/ Components, Referencing, Ladders, Insert wires, Edit wires, 3 phase components, Source and destination Signal Arrows, Insert component, parent/child components
Schematic II: Multiwire and circuits, Dashed Link Lines, 3 Phase Ladders.

Module III Editing Commands and panel drawings (6 hours)

Editing commands: Edit Component, Updating Drawings, Scoot & Align, Move & Copy Component, Delete & Surfer Component, Copy Catalogue Assignment, Copy Installation/Location Code Values, Attribute Editing Commands:

Insert Footprint and component, Edit footprint, Assign Item numbers, Add balloons.

Module IV: Terminals and Point-to-Point Wiring Drawings (6 hours)

Terminals: Insert Terminal Symbols, Multiple Level Terminals, Multiple Insert Component command, insert jumpers, Terminal Strip Editor, DIN Rail Command.

Point-to-Point Wiring Drawings: Insert & Edit Connectors, Insert Splices, Insert Multiple Wires, Bend Wires.

Module V: Symbol creation (6 hours)

Schematic Symbols, Naming Convention, Icon Menu Wizard, AutoCAD Electrical Databases, Project & Catalog Databases, Footprint Lookup Database, Insert PLC, Insert Individual PLC I/O Points.

Suggested Readings:

James D. Bethune, "Engineering Graphics with AutoCAD 2020", Macromedia Press.

Gaurav Verma and Matt Weber, "AutoCAD Electrical 2021 Black Book", 6th Edition, Cadcamcae Works.

Sham Tickoo, "AutoCAD Electrical 2021: A Tutorial Approach", 2nd Edition, CADCIM Technologies.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module v
CO 1	H	M	M	M	H
CO 2		H	M	M	

EEEL0114: ELECTRICAL WIRING

(2 Credits - 30 hours) (L-T-P: 0-1-2)

Course Outcomes

Define and explain the difference between direct current and alternating current. (Remembering)

Describe conditions likely to affect severity of electrical shock while maintaining safety during installation. (Remembering)

Demonstrate the different conductor systems used in residential and light commercial wiring in accordance with the codes and authorities for installation. (Applying)

Analyze the essential tools for residential wiring and be able to discuss the basic principles of tool-use and care. (Analysing)

Objective

To improve student electrical wiring skills through systematic training to enable students to create and test different electrical circuits using suitable electrical equipment, wires, protective devices and wiring accessories.

Module I: Basic Electrical Circuits (9 hours)

Measurement of Electrical quantities like Voltage, Currents, Resistance, Impedance, power factor and energy, Various Electrical Symbols, Electricity conductor, insulator, and resistance, Single-phase & three-phase circuits, Serial connection-diagram, Series and Direct Board-different types.

Module II: Different types of electrical wiring / installations (12 hours)

Two-way switch-wiring, 3-phase wiring, Overhead service connection, Definition and testing procedure of voltage current power MCB and bus bars, Earthing Connection – Different earthing systems.

Module III: Fundamentals of electricity-safety measures and precautions, first aid/Tools and equipment (12 hours)

Safely handling Tools & Equipment /Fire Fighting and use of fire extinguishers, Fires in electrical Circuits & Precautions, General Safety of Tools & equipment, Measuring tools, wire gauges etc. Classification, Identification of the electrical equipment cables, wires and electrical accessories.

Module IV: House Wiring Practical (12 hours)

House Wiring by PVC Casing Capping including Testing, House Wiring by PVC Rigid Pipe including Testing, Industrial Wiring by MS Pipe Including Testing, Measurement of Earth Resistance by Earth Tester, Common Faults in AC & DC Fans, Regulators and Remedies.

Suggested Readings

J.B. Gupta, "A Course in Electrical Installation Estimating and Costing", S.K. Kataria & Sons.
 S.L. Uppal and G.C. Garg, "Electrical Wiring Estimating & Costing", Khanna Publishers.
 Satheesh Kumar, "Electrical Wiring: An Introduction", Ane Books Pvt. Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	L	
CO 2	L	L	H
CO 3	M	H	L
CO 4	M	M	H

INTRODUCTION TO ELECTRIC VEHICLES**(2 Credits – 30 hrs) (L - T – P : 2-0-0)****Course Outcomes**

Compare the configurations of hybrid and battery electric vehicles. (Understanding)

Calculate the tractive effort required by electric vehicles. (Applying)

Analyze vehicle dynamics using Matlab Simulink. (Analysing)

Module I: Introduction to Electric Vehicle (5 hrs)

Historical background, Benefits of EVs, Types of EVs, Motor drive technologies, Energy source technologies, Battery charging technologies.

Module II: EV Systems and Configurations (15 hrs)

Components of an EV system, Battery electric vehicle configurations, Hybridization of energy sources, Hybrid electric vehicle configurations. Battery parameters, SoH and SoC estimation and Self Discharge.

Module III: Vehicle Dynamics (10 hrs)

Tractive effort: Aerodynamic drag, Rolling resistance, Uphill resistance, Acceleration force; EV range estimation, Gradability, Matlab-Simulink/Python simulation of tractive effort.

Suggested Readings:

Iqbal Husain, Electric and Hybrid vehicles, Design Fundamentals, CRC Press, 2003.2.

M. Ehsani, Y. Gao, S. Gay and A. Emadi, Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, CRC Press, 2005.

Mapping of COs to Syllabus

	Module I	Module II	Module III
CO1	L	H	L
CO2	L	L	H
CO3	L	L	H

EEPY0115: PYTHON FOR ELECTRICAL ENGINEERING**(2 Credits: 30 hours) (L-T-P: 0-1-2)****Course Outcomes**

Simulate Electrical Systems using Python. (Applying)

Evaluate the performance of new Electrical designs using Python. (Evaluating)

Construct Electrical systems using Python. (Creating)

Objective

The objective of this course is to familiarize the students with the Python Programming environment and its various applications in simulating Electrical Systems. The course will be a combination of tutorial and practical classes, focusing on hands-on exercises to be done by the students using Python and its various modules.

Module I: Introduction to Python (8 hours)

Python Packages, Anaconda, Python Editors, Resources, Installing Python. Python IDE, Python Shell, Running Python from the Console, Scripting Mode. Basic Python Program, Variables, Built-in Functions, Python Standard Library, Using Python Libraries, Packages and Modules, Plotting in Python.

Module II: Python Programming (6 hours)

Loops in Python programming, Creating Functions in Python, Creating Classes in Python, Creating Python Modules, File Handling in Python, Error Handling in Python, Debugging in Python, Installing and using Python Packages.

Module III: Python for Mathematics Applications (6 hours)

Mathematics in Python, Linear Algebra in Python, Complex Numbers in Python, Differential Equations, Optimization. Using Python for Simulations, Differential Equations, Discrete Systems, Real-Time Simulations.

Module IV: Python for Electrical Engineering Applications (10 hours)

Numerical Methods using Python, Numerical integration, Solving ordinary differential equations, Root finding, Interpolation, Curve fitting, Fourier transforms.

Python used for Control Applications, Transfer Functions, State Space Models, Frequency Response, Stability Analysis.

Applications of Python in- Electromagnetics, Circuit Analysis, Electrical Power Systems, Power Electronics, Signal Processing, Electrical System Modeling and Simulation.

Suggested Readings

Hans-Petter Halvorsen, "Python". Available: <https://www.halvorsen.blog/documents/programming/python/python.php>

Hans-Petter Halvorsen, "Python for Science and Engineering", 2019. Available: <https://www.halvorsen.blog/documents/programming/python/resources/Python%20for%20Science%20and%20Engineering.pdf>

Hans-Petter Halvorsen, "Python for Science and Engineering- YouTube Video playlist". Available: <https://www.youtube.com/playlist?list=PLdb-TcK6Aqj2hIH55Bn5oxF1vyoVbXxQS>

Hans-Petter Halvorsen, "Python for Control Engineering", 2020, Available: <https://www.halvorsen.blog/documents/programming/python/resources/Python%20for%20Control%20Engineering.pdf>

Hans-Petter Halvorsen, "Python for Control Engineering- YouTube Video Playlist", Available: https://www.youtube.com/playlist?list=PLdb-TcK6Aqj1Kg6pV3zlrpUnPIRwG2_Ox

Hans Fangohr, 'Introduction to Python for Computational Science and Engineering', 2018. Available: <https://fangohr.github.io/python/book/Introduction-to-Python-for-Computational-Science-and-Engineering.pdf>

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	M		H
CO 2			M	H
CO 3		M	L	H

EESL0200: SERVICE LEARNING (2 Credits – 30 hours)

Course Outcomes

Define and explain the understanding of Community-University Engagement (CUE) and outline CUE in relation to higher education policy in India. (Remembering)

Analyze and identify the social responsibility of higher education institutions to facilitate engaged teaching, research & service. (Analyzing)

Determine the various methods and tools on Community-Based Participatory Research (CBPR). (Evaluating)

Evaluate how Higher education institutions can undertake community engagement post COVID-19. (Evaluating)

Design a plan for the engagement of students with the community through engaged teaching, research and service. (Creating)

Objective

The objective of this course is to understand the theory and practice of community university engagement. The students provide an insight on the theme of Social Responsibility of Higher Education Institution (HEI) and to introduce community based participatory research and the tools to facilitate engaged research.

Module I: Community University Engagement (CUE) (6 hours)

History of Community University Engagement (CUE) in Indian Higher Education Policy, Fostering Social Responsibility by Higher Education: COVID-19 and Beyond, Current status and possible interventions, Recent initiatives, Principles of community engagement,

Module II: Social Responsibility of HEIs (5 hours)

Understanding Social Responsibility of HEIs – Engaged Teaching, Research & Service, Community Engaged teaching and research, Community based participatory research, practice based learning, Community service, Effective Methods and Tools for Engaging Community in Research

Module III: Community Engagement through Electrical and Electronics Engineering (19 hours)

Power sector scenario including generation, transmission, and distribution scenario of India, Duties and responsibilities of Assistant Electricity Meter Reader, Billing and cash collector and their career progression, Develop circuit and wiring diagram and electrical signage, code specifications to plan wiring layouts, consumption points accurately, as may be required, Standard location of service line connection, layout of main switch, circuit breakers required at main board, Install the protective device i.e. ratings as per the load, Replacement of damaged switches, MCB, fan- capacitor, regulator, lighting points i.e. holder, choke, starters, water coolers and their pump & motor, Operate principle of single phase motor, various types of motors like self start, capacitor start, capacitor run, universal motors and their applications and functions of condenser, Earth testing, Build a wind farm model, Application of drone technology in agriculture, search and rescue, wildlife tracking etc.

Suggested Readings

W. James Jacob, Stewart E. Sutin, John C. Weidman, John L. Yeager, "Community Engagement in Higher Education: Policy Reforms and Practice", Springer, 2015.

David Coghlan, Mary Brydon-Miller, "The SAGE Encyclopedia of Action Research", SAGE, 2014.

Book on Electricity rules.

Kronick, Robert F., "Emerging Perspectives on Community Schools and the Engaged University", IGI Global, 2019

Tami L. Moore, "Community-University Engagement: A Process for Building Democratic Communities", John Wiley & Sons, 2014.

Marshall Welch, "Engaging Higher Education: Purpose, Platforms, and Programs for Community Engagement", Stylus Publishing, 2016.

Barbara Jacoby, "Building Partnerships for Service-Learning", John Wiley & Sons, 2003.

Becca Berkey, Emily A. Eddins, Patrick M. Green, Cara Meixner, "Reconceptualizing Faculty Development in Service-Learning/Community Engagement: Exploring Intersections, Frameworks, and Models of Practice", Stylus Publishing, 2018.

Datasheets from the internet.

DEPARTMENT OF MECHANICAL ENGINEERING

BACHELOR OF TECHNOLOGY (BTECH) – MECHANICAL ENGINEERING

SEMESTER I						
Type	Type of Course/ Category	Course Code	Course Name	L-T-P	Credits	Page No
Theory	Basic Science Course/IC		Chemistry-I	3-1-0	4	
	Basic Science Course/IC		Mathematics -I	3-1-0	4	
	Engineering Science Course/IC		Basic Electrical Engineering	2-1-0	3	
	Basic Science Course/IC		Biology for Engineers	3-0-0	3	
Lab	Basic Science Course		Chemistry -I Lab	0-0-2	1	
	Engineering Science Course/IC		Basic Electrical Engineering Lab	0-0-2	1	
	Engineering Science Course/IC		Workshop/Manufacturing Practice	1-0-2	2	1205
	Engineering Science Course/IC		Design Thinking & Idea Lab	1-0-2	2	1207
	Mandatory Course/IC		Universal Human Values-1	0-0-0	NC	1208
Total Credits					20	
SEMESTER II						
Theory	Basic Science Course/IC		Physics-I	3-1-0	4	
	Basic Science Course/IC		Mathematics -II	3-1-0	4	
	Engineering Science Course/IC		Programming for Problem Solving	3-0-0	3	
	Engineering Science Course/IC		Engineering Graphics & Design	1-0-4	3	
	Humanities & Social Sciences		English for Technical Writing	2-0-0	2	
	Humanities and Social Sciences		Universal Human Values-2	3-0-0	3	1209
Lab	Basic Science Course/IC		Physics –I Lab	0-0-2	1	
	Engineering Science Course/IC		Programming for Problem Solving Lab	0-0-4	2	
	Humanities & Social Sciences		English for Technical Writing Lab	0-0-2	1	
	Mandatory Course/IC		Sports and Yoga or NSS/NCC	1-0-4	NC	
Online	Wadhvani course		Life skills	0-0-0	NC	
Total Credits					23	
SEMESTER III						

Type	Type of Course/ Category	Course Code	Course Name	L-T-P	Credits	Page No
Theory	Basic Science Course/IC		Engineering Mathematics III-Complex Variables, PDE and Probability and statistics	3-1-0	4	1211
	Engineering Science Course/DC		Basic Electronics Engineering	3-0-0	3	1212
	Engineering Science Course/DC		Engineering Mechanics	3-1-0	4	1213
	Engineering Science Course/DC		Basic Thermodynamics	3-1-0	4	1215
	Professional core course/DC		Fluid Mechanics & Hydraulic Machines	3-1-0	4	1216
	Mandatory Course/IC		Environment Science	2-0-0	NC	1218
	Mandatory Course/IC		Indian Knowledge System	2-0-0	2	1219
	Professional core course/DC		Mechanical Engineering Lab-I (Fluid)	0-0-2	1	1221
	Professional core course/DC		Internship Programme	0-0-2	1	1222
	Professional core course/DC		Machine Drawing Lab	0-0-2	1	1222
Online	Wadhvani course		Entrepreneurship skills	0-0-0	NC	
Total Credits					24	
SEMESTER IV						
Theory	Professional core course/DC		Applied Thermodynamics	3-1-0	4	1223
	Professional core course/DC		Strength of Materials	3-1-0	4	1225
	Professional core course/DC		Measurements and Metrology	3-1-0	4	1226
	Professional core course/DC		Kinematics and Theory of Machines	3-1-0	4	1227
	Professional core course/DC		Engineering Materials and Applications	3-1-0	4	1230
	Professional core course/DC		Production and Operation Management	3-1-0	4	1229
	Mandatory Course/IC		Constitution of India	2-0-0	NC	
Lab	Professional core course/DC		Mechanical Engineering Lab II: Materials Lab	0-0-2	1	1232
	Value added Course		Introduction to AutoCAD	1-0-2	NC	1232
Total Credits					25	
SEMESTER V						
Type	Type of Course/ Category	Course Code	Course Name	L-T-P	Credits	Page No
Theory	Professional core course/DC		Heat Transfer	3-1-0	4	1233
	Professional core course/DC		Design of Machine Elements	3-1-0	4	1235
	Professional core course/DC		Manufacturing Processes	3-1-0	4	1237
	Professional core course/DC		Mechatronics, Robotics & Control	3-0-2	4	1238

	Humanities & Social Sciences/IC		Economics for Engineers	3-0-0	3	1239
	Mandatory Course/IC		Service Learning	2-0-0	NC	
Lab	Professional core course/DC		Mechanical Engineering Lab-III Thermal	0-0-2	1	1241
	Professional core course/DC		Mechanical Engineering Lab-IV Design I	0-0-2	1	1241
Intern-ship	Professional core course/DC		Internship Programme	0-0-2	1	
	Value added Course		Quantitative Aptitude for Competitive Examination	2-0-0	NC	1241
Total Credits					22	
SEMESTER VI						
Theory	Professional core course/DC		Machine Design and Dynamics	3-1-0	4	1242
	Professional core course/DC		Manufacturing Automation	3-1-0	4	1243
	Professional core course/DC		Product Innovation and Entrepreneurship	3-0-0	3	1245
	Professional core course/DC		Mechanical Vibration	3-0-0	3	1246
	Professional Elective courses II/DE		Numerical Methods	3-0-0	3	1247
			Composite Materials	3-0-0	3	1247
			Internal Combustion Engines	3-0-0	3	1249
	Humanities & Social Sciences/IC		Operations Research	3-0-0	3	1250
Lab	Professional core course/DC		Mechanical Engineering Lab V: Design II	0-0-2	1	1251
	Professional core course/DC		Mechanical Engineering Lab VI: Manufacturing	0-0-2	1	1251
Project	Professional core course/DC		Mini project	0-0-2	1	1252
	Value added Course		Royal Enfield Fresher's Course	1-0-2	NC	1252
Total Credits					23	
SEMESTER VII						
Type	Type of Course/Category	Course Code	Course Name	L-T-P	Credits	Page No
Theory	Professional Elective courses III/DE		Refrigeration and Air Conditioning	3-0-0	3	1253
			Computer Aided Design and Manufacturing	3-0-0	3	1254
			Gas Turbines and Jet Propulsion	3-0-0	3	1256
	Professional Elective courses IV/DE		Automobile Engineering	3-0-0	3	1257
			Introduction to Biomedical Engineering	3-0-0	3	1258
			Non-conventional Sources of Energy	3-0-0	3	1259
	Open Elective courses I/IE		introduction to power plant	3-0-0	3	1261
	Open Elective courses II/IE		Emerging Materials	3-0-0	3	1262

Project	Professional core course/DC		Major project I	0-0-4	2	1263
Internship	Professional core course/DC		Industrial training	0-0-4	2	
	Value added Course		Scilab for Mechanical engineers	1-0-2	NC	1264
Online	Wadhwani course		Employability skills	0-0-0	NC	
Total Credits					16	
SEMESTER VIII						
Theory	Professional Elective courses V/DE		Additive Manufacturing	3-0-0	3	1265
			Power Plant Engineering	3-0-0	3	1266
			Electric Vehicles Technology	3-0-0	3	1267
	Open Elective courses III/IE		Renewable Energy Engineering	3-0-0	3	1268
Project/Industrial Internship	Professional core course/DC		Major project II/ Internship	0-0-16	8	1269
Total Credits					14	

Total 167

Exit Policy :

Degree	Courses
Certificate (At the end of 1 st year)	Social Internship for building Inter-personal Communication skill (2 credits) + (Welding/ Fitting) (2 credits)/Royal Enfield basic course + Elements of Mechanical Engineering (2 credits)
Diploma (At the end of 2 nd Year)	Skill based Micro project (2 credits) + Academic Internship (2 credits) + Introduction to Manufacturing Engineering (2 credits)
BSc. (At the end of 3 rd Year)	Skill Based Mini Project (2 credits) + Industrial Internship (2 credits) + Any one of the courses from any one of the listed Specializations as given below- (2 credits) Specialization 1: Thermal –Fluid Engineering List of Courses: 1. Power plant Engineering 2. Refrigeration and Air Conditioning Specialization 2: Manufacturing Engineering List of Courses: 1. Computer Aided Design and Manufacturing

	2. Manufacturing Automation Specialization 3: Machine Design List of Courses: 1. Mechanical Vibration 2. Numerical Method

List of courses offered for Honours in Mechanical Engineering

Domain 1 : Thermal-Fluid Engineering

Semester	Course name	L-T-P	Cred-its
3rd	Fluid Machines	3-0-0	3
4th	Advanced Engineering Thermodynamics	3-0-0	3
5th	Fluid Power Control	3-0-0	3
6th	Convective Heat Transfer Analysis	3-0-0	3
7 th	Alternative Energy Sources	3-0-0	3
8th	Energy Conservation and Waste Heat Recovery	3-0-0	3

Domain 2 : Design Engineering

Semester	Course name	L-T-P	Cred-its
3rd	Dynamics of Electric Vehicles	3-0-0	3
4 th	Rotordynamics	3-0-0	3
5 th	Design of Medical devices	3-0-0	3
6 th	Advanced Mechanics of Solids	3-0-0	3
7 th	Finite Element Methods in Mechanical Engineering	3-0-0	3
8 th	Nonlinear vibration	3-0-0	3

Domain 3: Manufacturing Engineering

Semester	Course name	L-T-P	Credits
3 rd	Welding Technology	3-0-0	3
4 th	Manufacturing Guidelines for Product Design	3-0-0	3
5 th	Inspection and Quality Control in Manufacturing	3-0-0	3
6 th	Advanced Manufacturing Methods	3-0-0	3
7 th	Surface Engineering	3-0-0	3
8 th	Mechanical Micromachining	3-0-0	3

List of courses offered for Minor in Mechanical Engineering

Semester	Course name	L-T-P	Credits
3 rd	Engineering Mechanics	3-0-0	3
4 th	Fluid Mechanics and Fluid Machines	3-0-0	3
5 th	Basic Thermodynamics	3-0-0	3
6 th	Theory of Machines	3-0-0	3
7 th	Strength of Materials	3-0-0	3
8 th	Manufacturing Processes	3-0-0	3

SCHOOL OF TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To establish the department as a hub of quality technical education and research for aiding the industry and to strive for the upliftment of the North East Region and nation as a whole.

Mission

To train the youth to be intellectually competent with strong fundamentals in Mechanical engineering.

To create an environment for carrying out fundamentals and interdisciplinary research to address the future needs and challenges of a society and the industry.

To cultivate strong moral values and professional ethics to build them as responsible and environmentally conscious citizens.

To motivate, nourish and mould the students to be dynamic leader and entrepreneurs.

Program educational objectives (PEOs)

To develop the ability to design a system, component or process to meet the social and industrial requirements within realistic constraints.

To achieve high level of technical expertise through extensive curricular and co-curricular training and activities.

To inculcate professional ethics, leadership qualities and inherent creative instincts in students.

To encourage lifelong learning and to foster the ability to function on multi-disciplinary teams.

Program Specific outcomes (PSOs)

PSO 1: To develop the ability to apply the concept of Mechanical engineering for design, development, manufacturing, analysis and maintenance of mechanical systems and processes.

PSO 2: To understand and demonstrate the key concepts related to entrepreneurship, professionalism, effective communication, shop floor management, project management and economics.

DETAILED SYLLABUS

MNWM100L: WORKSHOP/MANUFACTURING PRACTICES

0L:0T:4P 2 Credits

Objectives:

To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering.

To have a study and hands-on-exercise on plumbing and carpentry components.

To have a practice on gas welding, foundry operations and fitting

To have a study on measurement of electrical quantities, energy and resistance to earth.

To have a practice on soldering.

Laboratory Outcomes:

On completion of this laboratory course, students will be able:

CO 1. To fabricate components with their own hands.

CO 2. To relate practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

CO 3. To design small devices of their interest by assembling different components.

Module I: Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods.

Module II: CNC machining, Additive manufacturing.

Module III: Fitting operations & power tools.

Module IV: Electrical & Electronics.

Module V: Carpentry.

Module VI: Plastic moulding, glass cutting.

Module VII: Metal casting.

Module VIII: Welding (arc welding & gas welding), brazing.

Practicals:

Machine shop

Fitting shop

Carpentry

Electrical & Electronics

Welding shop (Arc welding + Gas welding)

Casting

Smithy

Plastic moulding & Glass Cutting

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Suggested Readings

AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual) ISBN: 97893-91505-332

Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

Kalpakkian S. And Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.

Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Experiments that may be performed through virtual labs:

S. No.	Experiment Name	Experiment Link(s)
1	Welding shop (Arc welding + Gas welding)	http://mm-coep.vlabs.ac.in/LaserSpotWelding/Theory.html?domain=Mechanical%20Engineering&lab=Welcome%20to%20Micromachining%20laboratory
2	Casting	http://fab-coep.vlabs.ac.in/exp7/Theory.html?domain=Mechanical%20Engineering&lab=Welcome%20to%20FAB%20laboratory

MNDI101L: DESIGN THINKING & IDEA LABORATORY

2 Credits (L-T-P:1-0-2)

Course Objective:

The objective of this Course is to provide the new ways of creative thinking and learn the innovation cycle of Design Thinking process for developing innovative products which useful for a student in preparing for an engineering career.

Course Outcomes (CO):

Students will able to

Compare and classify the various learning styles and memory techniques and Apply them in their engineering education

Analyze emotional experience and Inspect emotional expressions to better understand users while designing innovative products

Develop new ways of creative thinking and Learn the innovation cycle of Design Thinking process for developing innovative products

Propose real-time innovative engineering product designs and Choose appropriate frameworks, strategies, techniques during prototype development

Perceive individual differences and its impact on everyday decisions and further create a better customer experience

Module 1: An Insight to Learning

Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting

Module 2: Remembering Memory

Understanding the Memory process, Problems in retention, Memory enhancement techniques

Module 3: Emotions: Experience & Expression

Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

Module 4: Basics of Design Thinking

Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – Empathize, Define, Ideate, Prototype, Test

Module 5: Being Ingenious & Fixing Problem

Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving

Module 6: Process of Product Design

Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, Assignment – Engineering Product Design

Module 7: Prototyping & Testing

What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, Sample Example, Test Group Marketing

Module 8: Celebrating the Difference

Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

Module 9: Design Thinking & Customer Centricity

Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design

Module 10: Feedback, Re-Design & Re-Create

Feedback loop, Focus on User Experience, Address “ergonomic challenges, User focused design, rapid prototyping & testing, final product, Final Presentation – “Solving Practical Engineering

IDEA LAB WORKSHOP

Objectives:

To learn the skills associated with the tools and inventory associated with the IDEA Lab.

Learn useful mechanical and electronic fabrication processes.

Learn necessary skills to create print and electronic documentation for the system/project

Course Contents

3D printing and prototyping technology

3D scanning, point cloud data generation for reverse engineering.

User Experience (UX) Design: Design Sprints, Create wireframes using Figma, Create mock-ups in Figma.

Electronic component familiarization, Understanding electronic system design flow. Schematic design and PCB layout.

Familiarization and use of basic measurement instruments (CRO, FG, Spectrum Analyser) DMM, Signal and Function Generator, Power Supply, Solar Panel, Battery Types and charging.

Suggested Readings

E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company

AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), Veerana D.K., Khanna Book Publishing, 2023.

All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.

Simplified Q&A - Data Science with Artificial Intelligence, Machine Learning and Deep Learning, Rajiv Chopra, ISBN: 978-9355380821, Khanna Book Publishing Company, New Delhi.

3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.

The Big Book of Maker Skills: Tools & Techniques for Building Great Tech Projects. Chris Hackett. Weldon Owen; 2018. ISBN-13: 978-1681884325.

The Total Inventors Manual (Popular Science): Transform Your Idea into a Top-Selling Product. Sean Michael Ragan (Author). Weldon Owen; 2017. ISBN-13: 978-1681881584.

Make: Tools: How They Work and How to Use Them. Platt, Charles. Shroff/Maker Media. 2018. ISBN-13: 9789352137374

BTUH0001: UNIVERSAL HUMAN VALUES I: STUDENT INDUCTION PROGRAM (P/NP)

The following list presents the topics covered in the Mandatory Student Induction Program conducted in the Assam Don Bosco University School of Technology:

Physical activity – Yoga and sports activity (indoor and outdoor)

Creative arts through Extra-curricular clubs e.g., music & singing, dance, drama, debating & quiz, art & craft, photography

Universal Human Values – group discussions on the following topics:

Aspirations and family expectations

Gratitude

Competition and cooperation
Competition and excellence
Peer pressure
Self-confidence
Relationships in family
Trust and respect
Anger management
Happiness and prosperity
Dealing language barriers – tests on communication skill for future follow up.
Sexual orientation / courting / sexual harassment

Literary exposure through Literary Club

Proficiency Modules – Psychological tests and orientation, introduction to Co-curricular clubs and innovations.

Lectures by eminent people – in-campus invited Guests and over SKYPE

Visit to local areas – visit to industry and institutions of repute

Familiarization to departments and common facilities

Mentoring system – introduction and assignment of mentors

Selection / election of Class Representatives for college association

Health check-up for all with documentation for future reference

Library Orientation, Introduction to ERP and e-Resources, filling up “Online anti-ragging affidavit” by all.

BTUH0002: UNIVERSAL HUMAN VALUES II: UNDERSTANDING HARMONY

(3 Credits – 45 hours)

Objective: *The objective of the course is four fold:*

Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.

Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence

Strengthening of self-reflection.

Development of commitment and courage to act.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: recognize the nature of themselves, and their surroundings (family, society, nature); (understanding)

CO2: identify their responsibility in life, and handle problems with sustainable solutions, while keeping human relationships and human nature in mind. (understanding)

CO3: demonstrate their critical ability and also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). (applying)

CO4: execute what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction. (applying)

Module I: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education (9 hours)

Purpose and motivation for the course, recapitulation from Universal Human Values-I

Self-Exploration—what is it? - Its content and process; ‘Natural Acceptance’ and Experiential Validation—as the process for self-exploration

Continuous Happiness and Prosperity- A look at basic Human Aspirations

Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking disliking

Module II: Understanding Harmony in the Human Being - Harmony in Myself! (8 hours)

Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

Understanding the needs of Self ('I') and 'Body' - happiness and physical facility

Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

Understanding the characteristics and activities of 'I' and harmony in 'I'

Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module III: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship (9 hours)

Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

Understanding the meaning of Trust; Difference between intention and competence

Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives

Module IV: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence (9 hours)

Understanding the harmony in the Nature

Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module V: Implications of the above Holistic Understanding of Harmony on Professional Ethics (10 hours)

Natural acceptance of human values

Definitiveness of Ethical Human Conduct

Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

Competence in professional ethics:

- Ability to utilize the professional competence for augmenting universal human order
- Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
- Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems

Strategy for transition from the present state to Universal Human Order:

- At the level of individual: as socially and ecologically responsible engineers, technologists and managers
- At the level of society: as mutually enriching institutions and organizations

Sum up Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. Discuss the conduct as an engineer or scientist etc.

Suggested Readings

Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.

Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.

The Story of Stuff (Book).

The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi 5. Small is Beautiful - E. F Schumacher.

Slow is Beautiful - Cecile Andrews

Economy of Permanence - J C Kumarappa

Bharat Mein Angreji Raj - PanditSunderlal

Rediscovering India - by Dharampal

Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

India Wins Freedom - Maulana Abdul Kalam Azad

Vivekananda - Romain Rolland (English)

Gandhi - Romain Rolland (English)

Mapping of CO to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M	M			
CO 2		H			
CO 3			H		
CO 4				M	H

MNEM203T : Engineering Mathematics III-Complex Variables, PDE and Probability and statistics (4 Credits - 60 Hours) (3L: 1 T: 0P)

Course Objective :To introduce the solution methodologies for second order Partial Differential Equations with applications in engineering, To provide an overview of probability and statistics to engineers

Module-1: PDE and its Application (16 hrs)

Definition of Partial Differential Equations, Formation of First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Separation of variables method to simple problems in Cartesian coordinates, Heat diffusion and vibration problems, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. One dimensional diffusion equation and its solution by separation of variables.

Module-2: Basic Probability and Probability Distribution (16 hrs)

Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Variance of a sum, Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Chebyshev's Inequality. distribution functions and densities, normal, exponential and gamma densities. Bivariate distributions and their properties, conditional densities, Bayes' rule.

Module-3: Applied Statistics (8 hrs)

Basic Statistics, Measures of Central tendency: Moments, skewness and Kurtosis - Correlation and regression – Rank correlation. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, Tests for single mean, difference of means, and difference of standard deviations. Test for ratio of variances - Chi- square test for goodness of fit and independence of attributes.

Textbooks/References:

B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Publication.
Babu Ram, Engineering Mathematics, Pearson Publication, ISBN: 978-81-317-8503-4.
Dr. Hari Arora, Probability and Statistics, Katson Publication.
P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Re-print)
S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Course Outcomes:

Upon completion of this course, students will be able to -

- CO1: Determine the solution of partial differential equations by adopting various methods. (Evaluating)
- CO2: Formulate the partial differential equations by range of techniques and to predict the behaviour of certain model physical phenomena. (Create)
- CO3: Define the basic principles of probability theory, the concept of random variables also different methods to find the solution of PDE's. (Remembering)
- CO4: Apply the basic ideas of the measures of central tendency, correlation and regression to solve social and scientific related problems. (Applying)

ECEE0052 :BASIC ELECTRONICS ENGINEERING

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective: This course is intended to give a preliminary understanding of the world of Electronics-Semiconducting materials and basic devices, simple circuits and communication systems. It will also serve to create a better appreciation of going digital and to generate continued interest in the course.

Module I (15 hours)

Semiconductor Devices and Applications: Introduction to types of semiconductors – Intrinsic & Extrinsic, N-type and P-types, Energy Band Diagram; Introduction to P-N junction Diode – Construction, Operation, and V-I characteristics, Static & Dynamic Resistance, Ideal versus Practical, Half wave and Full-wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener diode and its characteristics, Zener diode as voltage regulator; Regulated power supply IC based on 78XX and 79XX series, Introduction to Bipolar Junction Transistor (BJT) – Construction, Operation; BJT Configurations – Common Base, Common Emitter and Common Collector, input-output and transfer characteristics, Operating Point; BJT as a single stage CE amplifier, frequency response and bandwidth.

Module II (15 hours)

Operational Amplifier and its Applications: Introduction to Operational Amplifiers – Equivalent circuit, Transfer Characteristics, Op-Amp input modes and parameters, Ideal Characteristics; Op- Amp in Open Loop Configuration, Op-Amp with Negative Feedback, Concept of Virtual Ground, Practical Op-Amp IC 741, Inverting and Non-inverting Amplifier; Applications of Op-Amp –Summing and Difference Amplifier, Unity Gain Buffer, Comparator, Integrator and Differentiator, Log Amplifier, Instrumentation Amplifier.

Timing Circuits and Oscillators: Oscillators – Basic Features, Barkhausen's criteria for oscillation, R-C phase shift and Wein bridge oscillator; RC-timing circuits, IC 555 and its applications as a stable and mono-stable multi vibrators.

Module III (8 hours)

Digital Electronics Fundamentals: Number System and Boolean Algebra, Basic and Universal Gates – Symbols, Truth tables, logic expressions; Logic simplification using K- map, Logic ICs, Half and Full Adder/Subtractor, Multiplexers, Demultiplexers, Flip-Flops, Shift Registers and Counters; Block diagram of Microprocessor/Microcontroller and their applications.

Module IV (7 hours)

Electronic Communication Systems: The Elements of Communication System, IEEE Frequency Spectrum, Signals and its Classification, Types of Signals; Transmission Media – Wired and Wireless, Baseband and Passband transmission; Modulation – Types of Modulation, Need for modulation, AM and FM Modulation schemes; Mobile communication systems – Cellular Concept and Block Diagram of GSM System.

Course Outcomes

After completing the course successfully the students will be able to-

CO1 : Recall the fundamental concepts of semiconductor devices, operational amplifiers, digital electronics, and communication systems, including their principles, classifications, and basic characteristics.(Remembering)

CO2 : Explain the working principles of electronic circuits, logic systems, and communication techniques, and interpret their functions in engineering applications.(Understanding)

CO3 : Design and analyze basic electronic circuits, such as rectifiers, amplifiers, oscillators, and timing circuits, using semiconductor devices, operational amplifiers, and ICs.(Applying)

CO4 : Implement digital systems using logic gates, adders, multiplexers, and counters, and apply modulation techniques (AM/FM) in practical communication scenarios.(Applying)

Suggested Readings

1. Bell, "Electronic Devices & Circuits" Oxford.
2. Floyd , "Electronic Devices" Pearson Education.
3. R.P. Jain , "Modern Digital Electronics", Tata McGraw Hill.
4. Frenzel, "Communication Electronics: Principles and Applications", Tata McGraw Hill.

MNEM204T :ENGINEERING MECHANICS

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective:

To provide foundational knowledge of statics, dynamics, and mechanics of rigid bodies, including force systems, friction, and equilibrium analysis. It aims to develop skills in analysing Truss, motion, energy principles, and vibrations in mechanical systems. Additionally, it introduces the application of virtual work, stability, and dynamics of rigid and particle systems in engineering contexts.

Module I (9 hours)

a. Force Systems Basic concepts, Particle equilibrium in 2-D and 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

b. Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack and differential screw jack.

Module II (8 hours)

Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams and types of beams; Frames and Machines.

Module III (8 hours)

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles,

Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

Module IV (8 hours)

Virtual displacements, principle of virtual work for particles and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.

Module V (9 hours)

a. Particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work, kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

b. Introduction to Kinetics of Rigid Bodies- Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Module VI (8 hours)

Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

Course Outcomes

After completing the course successfully the students will be able to-

CO1 : Recall fundamental principles of mechanics, including force systems, friction, equilibrium, motion, and vibrations, as well as the laws and equations governing them. (Remembering)

CO2 : Explain the concepts of equilibrium in three dimensions, centroid and moment of inertia, virtual work, and energy principles, and describe their applications in solving engineering problems.(Understanding)

CO3 : Apply mechanics principles to solve practical problems related to force analysis, trusses, beams, particle dynamics, and vibration systems. (Applying)

CO4 : Analyze complex mechanical systems for stability, motion, and energy interactions using methods like D'Alembert's principle, work-energy relationships, method of section, method of joint and dynamics of rigid bodies. (Analyzing)

Mapping of CO with PO & PSO

CO/PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2										1	2	2
CO2	3	3		2								2	3	3
CO3	3	3	2	2	1							2	3	3
CO4	3	3	2	3	2							2	3	3

Suggested Readings

Mariam and Craig, Engineering Mechanics, Wiley.

2. S. Timoshenko and D.H. Young, Engineering Mechanics McGraw Hill Int

3.R.K. Bansal, Engineering Mechanics, Laxmi Publication (P) Ltd.

4. K.L. Kumar, Engineering Mechanics, McGraw Publishing Co.

5. Irving H. Shames, Engineering Mechanics, 4th Edition, Prentice Hall

6. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II, Dynamics, Tata McGraw Hill

7. Shames and Rao, Engineering Mechanics, Pearson Education

8. Hibler and Gupta, Engineering Mechanics (Statics, Dynamics), Pearson Education.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute

1	Engineering Mechanics Statics and Dynamics	Prof. Anubhab Roy Prof. Mahesh Panchagnula	IIT Madras
2	Mechanics	Prof. A. Dasgupta	IIT Kharagpur
3	Engineering Mechanics	Prof. U.S. Dixit and Dr. G. Saravana Kumar	IIT Guwahati

MNBT205T :BASIC THERMODYNAMICS**(4 Credits – 60 hours) (L-T-P: 3-1-0)**

Objective: To provide an in-depth understanding of thermodynamic principles, including the laws of thermodynamics, entropy, and thermodynamic properties of substances. It aims to develop knowledge on air standard cycles and internal combustion engines, along with their performance and efficiency.

Module I (12 hours)

Thermodynamic System and Control volume; Property, State and Process, Exact and Inexact differentials, Work -Thermodynamic definition of work, Displacement work; Path dependence of displacement work and illustrations for simple processes; Thermodynamics equilibrium. Temperature, Definition of thermal equilibrium and Zeroth law; Temperature scales; Various Thermometers. Definition of heat; examples of heat and work interaction in systems. First Law for cyclic and non-cyclic processes; Limitation of first law of thermodynamics, Internal energy and Enthalpy.

Module II (13 hours)

a) First Law for Flow Processes - Derivation of general energy equation for a control volume; Steady state steady flow processes; Examples of steady flow devices; Unsteady processes; examples of steady and unsteady I law applications for system and control volume.

b) Second law : Definitions of direct and reverse heat engines; Definitions of thermal efficiency and COP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and external irreversibility; Carnot cycle; Carnot's theorem, Corollary of Carnot theorem, Clausius theorem; Definition of entropy; Inequality of Clausius, Principle of increase of entropy; Change of entropy undergoing different processes

Module III (12 hours)

Definition of Pure substance, p-v diagram, p-T diagram, p-v-T diagram, T-s diagram for a Pure Substance, h-s diagram, Mollier diagram, Dryness Fraction, Charts of Thermodynamic Properties. Equation of State of a Gas, Ideal Gas, Specific Heats, Internal Energy, Enthalpy and Entropy of an Ideal Gas, Equations of State, Compressibility Charts, Properties of Mixtures of Gases- Dalton's law of Partial Pressures, Internal Energy, Enthalpy and Specific Heats of Gas Mixtures.

Module IV (10 hours)

Air standard cycle assumptions, working; efficiency of Otto cycle, Diesel cycle, Dual cycle, Brayton cycle and Stirling cycle. Comparison of Otto cycle, Diesel cycle and Dual cycle.

Module V (13 hours)

Definition of Engine, classification of IC Engines, Performance Parameters, Construction and Working principle of four-stroke and two-stroke engine, Petrol Engine, Diesel Engine, Comparison between Petrol and Diesel Engine.

Course Outcomes

After completing the course successfully the students will be able to-

CO1 : Recall the fundamental principles of thermodynamics, including system properties, laws of thermodynamics, heat and work interactions, and thermodynamic cycles, as well as the construction and classification of IC engines. (Remembering)

CO2 : Explain the concepts of thermal equilibrium, entropy, properties of pure substances, air standard cycles and the working principles of internal combustion engines, along with their efficiency. (Understanding)

CO3 : Apply the first and second laws of thermodynamics, entropy principles etc. to solve problems for various open and closed systems. (Applying)

CO4 : Interpret thermodynamic property charts and equations of state for pure substances and gas mixtures to determine thermodynamic properties and predict system behaviour. (analysis)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	1									1	1
CO2	2	3	3	3		2	2					1	3	1
CO3	2	3	3	3	1	2	2				1	1	3	1
CO4	2	1	1	1									1	1

Suggested Readings

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., Fundamentals of Thermodynamics, John Wiley and Sons
2. Nag, P.K, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd,
3. Cengel, Boles, Thermodynamics An Engineering Approach, McGraw-Hill Publishing Co. Ltd

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://archive.nptel.ac.in/courses/112/106/112106310/ (Engineering Thermodynamics)	Prof. V. Babu	IIT Madras
2	https://archive.nptel.ac.in/courses/112/105/112105123/ (Basic Thermodynamics)	Prof. S. K. Som	IIT Kharagpur

MNFM206T : FLUID MECHANICS AND HYDRAULIC MACHINES**(4 Credits – 60 hours) (L-T-P: 3-1-0)****Objective:**

To introduce fundamental concepts of fluid properties, pressure measurement, and fluid forces, teach principles of fluid dynamics including flow types, boundary layers, and dimensional analysis, and explore the working principles and performance of rotodynamic machines, pumps, and turbines.

Module I (6 hours)

Definition of fluid, Units and dimensions-Properties of fluids, Pascal law, Pressure measurement manometer, types of manometer and its application, Newton's law of viscosity, Forces on submerged plane and curved surfaces, buoyant force, metacentre, centre of buoyancy, equilibrium of floating and submerged body.

Module II (11 hours)

Types of fluid flow: steady, unsteady, uniform, non-uniform, laminar, turbulent, compressible, incompressible, rotational, irrotational, one, two, three dimensional flows, velocity, acceleration, Velocity potential function, Stream function. Control volume- application of continuity equation and momentum equation, flow net, Vortex flow Bernoulli's equation and its applications to Venturimeter, Orificemeter and Pitot tube and Notches.

Module III (15 hours)

Exact flow solutions in channels and ducts, Laminar flow, Velocity distribution, mean velocity, velocity profile Kinetic energy factor and momentum Couette and Poiseuille flow, laminar flow through circular conduits and circular annuli. Turbulent flow: Reynold's experiment, laws of fluid friction, shear stress, types of boundary, Prandtl length concept, velocity distribution, mean velocity, velocity profile, resistance to flow in smooth and rough pipes, Darcy Weisbach equation, friction factor, Moody's diagram.

Module IV (7 hours)

Concept of boundary layer, laminar boundary layer, turbulent boundary layer, Laminar sub layer, Boundary layer thickness, displacement thickness, momentum thickness, energy thickness. Flow around submerged bodies- Introduction to concept and expression of drag and lift, pressure drag and friction drag, Streamlined and Bluff bodies.

Module V (4 hours)

Need for dimensional analysis, Buckingham's pi theorem and its application. Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis.

Module VI (9 hours)

Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor, velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps-Reciprocating pump – working principle.

Module VII (8 hours)

Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Define fundamental fluid properties, types of flows, pressure measurement techniques, and the principles governing submerged bodies and equilibrium.(Remembering)

CO2: Explain the concepts of fluid dynamics, including Bernoulli's equation, flow characteristics, boundary layer theory, and dimensional analysis with practical implications.(Understanding)

CO3: Apply the principles of fluid flow, dimensional analysis, and boundary layer theory to solve engineering problems, including designing and analyzing hydraulic machines and systems.(Applying)

CO4: Evaluate the performance of rotodynamic machines, pumps, and turbines by interpreting velocity triangles, efficiencies, and flow characteristics for improved system design and analysis of dimensional analysis and model analysis .(Analyzing)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1									1		
CO2	3	2	2	2								1	2	
CO3	2	2	2	2								1	2	
CO4	2	2	1	1								1	1	

Suggested Readings

1. Sukumar Pati, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill.
2. Dr. R.K. Bansal, Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications.
3. R.K Rajput, Textbook on Fluid Mechanics and Hydraulic Machines, S. Chand.
4. Y. A. Cengel, Fluid Mechanics Fundamentals and Applications, Tata McGraw Hill.
5. P.N. Modi and S.M. Seth, Hydraulics and fluid Mechanics including hydraulics machines, Standard Book House.

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/112105171 Fluid Mechanics	Prof.Suman Chakraborty	IIT Kharagpur
2	https://nptel.ac.in/courses/112104118 Fluid Mechanics	Prof. Gautam Biswas, Prof. Suman Chakraborty	IIT Kanpur

3	https://nptel.ac.in/courses/112105206 Fluid Machines	Prof. Suman Chakraborty	IIT Kharagpur

ENVIRONMENTAL SCIENCE**(NC– 30 hours) (L-T-P: 2-0-0)**

Objective: To create awareness about the multidisciplinary nature of environmental studies, highlighting the importance of natural resource conservation, ecosystem dynamics, and biodiversity. It explores the causes, effects, and mitigation strategies for environmental pollution and discusses critical social issues such as sustainable development and disaster management. Additionally, it examines the interrelation between human population, health, and environmental challenges, emphasizing the role of information technology in environmental sustainability.

Module I: The Multidisciplinary Nature of Environmental Studies (3 lectures)

Definition, scope and importance, need for public awareness.

Module II: Natural Resources (3 lectures)

a) Different types of natural resources and associated problems - forest resources, water resources, mineral resources, food resources, energy resources, land resources.

b) Conservation of natural resources.

Module III: Ecosystems (4 lectures)

a) Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, food chains, food webs.

b) Structure of following ecosystems - forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems.

Module IV: Biodiversity and Its Conservation (4 lectures)

Types of biodiversity – genetic, species and ecosystem, value of biodiversity, global biodiversity, India as a mega-diversity nation, threats to biodiversity, conservation of biodiversity - in-situ and ex-situ conservation.

Module V: Environmental Pollution (6 lectures)

a) Definition, causes, effects and control measures of - air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards and e- pollution.

b) Solid waste management

c) Disaster management

Module VI: Social Issues and the Environment (6 lectures)

a) From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, climate change, global warming, acid rain, ozone layer depletion.

b) Environment protection act.

c) Introduction to environmental impact assessment.

Module VII: Human Population and the Environment (4 lectures)

Population growth and sex ratio; Population explosion - family welfare programme; Environment and human health; HIV/AIDS; Role of information technology in environment and human health.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall key concepts related to natural resources, ecosystems, biodiversity, types of pollution, and associated environmental acts and regulations. (Remembering)

CO2: Explain the interrelationships between biodiversity, resource management, and the effects of human activities on environmental sustainability. (Understanding)

CO3: Apply environmental principles and sustainable practices to propose solutions for issues like pollution control, disaster management, and conservation efforts. (Applying)

Suggested Readings

1. Erach Bharucha, Textbook of Environmental Studies, UGC, New Delhi
2. J.P. Sharma, Environmental Studies, University Science Press

MIKS0109T: Introduction to Indian Knowledge Systems (2 Credits - 30 Hours)

Course Objectives

To introduce fundamentals of Ancient Indian Educations to understand the pattern and purpose of studying vedas, vedangas, upangas, upveda, purana & Itihasa

To help students to trace, identify and develop the ancient knowledge systems.

To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing

To build in the learners a deep rooted pride in Indian knowledge, committed to universal human right, well-being and sustainable development.

Course Outcomes

After completing the course, the students will be able to-

CO1: Identify the foundational elements of Bhāratīya civilization, including its knowledge systems, educational institutions, and philosophical traditions. (*Understanding*)

CO2: Apply traditional Indian approaches to language, logic, measurement systems, and physical reality to modern interdisciplinary contexts. (*Applying*)

CO3: Analyse the contributions of key scholars and literary figures in the development of Indian arts, sciences, and philosophy. (*Analysing*)

CO4: Evaluate the scientific principles and technological innovations from ancient India in the areas of mathematics, astronomy, medicine, and environmental studies. (*Evaluating*)

Detailed Syllabus

Module-I: Foundations of Indian Knowledge Systems and Civilisational Heritage

a. Bhāratīya Civilization and Development of Knowledge System (4 hours)

Genesis of the land, Antiquity of civilization, On the Trail of the Lost River, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization, Traditional Knowledge System, The Vedas, Main Schools of Philosophy, Ancient Education System, the Takṣaśilā University, the Nālandā University, Alumni, Knowledge Export from Bhārata.

b. Arts, Literature, and Scholars (3 hours)

Art, Music, and Dance, Naṭarāja– A Masterpiece of Indian Art, Literature, Life and works of Agastya, Lopāmudrā, Vālmīki, Patañjali, Vedavyāsa, Yājñavalkya, Gārgī, Maitreyī, Bodhāyana, Caraka, Suśruta, Jīvaka, Nāgārjuna, Kaṇāda, Patañjali, Kauṭīlya, Pāṇini, Āryabhaṭa, Varāhamihira, Ādi Śaṅkarācārya, Bhāskarācārya, Mādhavācārya.

c. Science, Astronomy, and Mathematics (5 hours)

Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, Bhāratīya Kāla-gaṇanā, Kerala

School for Mathematics and Astronomy, History and Culture of Astronomy, Sun, Earth, Moon, and Eclipses, Earth is Spherical and Rotation of Earth, Archaeoastronomy; Concepts of Zero and Pi, Number System, Pythagoras Theorem, and Vedic Mathematics.

d. Life, Environment, and Health (3 hours)

Ethnic Studies, Life Science in Plants, Anatomy, Physiology, Agriculture, Ecology and Environment, Āyurveda, Integrated Approach to Healthcare, Medicine, Microbiology, Medicine, Surgery, and Yoga, etc.

Module-II: Scientific Traditions and Technological Innovations in Indian Knowledge Systems

a. **Foundation concept for Science & Technology (7 hours)**

Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhya System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeṣikan approach to physical reality, constituents of the physical reality, Pramāṇa, Saṃśaya.

b. **Indian Science & Technology in IKS (8 hours)**

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Engineering Science and Technology in the Vedic Age and Post-Vedic Records. Indian Science and Technology Heritage, sixty-four art forms and occupational skills (64 Kalas). Metals and Metalworking technology: Copper, Gold, Zinc, Mercury, Lead, Silver, Iron & Steel. Dyes and Painting Technology, Town & Planning Architecture in India, Temple Architecture, Vastu Sastra.

References:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
3. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
4. SK Das, The education system of Ancient hindus, Gyan publication house, India.
5. BL Gupta, Value and distribution system in india, Gyan publication house, India.
6. Reshmi ramdhoni, Ancient Indian Culture and Civilisation, Star publication, 2018.
7. Supriya Lakshmi Mishra, Culture and History of Ancient India (With Special Reference of Sudras), 2020.
8. Gambirananda, Swami, Tr. Upanishads with the Commentary of Sankarachrya. Kolkata: Advaita Ashrama publication Department, 2002.
9. Ranganathananda, Swami. The Massage of the Upanishads. Bombay: Bharathya Vidya Bhaven, 1985.
10. Om Prakash, Religion and Society in Ancient India, Bhariya Vidhya Prakashan, 1985.
11. J Auboyer, Daily Life in Ancient India from Approximately 200 BC to AD 700, Munshi ram Manoharlal publication, 1994.

12. DK Chakkrabarty, Makkhan Lal, History of Ancient India (Set of 5 Volumes), Aryan book International publication, 2014.
13. Dr. Girish Nath Jha, Dr. Umesh Kumar Singh and Diwakar Mishra, Science and Technology in Ancient Indian Texts, DK Print World limited.
14. Swami BB Vishnu, Vedic Science and History - Ancient Indian's Contribution to the Modern World, gosai publication, 2015.
15. Chatterjee, S.C. The Nyaya Theory of Knowledge. Calcutta: University of Calcutta Press, 1950.
16. Dasgupta, Surendra. A History of Indian Philosophy. Delhi: Motilal Banarsidass, 1991. Vols. III & IV.
17. Mercier, Jean L. From the Upanishads to Aurobindo. Bangalore: Asian Trading Corporation, 2001.
18. M. Hiriyanna. Essentials of Indian Philosophy. London: Diane Publications, 1985.
19. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan.
20. History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).
21. Pride of India- A Glimpse of India's Scientific Heritage edited by Pradeep Kohle et al. Samskrit Bharati (2006).
22. Vedic Physics by Keshav Dev Verma, Motilal Banarsidass Publishers (2012).
23. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd. (2010).

MNFM206T :MECHANICAL ENGINEERING LAB-I (FLUID)
(1 Credit– 30 hours) (L-T-P: 0-0-2)

Objective:

To provide practical understanding of fluid mechanics concepts through experiments. It includes the study of fluid pressure distribution, verification of Bernoulli's theorem, and analysis of the performance of hydraulic machines. The focus is on hands-on experience in fluid flow measurement and equipment testing.

List of Experiments:

1. Determination of metacentric height.
2. Study of fluid pressure distribution on immersed bodies.
3. Experimental verification of Bernoulli's theorem.
4. Study of discharge through orifice meter or venturimeter.
5. Study of discharge through Triangular and Rectangular notches.
6. Determination of vorticity of free and forced vortex.
8. Determination of velocity through Pitot tube.
9. Determination of performance of Pelton Wheel
10. Determination of performance of Francis turbine.
11. Determination of performance of Reciprocating pump
12. Determination of performance of Centrifugal pump

Course Outcomes:

After completing the course successfully the students will be able to-

CO1: Comprehend the fundamental principles of fluid mechanics, including metacentric height, pressure distribution, and Bernoulli's theorem through experimental demonstrations.(Understanding)

CO2: Apply the concepts of fluid dynamics and statics to perform experiments on fluid flow measurement, including discharge determination through orifice meter, venturimeter, and notches.(Applying)

CO3: Analyze the performance characteristics of different hydraulic machines and fluid systems, such as Pelton wheel, Francis turbine, and pumps, notches based on the data obtained from experiments.(Analyzing)

CO4: Evaluate performance characteristics of fluid systems by assessing the experimental results.(Evaluating)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	1	1	2									1	1
CO2	2	1	1	2	2								1	1
CO3	2	1	1	2									1	1
CO4	2	1	1	3	2								1	1

Suggested Readings

1. Dr. R.K. Bansal, Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications.

Alternative Virtue Lab/NPTEL/SWAYAM Course:

Sr. No	Virtue Lab/NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://www.vlab.co.in/participating-institute-nitk-surathkal		NITK SURATHKAL
2	https://eerc03-iiith.vlabs.ac.in/		IIIT Hyderabad

MNIP207T : Internship Programme

CO1: Identify basic of mechanical engineering knowledge (Remembering)

CO1: Summarise basic mechanical engineering lab and their equipment. (Understanding)

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	1	1	2									1	1
CO2	2	1	1	2									1	1

**MNMD202P : MACHINE DRAWING LAB
(1 credits) (L-T-P: 0-0-2)****Objectives:**

1. To develop basic understanding of projections and sectional views of various mechanical parts.
2. To get an idea about the assembly drawing of machines.

List of Experiments:**(I) Orthographic projections and Perspective projections**

1. Principle of projections.
2. First and third angle projections.
3. Orthographic projections in first and third angle.
4. Perspective projections.

(II) Sectional views

1. Introduction and types of sectional views

2. Full section
3. Half section
4. Full and half sectional views of different machine parts.

(III) Assembly drawings

1. Procedure and types of assembly drawings.
2. Assembly drawings of machine units like stuffing box, connecting rod, foot step bearing, tool-post, flanged coupling etc.

Course Outcomes:

At the end of the course students will be able to:

CO 1: Explain the concepts of different types of projections. (Explaining)

CO 2: Identify the full and half sectional views of machine parts based on requirements. (Applying)

CO 3: Construct different types of assembly drawings of machine units based on their uses. (Creating)

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	2	1	2	1									1	1
CO2	1	2	2	1									1	1
CO3	3	1	1	1	2								1	2

Text Books/ References:

1. N. D. Bhatt, V. M. Panchal, Machine Drawing, Charotar Publishing House.

Applied Thermodynamics

(4 Credits-60 hours)(L-T-P: 3-1-0)

Objectives: To understand and analyze thermodynamic cycles, including Rankine, Carnot, and refrigeration cycles, steam turbine, nozzle, compressors, study the behaviour of isentropic flow and shock properties, and explore combustion processes, fuel characteristics, and energy efficiency in fluid and power systems.

Module I (12 hours)

Simple Steam Power Cycle, Rankine Cycle, Actual Vapour Cycle Processes, Comparison of Rankine and Carnot Cycles, Mean Temperature of Heat Addition, Reheat Cycle, Regeneration- Open Feedwater Heater, Reheat-Regenerative Cycle, Characteristics of an Ideal Working Fluid, Binary Vapour Cycles.

Module II (12 hours)

Reversed Carnot Cycle, Unit of Refrigeration, Limitation of Reversed Carnot Cycle, Gas Refrigeration Cycle, Vapor compression refrigeration cycles, p-h diagram. Properties of Atmospheric Air, Psychrometric Properties of Air, Psychrometric Chart.

Module III (12 hours)

a) Velocity of Pressure Pulse in Fluid, Stagnation properties, Mach Number, Property Relations for Isentropic Flow through a Duct, One Dimensional Steady Isentropic Flow, Critical Properties- Choking in Isentropic Flow, Normal Shocks, use of ideal gas tables for isentropic flow and normal shock flow, Flow through Actual Nozzles and Diffusers, Effect of Irreversibility on Nozzle Efficiency.

b) Introduction to Condensers, elements of steam condenser, types of steam condenser, air leakage and its effect on performance of condensers, vacuum efficiency, thermodynamic analysis of condensers

Module IV (12 hours)

a) Classification, Reciprocating Compressor Terminology, Work of Compression, Single stage Reciprocating Air Compressor, Volumetric Efficiency, Limitations of Single Stage Compression and Multistage Compression.

b) Classification of Steam Turbines, Simple Impulse Turbine, Optimum Operating Conditions from Blade-Velocity Diagram, Effect of Blade Friction on Velocity Diagram, work done on turbine blades and efficiencies of components, Compounding of Impulse Turbine, Reaction Turbine, Comparison between Impulse and Reaction Turbines, Losses in Steam Turbines.

Module V (12 hours)

Introduction to boilers, classification of boilers, description of each type of boilers, Characteristics of an Ideal Fuel, Liquid Fuel, Gaseous Fuel, Combustion, Amount of Air Required for Combustion, Air-Fuel Ratio, Air-Fuel Ratio from Analysis of Flue Gases, Heat Generated by Combustion, Standard Reference State, Enthalpy of Formation, Enthalpy of Reaction, Calorific value of Fuel.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall and describe various thermodynamic cycles, including Rankine and Carnot cycles, refrigeration cycles, and the properties of fluids used in these cycles and basic of nozzle, condenser, steam turbine compressor (Remembering)

CO2: Explain the principles behind different thermodynamic cycles, such as the Rankine cycle and the refrigeration cycle, and their limitations and applications in energy systems. (Understanding)

CO3: Calculate the performance of thermodynamic cycles, including steam and refrigeration cycles, and analyze the work and efficiency of compressors, nozzle condenser and turbines using the relevant thermodynamic principles. (Applying)

CO4: Analyze the effects of various factors, such as irreversibility in nozzles and diffusers, energy losses in turbines, and fuel combustion efficiency, on the overall performance of thermodynamic systems. (Analyzing)

Mapping of CO with PO & PSO

CO/PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	3		1	1						1	1
CO2	2	3	1	1	1		1					1	3	1
CO3	2	3	3	3		2						1	1	1
CO4	3	1	2	2									1	1

Suggested Readings

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., Fundamentals of Thermodynamics, John Wiley and Sons
2. Nag, P.K, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd,
3. Domkundwar, Kothandaraman, A course in Thermal Engineering, Dhanpat Rai & Co.
4. Gengel, Boles, Thermodynamics An Engineering Approach, McGraw-Hill Publishing Co.Ltd

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/112106314 Applied Thermodynamics	Prof. Babu Viswanathan	IIT Madras
2	https://nptel.ac.in/courses/112106419 Applied Thermodynamics	Prof. V. Raghavan	IIT Madras

Strength of Materials**(4 Credits – 60 hours) (L-T-P: 3-1-0)**

Objective: To provide foundational knowledge of stress, strain and deformation in solids, including principal stresses, shear force and bending moments in beams. It emphasizes understanding the behaviour of elastic deformation occurring in various simple geometries for different types of loading.

Module I (15 Hours)

Deformation in solids- Hooke's law, stress and strain- tension, compression and shear stresses- elastic constants and their relations- volumetric, linear and shear strains- principal stresses and principal planes- Mohr's circle, thermal stress.

Module II (15 Hours)

Beams and types transverse loading on beams, point and distributed loads. - shear force and bending moment diagrams-Types of beam supports, simply supported and overhanging beams, cantilevers, fixed and guided beams, Theory of bending of beams, bending stress distribution and neutral axis, shear stress distribution.

Module III (15 Hours)

a) Moment of inertia about an axis and polar moment of inertia, deflection of a beam using double integration method, computation of slopes and deflection in beams, Myosotis method for computing deflections and slopes, Castigliano's theorem, Maxwell reciprocity theorem.

b) Columns buckling: Calculation of critical loads using Euler's theory with different boundary conditions, Eccentric columns.

Module IV (8 Hours)

Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at both ends, stresses and deflection of helical springs.

Module V (7 Hours)

Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders, deformation in spherical shells subjected to internal pressure, Combined thermo mechanical stress.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall fundamental principles of stress, strain, elastic constants etc. for analysing the behaviour of solids under different loading conditions. (Remembering)

CO2: Recognize various types of loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components. (Understanding)

CO3: Evaluate the strains and deformation that will result due to the elastic stresses developed within the materials for simple types of loading (Applying)

CO4: Analyse and design beams, shafts and hollow cylinders. (Analyzing)

Mapping of CO with PO & PSO

CO/PO, P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	2	2	1	3		1							1	1
CO2	3	3	3	1	1							1	3	1
CO3	3	3	3	3		2						1	3	1
CO4	2	2	2	2	1								2	1

Suggested Readings

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi.
 2. R. Subramanian, Strength of Materials, Oxford University Press.
 3. Ferdinand P. Beer, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd.
 4. D S Bedi, Strength of Materials, Khanna Book Publishing
- Alternative NPTEL/SWAYAM Course:

Sr No	NPTEL/SWAYAM COURSE NAME	Name of In- structor	Hosting Institute
1	Strength of Materials (https://www.youtube.com/watch?v=GkFgy-sZC4Vc&list=PL27C4A6AEA552F9E6)	Prof. S.K. Bhattacharyya	IIT Kharagpur
2	Strength of Materials (https://www.youtube.com/watch?v=La4UEa7hA7Q&list=PLJoALJA_KMOARYNi50T6b488kPUBbOIsX)	Prof. K. Ramesh	IIT Madras

MEASUREMENTS AND METROLOGY**(4 Credits – 60 hours) (L-T-P: 3-1-0)**

Objective: To understand the principles and methods of measurement, metrology, and error analysis for accurate evaluation of physical parameters and system performance. Apply advanced tools and statistical techniques for designing experiments, ensuring quality control, and enhancing precision in engineering and manufacturing processes.

Module I: (10 Hours)

Measurement Purpose and Parameters: Parameters – geometry (straightness, flatness, roundness, etc.), displacement, force, speed, torque, flow, level, pressure, temperature, acceleration, etc.; Definitions: Accuracy, precision, range, resolution, uncertainty and error sources; Regression analysis. Measurement Principles: Structure and examples of measurement systems; Calibration principles; Linear and angular measurements; Comparators; Gauge design; Interferometry.

Module II: (8 Hours)

Limits, Fit and Tolerances: Definitions; Tolerance zone and grades, Hole and shaft system, Geometric tolerances, Taylor's principle of gauging, Design of tolerances for various applications; Tolerance analysis in manufacturing and assembly; Role of metrology in Design of Manufacturing.

Module III: (10 Hours)

Mechanical Measurements and Equipment: Dimensional metrology – Vernier, micrometers, LVDT; Form metrology – form tester, surface profiler, CMM, 3D scanning; Surface metrology -optical microscopes, Laser scanning microscopes, electron microscopy (SEM/TEM), x-ray microscopy, Raman spectroscopy; Tool wear, workpiece quality and process metrology. Thermal and Flow Measurement: Measurement of temperature, thermal conductivity and diffusivity; Flow obstruction methods; Magnetic flow meters.

Module IV: (10 Hours)

Electrical Measurements and Instruments: Signal generators and analysis; Wave analyzer; Spectrum analyzer; Frequency counters – measurement errors, extending the frequency range; Transducers – types, strain gages, displacement transducers; Digital data acquisition system - interfacing transducers to electronics control and measuring system; Instrumentation amplifier; Isolation amplifier; Computer-controlled test systems.

Module V: (7 Hours)

Design of Experiments and Statistical Analysis: DOE techniques; Taguchi orthogonal arrays; Data acquisition, signal processing and conditioning; Error of a system of ideal elements; Error probability density function of a system of non-ideal elements; Error reduction techniques; Quality control and assurance in industry.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall fundamental concepts of measurement parameters, principles of metrology, calibration, error sources, and the role of limits, fits, and tolerances in manufacturing and quality assurance.(Remembering)

CO2: Explain the operation and significance of mechanical, thermal, flow, and electrical measurement systems, as well as the application of statistical techniques and design of experiments in process optimization.(Understanding)

CO3: Utilize metrological instruments and techniques such as comparators, form testers, and coordinate measuring machines to evaluate dimensions, surface characteristics, and form deviations in engineering components.(Applying)

CO4: Implement transducers, data acquisition systems, and signal processing methods to measure, analyze, and control parameters such as temperature, pressure, flow, and displacement in practical engineering systems.(Applying)

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	3	1	1									1		
CO2	3	2	2	2								1	2	
CO3	2	2	2	2								1	2	
CO4	2	2	1	1								1	1	

Text /Reference Books:

1. E.O Doebelin and Dhanesh Manik, "Measurement Systems", McGraw Hill, 2017
2. Bewoor & Kulkarni, "Metrology & Measurement" Tata McGraw Hill, 2009.
3. D. James, and S, Meadow, "Geometric Dimensioning and Tolerancing", Marcel Dekker, 1995
4. Madhav S. Phadke, Quality Engineering using Robust Design, Prentice Hall, 1989

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	Mechanical Measurements and Metrology	Prof. S P Venkateshan	IIT Madras
2	Principles of Mechanical Measurement	Prof. Dipankar N Basu	IIT Guwahati

Kinematics and Theory of Machines

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective: To impart foundational knowledge of mechanisms, kinematic analysis, and design principles for cams, gears, and linkages. It aims to enable understanding of friction drives, flywheels, governors, and their applications in dynamic systems. The course emphasizes analytical and graphical methods for solving real-world kinematic and dynamic problems.

Module I : (12 hours)

Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain, slider crank chain and double slider crank chains, Limit positions- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- steering gear mechanism, equation of correct steering, intermittent motion mechanism- geneva wheel, paul and ratchet mechanism.

Module II : (12 hours)

Importance of Velocity and acceleration analysis of mechanisms; Graphical methods of velocity analysis using instantaneous center method and relative velocity methods, Concept of Configuration diagram; instantaneous center of rotation: their use in velocity analysis, their location; Aronhold-Keneddy's theorem, velocity and acceleration analysis of four bar mechanism, slider-crank mechanism, quick return motion mechanism, kinematic analysis of simple mechanisms etc; Coriolis component of acceleration- introduction to linkage synthesis..

Module III : (12 hours)

Classification of cams and followers- Terminology and definitions- Displacement, velocity and acceleration diagrams: Uniform velocity, simple harmonic motion, uniform acceleration and retardation and cycloidal

motions- derivatives of follower motions- inline and offset cam and follower; specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, disc cam profile design for roller/knife edge/flat face followers.

Module IV: (10 hours)

Gear drive: fundamentals and working, classification; Gear teeth nomenclature and gear parameters; , fundamental law of gearing and conjugate action, Involute and cycloidal gear teeth profiles; spur gear contact ratio and interference/undercutting; minimum number of teeth to avoid interference- helical, bevel, worm, rack and pinion gears; Gear train: classification, fundamentals and epicyclic and regular gear train kinematics.

Module V: (14 hours)

- Introduction to belt drive, types; law of belting, open and cross belting, velocity ratio, slip and creep, crowning of pulley, belt design for specific power transmission.
- Introduction to flywheel, turning moment diagram, fluctuation of energy and speed, coefficient of fluctuation of energy and speed.
- Introduction to governors and their working: Watt, Porter, Proell, Hartnell, Hartung and Wilson-Hartnell governors.

After completing the course successfully the students will be able to-

CO1: Recall the classifications, definitions, and fundamental laws related to machine and mechanisms; examine the degree of freedom of a given mechanism; state law of gearing, law of belting; list different types of cam & follower classify various types of gears and gear trains; state the working of governors, flywheels (Remembering)

CO2: Explain the principles of motion analysis, gear kinematics, cam design, and dynamic elements such as governors and flywheels in mechanical systems.(Understanding)

CO3: Solve problems related to gear or gear train, flywheel, governor and belt drives for practical applications.(Applying)

CO4: Design suitable cam profile with roller/knife-edge/flat faced follower for simple applications and Construct velocity and/or acceleration analysis diagrams of simple mechanisms. (Analysing)

Mapping of CO with PO & PSO

CO/PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1											1		
CO2	2	2	2										1	2
CO3	3	2	2	2									2	1
CO4	2	2	3										1	1

Suggested Readings

1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers and Distributors.
2. Cleghorn W. L., Mechanisms of Machines, Oxford University Press.
3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated EastWest Pvt. Ltd.
5. S. S. Rattan, Theory of Machines, McGrawHill.
6. V. P. Singh, Theory of Machines, Dhanpat Rai and Co.
7. Sadhu Singh, Theory of Machines, Pearson

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	Kinematics of Machines	Prof. Ashok K Mallik	IIT Kanpur
2	KINEMATICS OF MECHANISMS AND MACHINES	PROF. ANIRVAN DASGUPTA	IIT Kharagpur

Production and Operation Management

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective: To provide students with a comprehensive understanding of production and operations management, focusing on improving workplace efficiency through work study and ergonomics, optimizing factory management with effective location and layout planning, enhancing product development and design strategies, streamlining production planning and control processes, and applying project management techniques such as PERT and CPM.

Module I: Work Study and Ergonomics (10 hours)

Introduction to work study, Scope of Work study, Motion/Method study and Work measurement. Therbligs, use of motion camera in micro motion study, SIMO chart. Motion economy: Meaning, Principles related to (i) Workplace layout (ii) Design of tools and equipment and (iii) Use of human body. Ergonomics (Human factors engineering): Meaning, Characteristics (Cognitive ergonomics and Physical ergonomics), Introduction ONLY to Anthropometry, Biomechanics and Musculoskeletal Disorders (MSD) Preventive measures by ergonomic designs. Work measurement: Meaning, Methods such as (i) Stopwatch time study (ii) Work sampling (iii) Normal time, Rating factor (RF), allowances and determination of Standard Time.

Module II: Factory Management (13 hours)

Meaning of plant location, factors affecting location decisions, location theory, Qualitative models and semi quantitative models: Brown and Gibbs model, Break-Even analysis model, single facility location problems and multi-facility location problems. Meaning of plant/facility layout, factors influencing plant layout, objections of good facility layout, Types of plant layout; Systematic Layout Planning (SLP), Group Technology (GT), Flexible Manufacturing Systems (FMS) and flexible layout and Computer integrated manufacturing (CIM). Line balancing: objectives, solution of Assembly Line Balancing (ALB) problems by: Largest Candidate Rule and RPW methods. Objectives of quality control. Meaning of Total Quality and Total quality management (TQM) Statistical quality control: Meaning and tools; Reliability assessment of processes, Block chain, Energy management, Efficiency & throughput, Overall equipment effectiveness. Process capability, lean manufacturing.

Module III: Product development and Design (7 hours)

Meaning of product, product life cycle (PLC) and product mix. Decision to be taken during product development and design. Procedure for product development and design. Value of a product: its meaning, Value analysis: its objectives, procedure: Simplification and Standardization.

Module IV: Production planning and control (15 hours)

Meaning and objectives of production planning and control. Function of production planning and control, various steps in production planning and control (PPC), Forecasting – its meaning and scope, Qualitative and quantitative methods of forecasting and their scope in engineering industries. Introduction to MRP and MRP II, evolution from Materials Requirement Planning (MRP) to Manufacturing Resource Planning (MRP II). Enterprise resource planning (ERP). Inventory Management: Meaning of inventory, Necessity for maintaining inventory, Inventory classification, Meaning of inventory control, Costs associated with inventory system, Analysis of deterministic inventory model, Just in Time (JIT) and Kanban systems. Meaning of quality.

Module V: Project management (15 hours)

Meaning of project management and its objectives, Network development technique (Arrow diagram and AON diagram) for determination of critical path (CP), earliest and latest dates/times. PERT model: characteristics, probability density function used for PERT activities, probability density function used for the CP, Calculation of Expected length of CP and its standard deviation, calculation of probability of completion of a PERT project (iii) CPM model: characteristics, difference with PERT, direct and indirect costs, concept of crashing (cost time trade off). Project closure: acceptance of project deliverable; Analytics: Performance, capability aggregation, cost benefit analysis, variability analysis, Output-outcome analysis, project documentation, best practices, and depository.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall fundamental concepts of work study, ergonomics, factory management, production planning, product design, and project management, including associated tools and methodologies. (Remembering)

CO2: Explain the principles of motion study, plant layout, product development, inventory management, and project planning techniques such as PERT and CPM, along with their applications in industrial settings. (Understanding)

CO3: apply work study techniques, line balancing methods, and forecasting models to optimize production processes, manage inventory, and improve overall system efficiency. (Applying)

CO4: Evaluate production systems, analyze plant layouts, perform critical path assessments in project management, and assess process reliability using statistical tools for decision-making and optimization. (Analyzing)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	1	1	1							1		2	1
CO2	3	2	2	2							1	1	2	2
CO3	3	2	2	2	1						1	1	2	2
CO4	3	2	2	2							1	1	2	2

Suggested Readings

1. M. Telsang, Industrial Engineering, S. Chand & Company Ltd.
2. Kanishka Bedi, Production and Operations Management, Oxford University Press.
3. O. P. Khanna, Industrial Engineering and Management, Dhanpat Rai & Sons.
4. M. Mahajan, Industrial engineering, Dhanpat Rai & Company.
5. L. Krajewski, L. Ritzman and M. Malhotra, Operations Management, Pearson Education.
6. Adam, Ebert, Production and Operations Management, PHI.
7. R. Panneerselvam, Production and Operations Management, PHI.
8. K. Aswathappa & K. Shridhara Bhat, Production and Operations Management, Himalaya Publishing

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/110107141 Production and Operation Management	IIT Roorkee	Prof. Rajat Agarwal
2	https://nptel.ac.in/courses/112107292 Principles of Industrial Engineering	IIT Roorkee	Prof. D K Dwivedi

Engineering Materials and Applications

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objectives: To provide foundational knowledge of materials science, including crystal structures, mechanical properties, and phase diagrams. It aims to explore the properties, applications, and heat treatment of metals, alloys, polymers, ceramics, and composites. Additionally, it introduces advanced materials and their electrical, magnetic, and smart material applications.

Module I Engineering Materials and Classification (10 hours)

Metals, plastics, ceramics and composites; Relevant properties (physical, mechanical, thermal, electrical, chemical), cost; Range of applications; Material designation and standards; Ashby diagrams; Selection criteria and process.

Module II Mechanical Properties and Testing (10 hours)

Tensile, compression, torsion, fatigue, fracture and wear tests; Young's modulus; Relations between true and engineering stress-strain curves; Generalized Hooke's law; Yielding and yield strength; ductility, resilience, toughness and elastic recovery; Hardness measurement their relation to strength; SN curve, endurance and fatigue limits; Introduction to non-destructive testing (NDT).

Module III Metal and Alloys (10 hours)

Iron and steel; Stainless steel and tool steels; Copper & its alloys – brass, bronze & cupro-nickel; Aluminium & Al-Cu-Mg alloys; Nickel based superalloys & Titanium alloys; Phase diagrams and interpretation of microstructure; Iron Iron-carbide phase diagram and cooling (TTT) diagrams.

Module IV Heat Treatment (10 hours)

Heat treatment of Steel; Annealing, tempering, normalizing, spheroidising, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening

Module V Polymers, Ceramics and Composites (10 hours)

Polymers – Classification and applications; Polymerization techniques; Ceramics – Oxide ceramics, ceramic insulators, bio-ceramics and Glasses; Composites – Reinforcement, matrix, metal matrix composites, ceramic composites, polymer composites; Other advanced materials – biomaterials, optical materials, high temperature materials, energy materials, and nanomaterials.

Module VI Electrical and Magnetic Materials(10 hours)

Conducting and resisting materials – types, properties and applications; Semiconducting materials – properties and applications; Magnetic materials – Soft and hard magnetic materials and applications; Superconductors and dielectric materials – properties and applications; Smart materials; Sensors and actuators; Piezoelectric, magnetostrictive and electrostrictive materials.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall fundamental concepts of crystal structures, defects, mechanical properties, and the classification of materials such as metals, ceramics, polymers, and composites.(Remembering)

CO2: Explain the microstructural evolution during phase transformations, heat treatment processes, and the relationships between material properties and their applications.(Understanding)

CO3: Analyze mechanical property measurements and phase diagrams to predict material behaviour under various loading and environmental conditions.(Applying)

CO4: Apply knowledge of advanced materials and their properties in designing solutions for engineering applications, including smart materials, biomaterials, and energy-efficient (Applying)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	1									3	
CO2	3	2	3	2									3	
CO3	3	2	3	2		3							3	
CO4	3	2	3	3	3	3							3	

Suggested Readings

1. W. D. Callister, Materials Science & Engineering, Wiley India.
2. K. G. Budinski and M.K. Budinski, Engineering Materials, PHI India.
3. V. Raghavan, Material Science and Engineering, PHI India.
4. U. C. Jindal, Engineering Materials and Metallurgy, Pearson.
5. M.F. Ashby and D.R.H. Jones, Engineering Materials 1 - An Introduction to Properties, Applications and Design, Butterworth-Heinemann, USA, 201

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://onlinecourses.nptel.ac.in/noc22_me90/preview	Prof. Ratna Kumar Annabattula	IIT Madras
2	https://archive.nptel.ac.in/courses/113/102/113102080/#	Prof. Rajesh Prasad	IIT Delhi
3.	https://archive.nptel.ac.in/courses/113/102/113102080/#	Prof. Satish V. Kailas	Indian Institute of Science, Bangalore –
4.	Material Science and Engineering	Prof. Vivek Pancholi	IITRoorkee

Mechanical Engineering Lab II: Materials Lab**(1 Credits) (L-T-P: 0-0-2)****Objectives:**

To provide an understanding of various manufacturing processes.

To get an idea of the dimensional and form accuracy of products.

List of Experiments:

1. Use of slip gauges and sine bar.
2. To study the Brinell hardness testing machine and perform the Brinell hardness test.
3. To study the Rockwell hardness testing machine and perform the Rockwell hardness test.
4. To study the Vickers hardness testing machine and perform the Vickers hardness test.
5. Comparative study of microstructures of different given specimens (mild steel, gray C.I., brass, copper etc.)
6. To study the Impact testing machine and perform the Izod Impact tests.
7. To study the Impact testing machine and perform the Charpy Impact tests.
8. To study the Universal testing machine and perform the tensile test.
9. Use of Vernier caliper and height gauge.
10. Use of micrometer, depth gauge.

**Introduction to AutoCAD
(NC– 30 hours) (L-T-P: 1-0-2)**

Objective: To learn the basics of technical drawing thoroughly by using AUTOCAD software.

Module 1: (8 hours)

Interface of AutoCAD, Cartesian coordinate system: absolute coordinate system, relative coordinate system, AutoCAD

basics: Function keys, Draw Commands, Modify commands, Annotate dimension style manager, Single line text, Multiline

text, Layer properties, Insert blocks, Parametric, Isometric views

Module 2: (8 hours)

Isometric and Perspective projections, Isometric diagram's exercise, 2D Fundamentals in Auto CAD, Drawing units.

Interactive Input method: grid snap mode, introduction to 3d interface of Auto CAD.

Module 3: (8 hours)

a) Mechanical diagrams: nut and bolt, rivets, types of threads, keys, knuckle joint, Idler plate, Hook Joint, mechanical tools etc.

b) Civil engineering drawing: Brief history of building drawing Introduction to building drawing, simple building drawing plan.

c) Electrical and Electronic drawings: Circuit, transistor symbols, electrical plans etc.

Module 4: (6 hours) Group Assignment/ Activity**Course Outcomes**

After completing the course successfully the students will be able to-

CO1: Demonstrate an understanding of AutoCAD's interface, coordinate systems, basic drawing and modification tools, and their application in creating 2D and isometric views for mechanical engineering designs. (Understanding)

CO2: Apply knowledge of AutoCAD to construct 2D and isometric projections, mechanical diagrams (e.g., nuts, bolts, rivets, and threads) and electrical/electronic circuit diagrams using appropriate tools and techniques. (Applying)

CO3: Create detailed and accurate technical drawings and designs, including mechanical components and electrical schematics, utilizing advanced AutoCAD features. (Creating)

Mapping of CO with PO & PSO

CO/PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2				3					2		3	3	2
CO2	2	2	2		3					2		2	3	3
CO3	2	2	3	1	3				1	3	1	2	3	3

Suggested Readings

1. *Mastering AutoCAD 2021 and AutoCAD LT 2021*, Author: Brian C. Benton, George Omura, Publisher: Wiley India, ISBN: 9781119715355

2. *AutoCAD 2021 Tutorial First Level 2D Fundamentals*, Author: Randy H. Shih, Publisher: SDC Publications, ISBN: 9781630573605

Alternative NPTEL/SWAYAM Course:

1. Computer Aided Design and Manufacturing: Instructor: Prof. Anandaroop Bhattacharya (IIT Kharagpur): URL: <https://nptel.ac.in/courses/112/105/112105259>

2. NPTEL Course: Engineering Drawing and Computer Graphics: Instructor: Prof. Arnab Bhattacharya (IIT Kharagpur)

URL: <https://nptel.ac.in/courses/112/105/112105289>

Heat Transfer

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective: To provide comprehensive knowledge of heat transfer mechanisms, including conduction, convection, radiation, and phase change processes, alongside practical applications like fins and heat exchangers, and to introduce mass transfer concepts-

Module I: Conduction (15 hours)

Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, Fins,

Mathematical Equation of a Rectangular Fin of Uniform Cross section, Temperature and Heat Transfer Calculation of Fin with different boundary Conditions, Fin Efficiency and Fin Effectiveness.

Module II: Convection (20 hours)

- Heat convection, Mechanism of Convection, Concept of Velocity, and Thermal Boundary Layer, Laminar and Turbulent Flow, Forced and Free Convection, Dimensionless parameters for forced and free convection heat transfer, Governing Equations for Boundary Layers.
- Forced Convection: Flat Plate in Parallel Flow, Integral Method: Laminar Forced Convection on a Flat Plate, Turbulent Boundary Layer Condition for Flow over an Isothermal Flat Plate, Methodology for Calculation of Convection Coefficient, Analogy Between Heat and Momentum Transfer. Internal Flow: Hydrodynamic and Thermal Considerations, Laminar Flow Heat Transfer in a Circular Pipe: Fully Developed Flow, Turbulent Flow Convection in Pipes: Empirical Correlations, Heat Transfer Considerations: Constant Wall Temperature and Constant Heat Flux.
- Natural Convection: Analytical Solution of Laminar Free Convection over a Vertical Flat Plate, Integral Method for Natural Convection Heat Transfer on a Vertical Flat Plate, Correlation from Experimental Results.

Module III: Radiation (10 hours)

Fundamentals of Thermal Radiation, Absorptivity, Reflectivity and Transmissivity, Emissivity, Emissive Power, Spectral Energy Distribution of a Black Body, Stefan-Boltzmann Law, Planck's Law, Kirchhoff's Law, Intensity of Radiation, Calculation of radiation heat transfer between surfaces using radiative properties, Shape Factor, Electrical Analogy, Evaluation of Shape Factor, Radiation Heat Transfer Between Gray Bodies, Radiosity and Irradiation, Radiation Shields.

Module IV: Heat Exchanger, Phase Change and Mass Transfer (15 hours)

Types of heat exchangers, Compact, Shell and Tube and Plate Heat Exchangers, Overall Heat Transfer Coefficient, Fouling Factor, Use of LMTD, Cross Flow Heat Exchanger, Effectiveness-NTU Method, Heat Exchange Design Considerations. Condensation Heat Transfer, Dropwise Condensation, Laminar Film Condensation on a Vertical Plate, Boiling Heat Transfer, Regimes of Boiling, Nucleate Boiling, Correlations of Boiling Heat Transfer Data. Introduction to mass transfer, Diffusion Mass Transfer, Fick's law of Diffusion, Analogy between Momentum, Heat and Mass Transfer.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Explain the principles of conduction, convection, radiation, phase change, and mass transfer, including governing laws and boundary conditions. (Understanding)

CO2: Solve heat transfer problems in fins, extended surfaces, and thermal systems using analytical methods and empirical correlations. (Applying)

CO3: Analyze radiation heat exchange between surfaces using shape factors, electrical analogies, and evaluate performance of fins/radiation shields. (Analyzing)

CO4: Design and optimize heat exchangers using LMTD/NTU methods, and assess boiling/condensation processes using relevant correlations. (Evaluating)

Mapping of CO with PO & PSO

CO/PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1					1						2	
CO2	3	3	1		1								3	
CO3	3	3	2		1								3	
CO4	3	2	3		1								3	

Suggested Readings

1. J.P. Holman, Heat Transfer, Eighth Edition, McGraw Hill.
2. F.P. Incropera, and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley.
3. Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill.
4. P.K Nag , Heat and Mass transfer, McGraw Hill.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	Heat and Mass Transfer https://archive.nptel.ac.in/courses/112/101/112101097/	Prof. S.P. Sukhatme, Prof. U.N. Gaitonde	IIT Bombay

DESIGN OF MACHINE ELEMENTS
(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective: To apply the principles of mechanical design, including static and dynamic loading, stress analysis, and failure theories, to design machine components such as shafts, springs, bearings, and gears, ensuring safety, durability, and performance optimization using industry standards and methodologies.

Module I: Design against Static Load (15 hours)

Overview and need of design, Design procedures, Limits, Fits and Tolerances, BIS standards. Design against Static Loading: Modes of failure, Factor of safety, Stress-strain, Design of cotter and knuckle joints, Theories of failure: Maximum normal-stress theory, Maximum shear-stress theory and Distortion-energy theory.

Module II: Design against Dynamic Load (15 hours)

Stress concentration, Modes of failure, Fluctuating stresses, Fatigue failure and S-N diagram, Notch sensitivity, Soderberg, Goodman and Gerber diagrams, modified Goodman diagrams, Fatigue design under combined stresses.

Module III: Design of shafts and springs (10 hours)

- a. Shafts: Design of shaft subjected static and dynamic loading against failure due to bending, torsion and combined bending and torsion.
- b. Springs: Design of helical tension and compression springs, leaf springs and helical torsion springs, surge in spring

Module IV: Design of bearings and gears (20 hours)

- a. Bearings: Design of rolling contact bearings, Static and dynamic load carrying capacity, Load life relationship, Analysis and design of sliding contact bearings, Reynold's equation.
- b. Gears: Design of spur gears, force analysis, beam strength and wear strength of spur gear tooth, design of helical gears, virtual teeth and tooth proportions, force analysis and effective load, design of bevel gears, design of worm gears, strength and wear rating of worm gears.

Course Outcomes:

After completing the course successfully the students will be able to-

CO1: Recall and define key principles of mechanical design, including static and dynamic loading, stress analysis, failure theories, and BIS standards, along with the characteristics and applications of shafts, springs, bearings, and gears. (Remembering)

CO2: Explain the modes of failure, stress-strain relationships, fatigue phenomena, and the working principles of machine elements such as joints, shafts, springs, gears, and bearings under various loading conditions.(Understanding)

CO3: Apply design methodologies and failure theories to calculate dimensions, analyze stress distribution, and ensure the safe and functional design of machine components like shafts, springs, and gears under static and dynamic loads.(Applying)

CO4: Examine and evaluate the stress distribution, failure modes, and performance of machine components such as shafts, springs, gears, and bearings under varying loading conditions to identify critical factors influencing their design and functionality.(Analyzing)

CO5: Critically assess the suitability and performance of designed machine components, considering factors such as safety, efficiency, reliability, and adherence to industry standards.(Evaluating)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	3		1	1						1	1
CO2	2	3	1	1	1		1					1	3	1
CO3	2	3	3	3		2						1	1	1
CO4	3	1	2	2									1	1
CO5	2		1	3	2								2	1

Suggested Readings

1. J.E. Shigley et al., Mechanical Engineering Design, Tata McGraw-Hill Publications
2. Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan.
3. V. B. Bhandari, Design of Machine Elements, Tata McGraw Hill Publications.
4. U. C. Jindal, Machine Design, Pearson Education.
5. K Mahadevan et. al., Design Data Handbook, CBS Publishers and Distributors Pvt. Ltd.
6. V. B. Bhandari, Machine Design: Data book, Tata McGraw Hill Publications.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://archive.nptel.ac.in/courses/112/105/112105125/	Prof. B. Maiti	IIT Kharagpur

2	https://archive.nptel.ac.in/courses/112/106/112106137/	Prof. K. Gopinath and Prof. M. M. Mayuram	IIT Madras

Manufacturing Processes

(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective: To understand traditional and advanced manufacturing techniques, including casting, forming, machining, additive manufacturing, and joining processes, emphasizing their interdependencies, design for manufacturability, material behavior, tool performance, and modern industrial applications to optimize product quality and production efficiency.

Module I: (6 Hours)

Manufacturing Processes and Classification: Additive, subtractive and shaping processes; Relative advantages and limitations; Inter-dependency of geometry, material and process; Effect on product quality and cost; Part design for manufacturability; Process selection criteria.

Module II: (15 Hours)

Material Shaping Processes: Metal casting (sand, die and investment casting), Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses, Bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending); Thermoplastic and thermoset plastic processes (ex. injection and blow molding); Powder metallurgy; Metal injection molding

Module III: (12 Hours)

(a) Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components, Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids

(b) Material Removal Processes: Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

Module IV: (12 Hours)

(a) Additive manufacturing: Rapid prototyping and rapid tooling, power bed fusion, material jetting, binder jetting, direct energy deposition and lamination processes.

(b) Joining and fastening processes: Physics of welding, Arc welding, gas welding, shielded metal arc welding; GMAW (MIG) and GTAW (TIG); Brazing and soldering; Solid state joining; Adhesive bonding.

Module V: (15 Hours)

Other (unconventional) Manufacturing Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters, Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power, wire EDM; Electro-chemical machining (ECM), process parameters, MRR and surface finish, Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining; Micro and nano manufacturing.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall and define fundamental concepts of manufacturing processes, including additive, subtractive, and shaping methods, as well as key principles of casting, forming, machining, and joining techniques. (Remembering)

CO2: Explain the interdependence of geometry, materials, and processes in manufacturing, and describe the influence of these factors on product quality, cost, and design for manufacturability. (Understanding)

CO3: Apply knowledge of casting and forming techniques to design gating systems, risers, and forming setups, ensuring defect-free production with optimal material utilization. (Applying)

CO4: Implement machining and additive manufacturing principles to select tools, determine process parameters, and optimize material removal rates for enhanced efficiency and product accuracy. (Applying)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	1		1	1						1	1
CO2	1	1	1		1		1					1	2	1
CO3	3	1	1	2		2					1	1	1	1
CO4	1	1	2	2									1	1

Suggested Readings

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Ed.), Pearson India.
2. Degarmo, Black and Kohser, Materials and Processes in Manufacturing
3. OP Khanna, Foundry technology, Dhanpat Rai
4. A.B. Chattopadhyay, Machining and Machine Tools, Wiley India Pvt Ltd
5. Amitabha Ghosh and A.K. Mallick, Manufacturing Science. Affiliated East-West Press Pvt. Ltd.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	Fundamentals of Manufacturing Processes https://www.youtube.com/watch?v=jdFrBtHeJbs&list=PLSGws_74K01-g9nnTMBssGURHawYYQfMQ	Dr. D.K. Dwivedi	IIT Roorkee

Mechatronics, Robotics & Control (4 Credits – 60 hours) (L-T-P: 3-1-0)

Objectives: This course introduces the modeling and analysis of mechatronic systems for engineering applications, equipping students with the skills to design and evaluate integrated systems. Students will learn to identify and select appropriate sensors, transducers, and actuators for monitoring and controlling processes or products. The course also covers the development of Programmable Logic Controller (PLC) programs tailored to engineering applications. Additionally, students will gain expertise in evaluating the performance of mechatronic systems, enabling them to optimize and innovate in real-world engineering scenarios.

Contents

Module I: Introduction: Electro-mechanical systems; Typical applications; Examples – automobiles, home appliances, medical instruments, etc.

Module II: Sensors: Transduction principles; Sensitivity, accuracy, range, resolution, noise sources; Sensors for common engineering measurements – proximity, force, velocity, temperature, etc.; Signal processing and conditioning; Selection of sensors.

Module III: Actuators: Pneumatic and hydraulic actuators; Electric motors including DC, AC, BLDC, servo and stepper motors; Solenoids and relays; Active materials – piezoelectric and shape memory alloys.

Module IV: Machine Controls: Microprocessors and their architecture; Memory and peripheral interfacing; Programming; Microcontrollers; Programmable Logic Controllers; PLC principle and operation; Analog and digital input/output modules; Memory module; Timers, internal relays, counters and data handling; Industrial automation systems; Basic PLC programming; Industry kits (Arduino, Raspberry Pi, etc.).

Module V: Robotics: Robot configurations: serial and parallel; Denavit–Hartenberg parameters; Manipulators kinematics; Rotation matrix, Homogenous transformation matrix; Direct and inverse Kinematics for robot position and orientation; Workspace estimation and path planning; Robot vision; Motion tracking; Robot programming and control; Industrial robots - Pick and place robots, sorting, assembly, welding, inspection, etc.

Module VI: Control Theory and Systems: Basic control concepts; Feedback; Open and closed loop control; Concept of block diagrams; P, PI and PID controllers; Tuning the gain of controllers; System models, transfer functions, system response, frequency response; Root Locus method and Bode plots.

Module VII: Computational Tools: Demonstration and projects using simulation software (e.g., Matlab, Scilab, ROBODK) for control systems and robotics.

Course Outcomes:

At the end of this course students will demonstrate the ability to -

1. Explain the principles and applications of sensors and actuators in electro-mechanical systems used in automobiles and medical instruments. (Understand)
2. Apply the principles of microcontrollers and PLCs to program basic control sequences for industrial automation systems using Arduino or Raspberry Pi kits. (Apply)
3. Analyze the kinematics of robotic manipulators using Denavit-Hartenberg parameters and homogeneous transformation matrices to determine position and orientation. (Analyze)
4. Evaluate the performance of PID controllers in electro-mechanical systems using simulation tools like MATLAB to optimize system response and stability. (Evaluate)

Mapping of CO with PO & PSO

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	3	2	1		1	1	1					1	3	1
CO2	3	2	2	1	3	1	1					1	3	1
CO3	3	3	2	2	2	1						1	3	1
CO4	3	3	3	2	3	1	1					1	3	1

Text /Reference Books:

1. W. Bolton, "Mechatronics," Addison Wesley Longman, 2010.
2. J. J. Craig, Introduction to Robotics Mechanics and Control, Addison Wesley, 1999.
3. G.K. McMillan, "Process/Industrial Instruments and Controls Handbook," McGraw-Hill, 1999.
4. S. Mukherjee, "Essentials of Robotics Process Automation", Khanna Book Publishing, 2021.

Online Resources:

1. <https://nptel.ac.in/courses/107/106/107106090/>
2. <https://nptel.ac.in/courses/112/101/112101098/>
3. <https://nptel.ac.in/courses/112/107/112107289/>
4. <https://nptel.ac.in/courses/112/104/112104298/>

ECONOMICS FOR ENGINEERS (3 credits-45 hours)(L-T-P: 3-0-0)

Objective: The objective of this course is to make the students of engineering aware of the basic concepts in Economics, introduce them to the preliminary techniques of quantitative analysis in Economics and finally to certain relevant concepts of the stock market. The purpose of this course is to increase the all-round knowledge of the engineer and enhance his/her professional competence in the work field.

Module I (15 hours)

- a) Definition of Economics: Subject matter, scope, principal division of Economics – Microeconomics and Macroeconomics.
- b) Theory of Demand: Meaning of Demand and Supply, The law of demand, meaning of utility, marginal utility and total utility, law of diminishing marginal utility, Indifference curve approach, Consumer's Equilibrium, elasticity of demand- determinants, types and measurement, exceptions to the law of demand.

- c) Theory of Production: Meaning of Production function, production function with one variable input – Law of Variable Proportions, production function with two variable inputs – Law of Returns to Scale, Cobb-Douglas production function. Economic concept of cost- short-run and long-run.
- d) Market Structure: Market Classification- perfect competition, monopoly, monopolistic competition. Concepts of Revenue - Average Revenue, Marginal Revenue and Total Revenue. The firm- objectives and constraints, Equilibrium of the firm- TR-TC approach, MR-MC approach.

Module II (10 hours)

- a) Macroeconomic concepts and aggregates: Circular flow of income, National Income- GDP, GNP, Meaning and relation between: consumption, saving, investment. Aggregate demand and aggregate supply - Saving and Investment functions, Multiplier Mechanism.
- b) Money: Definition of money, functions of money, Money Supply- M1M2M3M4, Inflation- meaning, types, control of inflation- monetary policy, fiscal policy.
- c) Banking: Central Banks, Commercial Banks, creation of credit.
- d) Trade Cycles: Meaning of Trade Cycle, Various phases of Trade Cycle.
- e) International Trade: Balance of Payments, Devaluation, Exchange Rate, Special Drawing Rights (SDR), IMF, WTO, concept of Globalization, Role of MNCs, Regional Economic Integration.

Module III (10 hours)

- a) Quantitative Analysis in Economics: Profit Maximization problems, break-even analysis, demand estimation.
- b) Introduction to Statistics: Data, diagram, Data Interpretation problems, Measures of Central Tendency, Measures of Dispersion, dispersion, Index numbers.

Module IV (10 hours)

- a) Introduction to Stock Market: Stock Markets - Meaning, NSE, BSE, NYSE, Stock Market Indices - SENSEX, NIFTY, DOW. Bull Market and Bear Market, Role of SEBI in stock market, FDIs and FII, Role of FII in stock market.
- b) Basic terms related to stock market: Shares, equity shares, bonus shares, preference shares, buyback shares, splitting of shares, trading - intraday trading, commodity trading, futures, hedging, arbitrage.
- c) Mutual Funds: Meaning of Mutual funds, Types of Mutual Fund.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall fundamental concepts of economics, including theories of demand and production, market structures, macroeconomic aggregates, and key financial terms related to stock (Remembering)

CO2: Explain the principles of demand, production, and market structures, along with macroeconomic concepts such as national income, inflation, and trade cycles, and their impact on economic systems.(Understanding)

CO3: Apply quantitative methods such as break-even analysis, demand estimation, and statistical measures to solve economic and business-related problems.(Applying)

CO4: Utilize knowledge of stock market operations, financial instruments, and mutual funds to interpret market trends and make informed investment decisions (Applying)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1						3								3
CO2											3			3
CO3		3												3
CO4								2				3		3

Suggested Readings

1. H.L. Ahuja, Modern Economics, S. Chand & Co. Ltd., New Delhi
2. Dr. K.K Dewett and M.H. Navalur, Modern Economic Theory, S. Chand & Co. Ltd., New Delhi
3. Manab Adhikary, Business Economics, Excel Books.
4. Madhu Vij, International Financial Management, Excel Books.
5. Koutsoyiannis, Modern Microeconomics, Palgrave MacMillan, 2003, 2nd Revised edition
6. Dominick Salvatore, Microeconomic Theory, Schaum's Outline series, TMH.

7. Bradley Schiller, Essentials of Economics, Tata Mcgraw Hill.
8. Atmanand, Managerial Economics, Excel Books.
9. M S Loganathan and B Nandhakumar, Dictionary for Economics, Excel Books.
10. Sheetal Thomas, Dictionary of Finance, Excel Books.

**Mechanical Engineering Lab-III: Thermal
(1 Credits) (L-T-P: 0-0-2)**

Objective: To introduce the student the fundamental theories and laws along with the industrial applications of thermodynamics and heat transfer.

List of Experiments:

1. Determination of dryness fraction of combined separating and throttling calorimeter.
2. Determination of Coefficient of Performance of Vapour Compression Refrigeration System.
3. Study and Performance test of Single Acting Reciprocating Air Compressor.
4. Determination of Thermal Conductivity of Metal Rod and Composite Wall
5. Determination of Heat Transfer Coefficient in Natural Convection and Forced Convection.
6. Determination of Temperature Distribution and Fin Efficiency in both Natural and Forced Convection.
7. Determination of Stefan Boltzmann Constant.
8. Determination of LMTD of both parallel flow and counter flow heat exchanger.
9. Study and Performance test on a Petrol Engine.
10. Study and Performance test on a Diesel Engine.

**Mechanical Engineering Lab-IV: Design -1
(1 Credits) (L-T-P: 0-0-2)**

Objectives:

- (i) To understand the measurement of mechanical properties of materials
 - (ii) To understand the deformation behaviour of materials
 - (iii) To understand the kinematic and dynamic characteristics of mechanical devices
- Contents

List of Experiments:

1. **Determination of Coefficient of Friction between two given surfaces.**
2. **Determination of Moment of Inertia of the Fly Wheel.**
3. **Verification of Triangle Law and Polygon Law of Forces.**
4. **Determination of efficiency of Screw Jack.**
5. **Worm and Worm wheel experiment**
6. **To verify the law of moment of force and to determine the Bending Moment for a simply supported beam.**
7. **Study of gyroscope and gyroscopic effect/couple.**
8. **Study of different types of brakes and dynamometers.**

**QUANTITATIVE APTITUDE FOR COMPETITIVE EXAMINATION
(NC– 30 hours) (L-T-P: 1-0-2)**

Objective:

This course is aimed to provide the learners a platform to have an insight about the various quantitative aptitude Problems

Module I: (15 hours)

Simplification, HCF and LCM, Ratio and Proportion, Percentage, Partnership, Average, Profit and Losses, Areas and Volumes, Simple Interest and Compound Interest.

Module II: (15hours)

Time and work, Time and distance, Problems on ages, Pipes and cisterns, Boats and streams, Visualization of space, Probability.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Solve different numerical problem related to quantitative aptitude.(Applying)

Mapping of CO with PO & PSO

CO/PO,PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1									1		

Suggested Readings

1. Dr. R.S. Aggarwal , Quantitative Aptitude for Competitive Examinations, S. Chand

Machine Design and Dynamics
(4 credits-60 hours)(L-T-P:3-1-0)

Objectives: This course seeks to provide an introduction to the design of machine elements and introduction to dynamics of machinery, students will learn various design aspects of components like screws, couplings, belt, chain, flywheel etc. and the applicability of available design data during designing. The course involves introduction to gyroscope and governor and aims at developing skills to understand the dynamics of the mechanisms.

Module I: Design of Power Screws, Joints, Keys and Couplings (20 hours)

- a) Power Screw: Analysis and applications of power screws, forms of threads, self-locking, efficiency of screw.
- b) Threaded fasteners: ISO Metric screw threads, bolted joint analysis under eccentric load, torque required for bolt tightening.
- c) Permanent Joints: Design of Riveted and welded joints and their strength.
- d) Keys: Introduction to different types of keys, Force analysis.
- e) Couplings: Analysis and design of rigid flange couplings.

Module II: Brakes and Clutches (10 hours)

- a) Brakes: Analysis of Block, band and disc brakes.
- b) Clutches: Classification, Analysis of friction clutches

Module III: Design of Belt Drive, Chain Drive and Flywheel (15 hours)

- a) Design of belt drive: geometrical relationships, analysis, condition for maximum power, V belts.
- b) Design of chain drive: geometrical relationships, sprocket wheels, design of chain drive.
- c) Design of Flywheels: Introduction, Turning moment diagram, solid disk flywheel, rimmed flywheel.

Module IV: Balancing (8 hours)

- a) Balancing of rotational mass: Static and dynamic balancing.
- b) Balancing of reciprocating mass: Partial balancing, Different balancing approaches.

Module V: Governors and Gyroscope (7 hours)

- a) Governor: Introduction, types, principle, working and need.
 b) Gyroscope: Introduction, principle and application.

COURSE/LEARNING OUTCOMES

After completing the course successfully the students will be able to-

CO1: Define the basic concepts related to the design process.

CO2: Illustrate the idea of working and design of different types of brakes and clutches based on established theories.

CO3: Evaluate suitable dimensions for belt drive, chain drive and flywheel based on failure criterion.

CO4: Compute required balancing weight in machines in static and dynamic balancing cases.

CO5: Illustrate the use and working principles of governors and gyroscopes.

Mapping of CO with PO & PSO

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	3		2	1									1	1
CO2	1	2			1								2	1
CO3	2	1	3										1	2
CO4	2		2	1		2							2	
CO5	2	1	3	1									2	

Suggested Readings

1. J.E. Shigley et al., Mechanical Engineering Design, Tata McGraw-Hill Publications.
2. Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan.
3. V. B. Bhandari, Design of Machine Elements, Tata McGraw Hill Publications.
4. U. C. Jindal, Machine Design, Pearson Education.
5. K Mahadevan et. al., Design Data Handbook, CBS Publishers and Distributors Pvt. Ltd.
6. V. B. Bhandari, Machine Design: Data book, Tata McGraw Hill Publications

Manufacturing Automation
(4 Credits – 60 hours) (L-T-P: 3-1-0)

Objective:

To understand the importance of automation in the field of machine tool based manufacturing and to get the knowledge of various elements of manufacturing automation – CAD/CAM, sensors, pneumatics, hydraulics and CNC. Also it is intended to understand the basics of product design and the role of manufacturing automation.

Module I: (15 hours)

Introduction to manufacturing: types based on human participation, materials processed and quality requirement; Definition of automation; Reasons for automating; Strategies; Types of automation; five levels of automation; Automation Vs Mechanization; Current trends, CAD, CAM, CIM; Rigid automation: Part handling, Machine tools. Flexible automation: Computer control of Machine Tools and Machining Centres, CNC machines, Automated flow lines (types, selection); Work part transport and transfer mechanisms; Feedback systems and control; Automated Material handling. Assembly, Flexible fixturing; Introduction to Modelling and Simulation: Product design, process route modelling, Product Optimization techniques.

Module II: (15 hours)

DFMA: concept and implementation strategy; Computer Aided Manufacturing: Numerical control (NC, CNC, DNC); Introduction to CNC part programming and computer-aided process planning, G code/M codes; absolute vs incremental coordinate system, CNC technology, PLC, Microcontrollers, CNC Adaptive Control; online and offline monitoring of tool.

Module III: (15 hours)

Automation Tools and Techniques: Mechanical, electro-mechanical, pneumatic and hydraulic systems; Sensors integration; Process monitoring, data analysis and control using actuators; Robots (pick, place, assembly, welding, painting, etc.); Automatic Guided Vehicles; Automated inspection and measurement (CMM and 3D Scanning); Machine vision, AI and machine learning; Human-machine interfaces; Examples and case studies.

Module IV: (15 hours)

Advanced Automation Trends: Digital, inclusive, smart and distributed manufacturing; Industry 4.0; Digital transformations in shop-floors (CIM to Smart factory; Intelligent machines to Smart Machines; Factory automation to Distributed automation; Human sense to system sensed); Orientation of parts: in-bowl and out-of-bowl tooling; Manufacturing equipment embedded with digital data and driven by adoptive controls; Manufacturing automation with autonomous decisions taken by computers based on the realistic process/machines (production conditions) data acquired from the resources.

Course Outcomes

After completing the course successfully the students will be able to-

1. Recall and understand the concept of and identify automated system, various tools and techniques used for automation, know the working of various parts of an automated system
2. Synthesize CNC part program using G/M codes for a given product geometry under specified conditions
3. understand the key CNC technologies and their implementation for specific tasks, uses of robotics in manufacturing automation for specific tasks.
4. Analyze the Product design process, modelling and simulation; know the advanced trends in automation; Industry 4.0 and smart manufacturing

Mapping of CO with PO & PSO

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	1											1	1	
CO2		2	3	2	1								2	
CO3	2	1										1	1	
CO4	2		1		1							1	1	

Suggested Readings

1. M. P. Groover, Automation, Production Systems and Computer-integrated Manufacturing, Prentice Hall, 2018.
2. S. Kalpakjian and S. R. Schmid, Manufacturing – Engineering and Technology, Pearson.
3. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill, 2005
4. CAD/CAM Principles and Applications, P.N. Rao, Tata McGraw Hill, 2010.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	Manufacturing Automation	Prof. Sounak Kumar Choudhury	IIT Kanpur
2	Automation in Manufacturing	Prof. S.N.Joshi	IIT Guwahati

Product Innovation and Entrepreneurship (3 credits-45 hours)(L-T-P: 3-0-0)

Objectives: To expose aspiring student entrepreneurs to various elements of a technology venture starting from market need identification to innovative solution development and its commercialization through business planning and start-up company incubation.

Module 1: Entrepreneurship: Role of entrepreneurship in economic development; Entrepreneurial mindset, motivation and competencies; Market pull and technology push factors; New product development lifecycle; Technology readiness levels; Product-market fit validation; Commercialization pathways; Business vision & leadership; Team composition & management.

Module 2: Product Innovation: Opportunity scanning, market survey, need identification and problem definition; Creative design thinking for concept generation; Detailed design & prototyping; Functionality & manufacturability; Bill of materials & components supply chain; Manufacturing & assembly plan; Product testing & quality assurance; Intellectual property rights management.

Module 3: Marketing & Finance: Market segmentation & market sizing; Customer persona & value proposition; Marketing (Go-to-market) strategy; Distribution channels and sales network; Funding requirement (based on stage); Source of funding for startup ventures; Financial projections and accounting; Startup to scale up financing.

Module 4: Venture Creation: Sustainable business options & pathways; Business model & business canvas; Startup team & business partners; Startup ecosystem and stakeholders; Technology business incubators & parks; Proposal pitching & agreements; Startup company incorporation; Social impact & responsibility.

Course Outcomes:

At the end of this course students will demonstrate the ability to

1. Understand how to identify an unmet need through market research
2. Learn how to create an innovative solution and check problem-solution fit
3. Practice business planning, including marketing, fund-raising and start-up incubation.

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1		3	2	3	2	3	2		2		1	2	2	2
CO2	2	3	3	3	2	2	2	1	2		1	2	3	1
CO3	1	2	2	1	2	2	1	2	3	1		2	1	2

Text /Reference Books:

1. Bill Aulet, "Technology Entrepreneurship", 4th ed., Tata McGraw Hill, 2014.
2. Peter F. Drucker, "Innovation and Entrepreneurship", 1st ed., Harper Business, 2006.
3. Chelat Bhuvanachandran, Innovision, Khanna Book Publishing, 2022.
4. Byers, Dorf, and Nelson, Technology Ventures: From Ideas to Enterprise, McGraw Hill, 2010
5. Steve Blank, "The Startup Owner's Manual"

6. T.V. Rao, "Entrepreneurship - A South Asian Perspective"

Online Resources: 1 https://onlinecourses.nptel.ac.in/noc22_ge03/preview

MECHANICAL VIBRATION

(3 credits-45 hours)(L-T-P: 3-0-0)

Objective: To impart fundamental knowledge of mechanical vibrations, enabling students to model, analyze, and solve vibration problems in engineering systems, with an emphasis on free and forced vibrations, damping, resonance, and vibration control in mechanical structures and machinery.

Module I: Introduction (15 hours)

Definition, types of vibration:- Free and Forced vibration, Damped (viscous) and Undamped vibration; degrees of freedom (DOF), beats, mathematical models, displacement, velocity and acceleration, Resonance, Whirling of shafts.

Module II: Free Vibrations (15 hours)

a) Undamped free vibration: Derivation of differential equation by equilibrium method and energy method, Newton's 2nd law method, Solutions to differential equations of single degree and 2 degree of freedom system, mode shapes.

b) Damped free vibration: Introduction, free vibration with viscous damping- overdamped, underdamped and critically damped system, logarithmic decrement, coulomb damping.

Module III: Forced Vibrations (15 hours)

a) Introduction, Response under a periodic force for first order and second order systems, resonance, vibration isolation and force transmissibility, vibration absorbers.

b) Multi degree of freedom systems: equations of motion, matrix methods, eigenvalue problems.

Course Outcomes:

After completing the course successfully the students will be able to-

CO1: Understand the fundamental concepts of mechanical vibrations, including types of vibrations, damping, resonance, and whirling of shafts. (understanding)

CO2: Develop and solve mathematical models for free and forced vibrations of single and multi-degree-of-freedom systems using analytical methods. (applying)

CO3: Analyze and evaluate vibration responses to various forcing conditions and apply vibration isolation and control techniques in practical systems. (analysing and evaluating)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1									1		
CO2	3	2	2	2								1	2	
CO3	2	2	2	2								1	2	

Suggested Readings

1.V. P. Singh, "Mechanical Vibrations," Dhanpat Rai & Co. (P) Ltd.

2.G. K. Grover, "Mechanical Vibrations," Nem chand and Brothers.

3.S. S. Rao., "Mechanical Vibrations," Pearson Education.

Alternative NPTEL/SWAYAM Course:

NUMERICAL METHODS**(3 credits-45 hours)(L-T-P: 3-0-0)**

Objective:

Module I :(15 Hours)

Taylor Series; Roots of equations: The Bisection Method, The False Position Method, Simple Fixed Point Iteration, Newton Raphson method, Secant method. Sets of Linear algebraic equations, Gauss Elimination method, Gauss Jordan elimination method, LU Decomposition method, Gauss Seidel iteration method. Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8th rule, Ordinary Differential Equations: Euler's method, RungeKutta Methods.

Module II :(15 Hours)

Numerical solutions to Partial Differential Equations using Finite Difference Method (FDM): Elliptic Equations, Parabolic equations. Curve Fitting: Least Squares Regression. FDM applications in heat transfer and CFD.

Module III :(15 Hours)

Introduction to finite element method; Principle of potential energy; FE analysis of 1D element problems (spring, bar, truss elements); Development of element stiffness equation and their assembly; Plain strain and plain stress problems.

Course Outcomes

After completing the course successfully the students will be able to-

Mapping of CO with PO & PSO

Suggested Readings

1. Steven C. Chapra et al., Numerical Methods for Engineers, Tata McGraw Hills Publication.
2. Dr. B. S. Grewal, Numerical Methods in Engineering and Science with Programs in C and C++, Khanna Publications.
3. Bhatti, M.A., Fundamental Finite Element Analysis and Applications: with Mathematical and MATLAB Computations, Wiley.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	Numerical Methods (https://archive.nptel.ac.in/courses/111/107/111107105/)	Prof. Ameet K. Nayak	IIT Roorkee
2	https://archive.nptel.ac.in/courses/127/106/127106019/	Prof. Niket Kaisare	IIT Madras

COMPOSITE MATERIALS**(3 credits-45 hours) (L-T-P: 3-0-0)**

Objective:

This course on Composite Materials provides a concise overview of principles, properties, and applications in mechanical engineering. Students will analyze and design composite structures using the rule of mixtures, failure criteria, and techniques like bending, buckling, and vibration analyses. It covers laminated composite performance and manufacturing processes, equipping students to solve engineering challenges.

Module1 (15 hours)

Definition and applications of composite materials, Fibers- glass, carbon, ceramic and aramid fibers; Matrices- polymer, graphite, ceramic and metal matrices; characteristics of fibers and matrices. Lamina- assumptions, macroscopic viewpoint, generalized Hooke's law, reduction of homogeneous orthotropic lamina, isotropic limit case, orthotropic stiffness matrix, commercial material properties, rule of mixtures, transformation matrix, transformed stiffness.

Module II (18 hours)

Manufacturing of composite materials, bag moulding, compression moulding, pultrusion, filament welding, other manufacturing processes. Basic assumptions of laminated anisotropic plates, symmetric laminates, angle ply laminates, cross ply laminates, laminate structural moduli, evaluation of lamina properties, determination of lamina stresses, maximum stress and strain criteria, von Mises Yield criterion for isotropic materials, generalized Hill's criterion for anisotropic materials, Tsai-Hill's criterion for composites, prediction of laminate failure, thermal analysis of composite laminates.

Module III (12 hours)

Analysis of laminated plates- equilibrium equations of motion, energy formulation, static bending analysis, buckling analysis, free vibrations, natural frequencies.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Explain the characteristics and applications of composite materials, fibers, and matrices using real-world examples. (Understanding)

CO2: Apply the rule of mixtures and transformation matrix to determine the stiffness properties of an orthotropic lamina. (Applying)

CO3: Analyze the stresses in laminated composite plates using failure criteria such as Tsai-Hill and von Mises under specified loading conditions. (Analyzing)

CO4: Evaluate the structural performance of laminated composite plates through static bending, buckling, and free vibration analyses with reference to equilibrium equations. (Evaluating)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1				1	1			1		1	2	1
CO2	3	2	1	1	1							1	3	
CO3	3	3	2	2	1							1	3	
CO4	3	3	3	2	2							1	3	

Suggested Readings

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://archive.nptel.ac.in/courses/112/104/112104229/ Introduction To Composites	PROF. NACHIKETA TEWARI	IITK

INTERNAL COMBUSTION ENGINES**(3 credits-45 hours) (L-T-P:3-0-0)**

This course aims to provide students with a comprehensive understanding of internal combustion engines (ICE) and their integration with modern propulsion technologies. It covers the fundamental principles, terminology, and operational systems of ICE, while exploring advancements such as hybrid systems, hydrogen combustion, and emission reduction technologies. The course emphasizes sustainable engineering practices and prepares students to analyze and design efficient, environmentally friendly powertrains for diverse applications.

Module I: Fundamentals of IC Engines and Hybrid Systems (10 hours)

Overview of internal combustion engines: history, types, and applications. Air standard cycles (Otto, Diesel, Dual) and their assumptions. Fuel-air cycles: effects of specific heat variation, fuel-air ratio, compression ratio, and dissociation. Introduction to hybrid propulsion systems: integration of ICE with electric motors, regenerative braking, and energy management. Losses in actual cycles and efficiency improvements in modern engines.

Module II: Fuel Delivery and Ignition Systems (10 hours)

Fuel delivery systems: carburetors (basics), multipoint fuel injection (MPFI), and gasoline direct injection (GDI). Diesel injection systems: common rail direct injection (CRDI), injectors, and nozzles. Ignition systems: spark plugs, battery, and magneto ignition, with advancements in plasma ignition. Firing order, ignition timing, and valve timing optimization. Introduction to electronic control units (ECUs) for precise fuel and ignition management.

Module III: Combustion, Supercharging, and Hydrogen Technology (12 hours)

Combustion processes in SI and CI engines: parameters affecting combustion, detonation, and knocking prevention. Combustion chamber design for efficiency and emissions control. Supercharging and turbocharging: thermodynamic principles, performance enhancement, and variable geometry turbochargers. Introduction to hydrogen combustion engines: design challenges, efficiency, and emission benefits. Comparison with traditional fuels.

Module IV: Lubrication, Cooling, Fuels, and Emission Control (13 hours)

Lubrication systems: properties of modern synthetic lubricants, wet and dry sump systems. Cooling systems: advancements in air and liquid cooling, thermal management in hybrid systems. Fuels: classification, characteristics, and ratings (octane, cetane). Alternative fuels: biofuels, hydrogen, e-fuels, and their environmental impact. Emission control: catalytic converters, particulate filters, selective catalytic reduction (SCR), and exhaust gas recirculation (EGR). Greenhouse gas emissions, regulatory standards and sustainable engineering practices.

COURSE/LEARNING OUTCOMES

After completing the course the students will be able to

CO1: Explain the principles of air standard cycles and fuel-air cycles, including the effects of specific heat variation and compression ratio (Understanding).

CO2: Apply fuel delivery and ignition system concepts to optimize combustion efficiency (Applying).

CO3: Analyze the impact of combustion chamber design and supercharging techniques on engine performance and emission control (Analyzing)

CO4: Evaluate lubrication, cooling, and emission control systems for sustainability and regulatory compliance (Evaluating,).

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2	1									1	3	
CO2	3	3	2	1	1							1	3	
CO3	3	3	2	2	2		2					1	3	
CO4	3	3	2	2	2		2					1	3	

Suggested Readings

1. Heywood J. B, "Internal Combustion Engine Fundamentals", McGraw Hill Book Co. NY, 1989.

- 2.Mathur M.L., "Internal Combustion Engine", Dhanpat Rai Company Ltd.
- 3.Ganesan V., "Internal Combustion Engine", Tata McGraw Hill.
- 4.<https://nptel.ac.in/courses/112/104/112104033/> Engine combustion
- 5.<https://nptel.ac.in/courses/101/104/101104070/> Fundamentals of Combustion (Part1)
- 6.<https://nptel.ac.in/courses/101/104/101104072/> Fundamentals of Combustion (Part2)
- 7.<https://nptel.ac.in/courses/103/105/103105110/> (Fuels & Combustion Technology) [PDF Notes]

OPERATIONS RESEARCH (3 credits-45 hours)(L-T-P: 3-0-0)

Objective:

Module I: Introduction to Linear Programming (10 hours)

Introduction to linear programming - formulation, graphical method, Simplex method and its applications, initial basic feasible solution, optimality test, Big M method

Module II: Special topics in Linear Programming (15 hours)

Duality in linear programming, the dual simplex method, the revised simplex method,, Goal programming, and introduction to Integer programming.

Module III: The Transportation Model and The Assignment Model (10 hours)

- a) Formulation and solution of Transportation Model, North-west Corner method, Vogel's approximation method, stepping stone method, modified distribution method, degeneracy in Transportation problem, least time transportation problems,
- b) Mathematical representation and solution of assignment model, Hungarian method.

Module IV: Sequencing Problem, Replacement Analysis and Queuing Model (10 hours)

Assumptions in sequencing problem, processing of n jobs through one machine, two machines and three machines, processing of two jobs through m machines. Replacement of items whose maintenance and repairing cost increase with time, i) ignoring changes in the value of money, ii) value of money changes with time; replacement of items that fail suddenly. Introduction to Queuing Model.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall the fundamental concepts, terminologies,assumptions and methods used in linear programming, goal programming, transportation and assignment models, sequencing model, replacement analysis, and queuing theory.(Remembering)

CO2:Interpret the principles, formulations, and theoretical foundations of linear, duality, revised simplex method, and integer programming,various sequencing models, transportation and assignment problems, and queuing systems.(Understanding)

CO3:Apply suitable optimization techniques such as the graphical method,Simplex method, Big M method,revised simplex method,convert dual from primal, goal programming method Hungarian method,basic initial solution of various transportation model, Modi method,graphical and various sequencing model solution and queuing models to solve real-world engineering and managerial problems.(Applying)

Mapping of CO with PO & PSO

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	2	1										1	1	2
CO2	2	2	2	2								1	1	2
CO3	3	2	2	2								1	1	2

Suggested Readings

- 1.D. S. Hira and P.K. Gupta, Operations Research, S. Chand
- 2.J.K. Sarma "Operations Research, Trinity Press.
- 3.Taha ,Operation Research an introduction, Pearson

4. Billey Gillet, Operations Research, PHI
 5. N.G Nair, Operations Research, Dhanpat Rai Publication

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/112106134 Fundamentals of Operations Research	Prof. G. Srinivasan	IIT Madras
2	https://nptel.ac.in/courses/110106062 Introduction to Operations Research	Prof. G. Srinivasan	IIT Madras

**Mechanical Engineering Lab V: Design – II
(1 Credits) (L-T-P: 0-0-2)**

Objectives:

- (i) To understand the deformation behaviour of materials
 (iii) To understand the kinematic and dynamic characteristics of mechanical devices Contents

List of Experiments:

1. Determination of the sleeve lift for various speeds of a Hartnell governor.
2. To plot follower displacement vs Cam rotation for various cam follower systems.
3. Velocity ratios of simple, compound, epicyclic and differential gear trains.
4. Study of four bar mechanism, slider crank mechanism and their inversions.
5. Cam and follower and motion studies.
6. Determination of natural frequency of an undamped single and two degree freedom system.
7. Single degree of freedom Spring-mass-damper system, determination of natural frequency and damping coefficient.
8. To study the free vibration and to determine the natural frequency of vibration of the Two-Rotor system.
9. To study the torsional vibration and to determine the natural frequency vibration of a single rotor system.

**Mechanical Engineering Lab VI: Manufacturing
(1 Credits) (L-T-P: 0-0-2)**

Objectives:

To provide an understanding of various manufacturing processes.

To get an idea of the dimensional and form accuracy of products.

1. Facing, Turning: Step turning, taper turning.
2. Thread Cutting- Internal and external thread cutting using a single point cutting tool.
3. Contour milling using a vertical milling machine.
4. Spur gear cutting in milling machine.
5. Study of CNC part programming.
6. Use of CNC machine tools: Lathe (2 Axis)
7. Use of CNC machine tools: Milling (3 Axis)
8. Use of CNC machine tools: Milling (4 Axis)
9. Study and use of Universal Robot Arm.

Mini project Objective:

Process:

1. Literature Review
2. Synopsis Presentation
3. Progress Presentation
4. Model/Prototype/ Software analysis Project Execution
5. Final Presentation and Demonstration of the Project

Course Outcomes

After completing the course successfully the students will be able to-

1. Apply practical knowledge within the chosen area of technology for project development. (Applying)
2. Demonstrate the skills to carry out research work independently. (Understanding)
3. Plan for executing projects with a comprehensive and systematic approach. (Applying)
4. Take part in development of technical projects as an individual or in a team. (Analyzing)
5. Develop effective communication skills for presentation of project related activities. (Creating)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1	1									1		
CO2	3	2	2	2								1	2	
CO3	2	2	2	2								1	2	
CO4	2	2	1	1								1	1	

Royal Enfield Fresher's Course (NC- 30 hours) (L-T-P: 1-0-2)

Objective: To make the learners familiar with the state of the art of Royal Enfield two wheelers' working, troubleshooting and servicing and technical knowhow of different parts.

Pre-requisite: Basic knowledge of IC engines, Kinematics & Theory of Machines

Module I: Technical theory Sessions (6 hours)

History, 4 stroke/2 stroke engines and their working, bore, stroke, cubic capacity, technical specifications of engine & components, valve overlapping, Electrical Connections, parts locations, different sensors- their working & troubleshooting, clutch, brake, chain, suspension, steering, BS IV and BS VI

Module II: Practical Sessions (24 hours)

Hands on training Practical on UCE, Himalayan, 650, meteor. Dos and Don'ts at training center, engine dismantling, engine & gearbox assembly, wheel removal, refit, free play, clutch, suspension, steering, brake, air filter, use of multimeter & special tools, Electrical systems: inspection of components and troubleshooting.

Course Outcomes

After completing the course successfully the students will be able to-

1) identify various components of a RE bike, various tools used for servicing; practically understand the working and troubleshooting of various components of RE bike

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	2	2	1		1								1	1

REFRIGERATION AND AIR CONDITIONING

(3 credits-45 hours)(L-T-P: 3-0-0)

Objective:

This course provides an introduction to the principles and operation of refrigeration and air conditioning systems. Upon completion, students will be able to understand the functionality of vapor compression and absorption refrigeration systems, evaluate refrigerants based on their properties, environmental impact, and selection criteria, and apply psychrometric principles to analyze air conditioning processes using psychrometric charts. With the increasing demand for energy-efficient and environmentally sustainable cooling solutions, this course equips students with the foundational knowledge to develop advanced refrigeration and air conditioning technologies.

Module I: Fundamentals and Air Refrigeration Systems (10 Hours)

Introduction: Definitions of refrigeration and air conditioning; history; natural vs. artificial refrigeration; applications; unit of refrigeration, COP, EER; Joule-Thomson effect; refrigerator vs. heat pump.

Air Refrigeration: Reversed Carnot cycle; Bell-Coleman cycle (analysis, T-s/p-h diagrams); aircraft refrigeration (simple, bootstrap, regenerative, reduced ambient); merits and demerits.

Module II: Vapor Compression and Absorption Systems (12 Hours)

Vapor Compression Refrigeration (VCR): Ideal and actual VCR cycles (working, analysis, limitations); sub-cooling, superheating effects; multi-stage and cascade systems; COP improvement methods; numerical problems.

Vapor Absorption Refrigeration (VAR): Simple VAR working; aqua-ammonia and lithium bromide-water systems; rectifier and analyzer in aqua-ammonia systems; advantages, limitations, maximum COP.

Refrigerants: Nomenclature, classification, desirable properties, environmental considerations, selection.

Module III: Refrigeration Components and Alternative Systems (11 Hours)

VCR Components: Compressors (reciprocating, rotary, centrifugal, axial); condensers and evaporators (natural/forced convection); expansion devices; working principles.

Other Systems: Overview of steam-jet, vortex tube, thermoelectric, and magnetic refrigeration; comparison with VCR and VAR.

Module IV: Psychrometry and Air Conditioning (12 Hours)

Psychrometry: Air-water vapor mixtures; psychrometric properties; psychrometric chart; processes (sensible heating/cooling, latent heat, adiabatic mixing); sensible heat factor, bypass factor, apparatus dew point.

Air Conditioning: System classification (window, split, central, summer/winter/year-round); ASHRAE nomenclature; thermal comfort; cooling/heating load estimation; ventilation basics.

Equipment: Humidifiers, dehumidifiers, filters, fans, blowers; heat pump circuits.

Course Outcomes

After completing the course successfully the students will be able to-

Explain fundamental concepts of refrigeration, air conditioning, and their applications. (Understand)

Analyze the thermodynamic cycles of air and vapor refrigeration systems using T-s/p-h diagrams. (Analyze)

Evaluate the performance of refrigerants and components based on thermodynamic properties and environmental impact. (Evaluate)

Construct psychrometric processes using psychrometric charts. (Apply)

Compare various air conditioning systems based on cooling load, efficiency, and ASHRAE standards. (Analyze)

Mapping of CO with PO & PSO

CO/PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1					1						3	
CO2	2	3			1								3	
CO3	2	2	3		1		3						3	
CO4	3	2			2								3	
CO5	2	3	2		1		1						3	

Suggested Readings

1. Stoecker, W.F. and Jones, J.W., Refrigeration and Air conditioning, Tata McGraw Hill.
2. Arora, C.P., Refrigeration and Air conditioning, Tata McGraw Hill.
3. Prasad, M, Refrigeration and Air Conditioning, New Age International Publishers.
4. Singh, Sadhu., Refrigeration and Air conditioning, Khanna Book Publishing Edition.
5. Domkundwar, Refrigeration and Air conditioning, Dhanpat Rai and Co
6. Gosney, W.B, Principles of Refrigeration, Cambridge University Press.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	Refrigeration and Air Conditioning https://archive.nptel.ac.in/courses/112/107/112107208/	Prof. Ravi Kumar	IIT Roorkee

Computer Aided Design and Manufacturing 3 credits-45 hours)(L-T-P: 3-0-0)

Objective: To make the reader appreciate the importance of CAD CAM in the field of modern design and manufacturing of products and to understand the various underlying principles, techniques and technologies relating to the field.

Module I:(7 hours)

Introduction to CAD/CAM, need, advantages, Fundamentals of design process, stages in design process and product development cycle, Computers in design applications, role of computers in industrial manufacturing, components of CAD/CAM/CAE systems, system software and application software, CAD database and structure, coordinate systems in CAD, Typical Product Life Cycle

Module II:(10 hours)

Intro to Rigid body transformation, affine transformation and general transformations; Basic transformations: Translation, Rotation, Scaling, Reflection and Shear; Introduction to Homogeneous coordinate representation: 2D and 3D; Concatenated transformation.

Module III:(10 hours)

- a. 3D wire frame modeling, wire frame entities- definitions interpolation and approximation curves, concept of parametric and nonparametric representation of curves, curve fitting techniques, definitions of cubic spline and Bezier, B-spline.
- b. Surface modeling: Algebraic and geometric form, parametric space of surface, blending functions, Reparametrization of a surface patch, subdividing, cylindrical surface, ruled surface, surface of revolution, spherical surface, Composite surface, Bezier surface, B-spline surface.
- c. Solid modeling: Definition of cell composition and spatial occupancy enumeration, sweep representation, constructive solid geometry, boundary representations.
- d. Product data exchange: Need, advantage, IGES, STEP

Module IV:(9 hours)

- a. Introduction to NC, CNC, DNC; NC coordinate system; Introduction to NC part programming: manual part programming, computer assisted part programming (APT language), advantages and limitations of programming methods.
- b. Introduction to Robotics: Robot definition, origin and characteristics; History of robotics; Asimov's laws of robotics, types of robots, specifications and applications, advantages and limitations, Introduction to robot anatomy.

Module V:(4 hours)

Group technology and flexible manufacturing system: Part families, parts classification and coding, production flow analysis, machine cell design, FMS workstations, Material handling and storage system, Application of Group technology and FMS.

Course Outcomes

After completing the course successfully the students will be able to-

- 1. Name various hardware, software components and system requirements for implementing CAD/CAM; Illustrate the product design and manufacturing process ; state the different laws governing robotics & understand the use of robotics and automation in different environment; summarize the concepts of group technology, FMS and their applications
- 2. Solve transformation operation related problems to manipulate an object under consideration as per the need of the design/manufacturing process
- 3. Understand and compare various types of geometric modelling techniques, know different geometric primitives, curves, surfaces, product data exchange in CAD
- 4. Synthesize a CNC manual or computer assisted part program to use it for machining of different parts by various manufacturing operations.

Mapping of CO with PO & PSO

CO/PO, PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1													
CO2	2	2	2										1	
CO3	2				1								1	
CO4	2	2	3		1								1	

Suggested Readings

1. Mickel P. Groover, Automation, production systems and computer Integrated manufacturing, PHI.
2. Ibrahim Zeid., CAD/CAM Theory and practice, Tata Mcgraw Hill education private limited.
3. David D Bedworth, Computer Integrated design and Manufacturing, McGraw Hill International.
4. P. N. Rao, CAD/CAM Principles and Applications, 3rd edition, Tata McGraw Hill.
5. Dr. K. C. Jain, Sanjay Jain, Principles of Automation and Advanced Manufacturing Systems, Khanna Publishers.
6. K. Lalit Narayan, K. Mallikajurna Rao, M.M. Sarcar, Computer aided design and manufacturing. PHI.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	Computer Aided Design and Manufacturing	Prof. P.V. Madhusudan Rao Prof. Anoop Chawla	IIT Delhi
2	Computer Aided Engineering Design	Dr. Anupam Saxena	IIT Kanpur

**Gas Turbines and Jet Propulsion
(3 credits-45 hours)(L-T-P: 3-0-0)**

Objectives: This course provides an introduction to the principles and components of gas turbine power plants, enabling students to understand their major components and operational mechanisms. Students will develop skills to assess the performance of combined cycle power plants and gain knowledge about various combustion chamber designs and their modifications. Additionally, the course covers the classification of jet propulsion cycles and their working principles, preparing students to contribute to the design and optimization of efficient and advanced power generation and propulsion systems.

Module 1: Gas Turbines (10 hours)

Open cycle Arrangements, Closed cycle, Basic requirements of the Working Medium, Applications, Comparison of Gas Turbines with Reciprocating Engines, Assumptions in Ideal Cycle Analysis, Simple Gas Turbine Cycle, Reheat Cycle, Intercooled Cycle, Regeneration Cycle, Comparison of various cycles, Combined Steam-Gas Turbine Plant, Blade Materials, Manufacturing Techniques, Blade Fixing.

Module 2: Centrifugal and Axial Flow Compressors (10 hours)

Centrifugal Compressors: Essential Parts, Principle of Operation, Ideal Energy Transfer, Blade Shapes and Velocity Triangles, Analysis of Flow through the Compressor, Diffuser, Volute Casing, Performance Parameter, Losses in Centrifugal Compressor, Compressor Characteristics, Surging and Choking.
Axial Compressors: Geometry and Working Principle, Stage Velocity Triangles, Work Done Factor, Enthalpy-Entropy Diagram, Compressor Stage Efficiency, Performance Coefficients, Degree of Reaction, Flow through Blade Rows, Flow Losses, Stage Losses, Performance Characteristics.

Module 3: Combustion Chamber (8 hours)

Combustion Theory Applied to Gas Turbine Combustor, Factors affecting Combustion Chamber Design, Factors affecting Combustion Chamber Performance, Form of Combustion System, Requirements of the Combustion Chamber, Process of Combustion in a Gas Turbine, Combustion Chamber Geometry. Ignition and Pollution.

Module 4: Jet Propulsion Cycles and Rocket Propulsion (12 hours)

Reciprocating or Propeller Engines, Gas Turbine Engines, Ramjet engine, Pulse Jet engine, Turbo-prop engine, Turbo jet engine, Thrust and Thrust equation, Specific thrust of the Turbojet engine, Efficiencies, Parameters affecting Flight Performance.

Classification of Rockets, Principle of Rocket Propulsion, Analysis of an Ideal Chemical Rocket, Classification of Chemical Rocket-Solid Propellant, Liquid Propellant and Free radial rockets.

Course Outcomes:

After completing the course the student will be able to

CO1: Explain the operational principles and components of gas turbine cycles with reference to their applications. (Understand).

CO2: Apply velocity triangle analysis to calculate the performance parameters of centrifugal and axial flow compressors in gas turbine systems. (Apply)

CO3: Analyze the factors affecting combustion chamber design and performance in gas turbine systems. (Analyze)

CO4: Evaluate the performance of jet propulsion cycles and rocket propulsion systems using thrust equations and efficiency parameters to optimize design for specific application. (Evaluate)

Mapping of CO with PO & PSO

CO/PO,PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1					1						3	
CO2	3	2	1		1								3	
CO3	3	3	2	1			1						3	
CO4	3	3	3	2	1		1						3	1

Text Books/ References:

1. Ganesan, V. "Gas Turbines", Mc Graw Hills.
2. Kharuja and Dubey, "Gas Turbines and Propulsive Systems". Dhanpat Rai Publications.
3. Mattingly, J. "Element Gas Turbine Propulsion", Mc Graw Hill Education.
4. Cohen and Rogers, "Gas Turbine Theory", Pearson Education.

**Automobile Engineering
(3 credits-45 hours)(3L: 0T:0P)**

Objective: This course is an introduction to the description and working of various mechanical parts of an automotive vehicle. After learning the course students will be able to understand the usage of mechanical components and their assembly. As there is a growing demand for design and development of modern environment friendly vehicles, this course serves as an introduction to enable students to develop better technologies.

Module 1: Introduction to Automobiles and Internal Combustion Engines ((5 hours)

History of automobiles; Classification of automobiles; Power plant classification; Engine terminology; Types of cycles; Working principle of an IC engine; Advanced classification of engines and multi cylinder engines; Engine balance and firing order.

Module 2: Fuel, Ignition & Electrical Systems (7 hours)

Spark Ignition engines – fuel tank, fuel filter, fuel pump, air filter, carburetor, direct injection of petrol engines; Compression Ignition engines –fuel injection (air and solid), pressure charging, super charging and turbo charging; Ignition systems– components, battery ignition, magneto ignition, electronic ignition and ignition timing; Main electrical circuits – generating and starting circuit, lighting, indicating devices.

Module 3: Lubrication and Cooling Systems (5 hours)

Functions and properties of lubricants, methods of lubrication; Oil filters, oil pumps, oil coolers; Characteristics of an effective cooling system; types of cooling systems; Radiator, thermostat, air cooling and water cooling.

Module 4: Automotive mechanisms and systems (20 hours)

Chassis & Transmission: Parts of automobile body; Automobile frames – functions, constructions, sub frames, materials and defects; Transmission – axles, clutches, propeller shafts, differential, gear boxes, automatic transmission, electronic transmission control, functions and types of front and rear axles, types and functions of clutches, Hotchkiss drive torque tube drive, traction control.

Steering, Braking and Suspension: Steering mechanism, steering gear box types, wheel geometry;

Brakes – principle, functions, types, construction, operation and parking brake; Suspension - types of spring shock absorbers, objectives and types of suspension system, rear axle suspension, electronic control and proactive suspension system

Module 5: Auxiliary Systems and Recent Trends (8 hours)

Automotive Air Conditioning: Ventilation, heating, air condition, refrigerant, compressor and evaporator. Wheels and Tyres: Wheel quality, assembly, types of wheels, wheel rims. Construction of tyres and tyre specifications.

Recent Trends: E-vehicles; Satellite-based navigation; Automated steering; Environment effect and mitigation.

Course Outcome:

CO1: Explain the fundamentals of automobile systems and internal combustion engine components such as classification, working cycles, and engine balancing.

CO2: Illustrate the construction and working of fuel, ignition, and electrical systems in both SI and CI engines.

CO3: Analyze the performance and effectiveness of automotive lubrication, cooling, transmission, suspension, steering, and braking systems.

CO4: Evaluate recent advancements in auxiliary systems and modern trends such as electric vehicles, automated steering, and environmental mitigation in automotive technology.

CO4: Examine the performance of transmission, suspension, steering and braking systems. (Analysing)

Mapping of CO with PO & PSO

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO2
CO1	3	2	1	3		1	1						1	1
CO2	2	3	1	1	1		1					1	3	1
CO3	2	3	3	3		1						1	1	1
CO4	3	1	2	2									1	1

Suggested Readings

1. P. S. Gill, Automobile Engineering I and II, S. K. Kataria and sons.
2. D. S. Kumar, Automobile Engineering, S. K. Kataria and sons.
3. K. K. Jain, R. B. Asthana, Automobile Engineering, Tata McGraw Hill publishing co. Ltd.
4. R K. Rajput, A Textbook of Automobile Engineering, Laxmi Publications (P) Ltd.

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/107106088 Fundamentals of Automotive Systems	Prof. C.S.Shankar Ram	IIT Madras
2			

Introduction to Biomedical Engineering (3 credits-45 hours)(3L: 0T:0P)

Course Objectives: This course introduces the fundamental principles of biomedical engineering, emphasizing its interdisciplinary applications in healthcare. Students will analyze the working principles of biomedical instruments, sensors, and medical imaging systems, while also evaluating the mechanical properties of bio-

materials used in implants and prosthetics. Furthermore, the course explores emerging trends such as artificial intelligence in healthcare, wearable devices, and the ethical considerations surrounding medical technology, equipping students to contribute to innovative and responsible advancements in the field.

Module 1: Introduction to Biomedical Engineering (Hours: 10)

Overview of Biomedical Engineering - Definition, history, and interdisciplinary nature, Biomechanics, Biomaterials, Medical Imaging, Bioinformatics. Healthcare and Engineering - Role of engineers in medicine (diagnosis, treatment, rehabilitation), Medical vs. engineering perspectives. Ethics and Regulations - FDA, ISO standards, and ethical considerations in medical device design.

Module 2: Biomedical Instrumentation & Sensors (Hours: 12)

Biosensors and Bioelectronics, Principles of biosensors (electrochemical, optical, piezoelectric), Medical Instrumentation- ECG, EEG, EMG, MRI, Ultrasound, and X-ray systems. Diagnostic and Therapeutic Devices - Glucometers, dialysis machines, defibrillators.

Module 3: Biomechanics & Biomaterials (Hours: 11)

Biomechanics Fundamentals - Stress-strain in biological tissues, gait analysis, and joint mechanics. Biomaterials - Properties of metals, polymers, ceramics, and composites in implants. Biocompatibility and degradation.

Module 4: Medical Imaging & Emerging Trends (Hours: 12)

Imaging Techniques - Principles of CT, PET, SPECT, and Optical Imaging. Image Processing Basics - Segmentation, enhancement, and AI in diagnostics. Emerging Trends - Telemedicine, wearable devices, AI in healthcare, 3D bioprinting.

After completing this course, students will be able to:

CO1: Explain the role of biomedical engineering in healthcare and describe key subfields. (Understanding)

CO2: Demonstrate the working principles of biomedical instruments and biosensors. (Applying)

CO3: Apply biomechanical concepts to analyze biological tissues and evaluate biomaterials for medical devices. (Evaluating)

CO4: Analyze medical imaging modalities and their clinical applications. (Analyzing)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	1		1			1	1				1	1	2
CO2	3	2	1	2	2							1	2	1
CO3	3	3	2	2	1		1					1	3	
CO4	3	2	1	2	2							1	1	1

Suggested books:

Handbook of Biomedical Instrumentation – R.S. Khandpur (McGraw Hill)

PRINCIPLE OF MEDICAL ELECTRONICS & BIOMEDICAL Instrumentation - Raja Rao & BGuha - University Press

Non-conventional Sources of Energy (3 credits-45 hours)(3L: 0T:0P)

Objective: To convey the knowledge of basics of different non conventional energy systems in detail so that it helps them in understanding the need and role of Non-Conventional Energy sources particularly when the conventional sources are meager in nature.

Module 1: Introduction (5 hours)

- a) Fossil fuel based systems: Impact of fossil fuel based systems. Non-conventional energy – Seasonal variations and availability. Renewable energy – sources and features. Hybrid energy systems Distributed energy systems and dispersed generation (DG)
- b) Traditional Energy Systems: Sources. Features and characteristics. Applications: Transport – bullock cart, horse carriage, camels; Agriculture – ox plough, water lifting devices; Human power – bicycle, cycle rickshaw etc.; House hold – cooking (bio mass), lighting etc.

Module 2: (11 hours)

- a) Solar Thermal Systems: Solar radiation spectrum. Radiation measurement. Technologies. Applications: Heating, Cooling, Drying, Distillation, Power generation
- b) Solar Photovoltaic System: Operating principles. Photovoltaic cell concepts. Cell, module, array. Series and parallel connections. Maximum power point tracking. Applications: Battery charging, Pumping, Lighting, and Peltier cooling.

Module 3: (7 hours)

- a) Microhydel: Operating principles. Components of a microhydel power plant. Types and characteristics of turbines. Selection and modification. Load balancing.
- b) Wind: Wind patterns and wind data. Site selection. Types of windmills. Characteristics of wind generators. Load matching.

Module 4: (6 hours)

- a) Biomass: Operating principles. Combustion and fermentation. Anaerobic digester. Wood gassifier. Pyrolysis. Applications: Biogas, Wood stoves, Bio diesel, Combustion engine.
- b) Wave Energy Systems: Shoreline systems. Near shore systems. Off shore systems.

Module 5: (7 hours)

- a) Costing: Life cycle costing (LCC). Solar thermal system LCC. Solar PV system LCC. Microhydel LCC. Wind system LCC. Biomass system LCC
- b) Hybrid Systems: Need for Hybrid Systems. Range and type of Hybrid systems. Case studies of Diesel-PV, Wind-PV, Microhydel-PV, Biomass-Diesel systems, electric and hybrid electric vehicles

Course outcomes: After completing the course successfully the students will be able to-

1. Compare the various fossil fuel sources with respect to their impact on the environment.
2. Analyze harnessing of solar energy.
3. Analyze harnessing of microhydel and wind energy
4. Analyze harnessing of Biomass and wave energy
5. To study and compare energy storage systems.

Mapping of CO with PO & PSO

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	3	3	3	1	2	2					1	3	3	1
CO2	3	3	3	2	2	2					1	3	3	1
CO3	3	3	3	2	2	2					1	3	3	1
CO4	3	3	3	2	2	2					1	3	3	1
CO5	3	3	3	1	2	2					1	3		

Text Books/ References:

1. Rai.G.D, "Non-Conventional Energy Sources", Khanna Publishers, 4th edition, New Delhi, 2009.
2. Roland Wengenmayr, Thomas Buhrke," Renewable energy: Sustainable energy concepts for the future", Wiley-VCH, 1st edition, 2008.
3. B H Khan, "Non-Conventional Energy Resources", 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011
4. S. Hasan Saeed and D. K. Sharma, "Non-Conventional Energy Resources", 3rd Edition, S. K. Kataria and Sons, 2012

5. G.N. Tiwari and M.K.Ghosal, "Renewable Energy Resource: Basic Principles And Applications", Narosa Publishing House, 2004
6. Godfrey Boyle, "Renewable energy", Oxford University Press, 2nd edition, 2010
7. Hans-Josef Fell, "Global cooling strategies for climate protection", CRC Press, 2012.
8. Ottmar Edenhofen, "Renewable energy sources and climate change mitigation", Cambridge University Press, 2011.
9. B.K. Hodge, "Alternative energy systems and applications", John Wiley and Sons, 2009.
10. Mark Diesendorf, "Greenhouse solutions with sustainable energy", University of New South Wales Press, 2007.
11. <https://nptel.ac.in/courses/108/108/108108078/>
12. <https://nptel.ac.in/courses/121/106/121106014/>

INTRODUCTION TO POWER PLANT (3 credits-45 hours)(L-T-P: 3-0-0)

Objective: To provide a comprehensive understanding of conventional and non-conventional power generation systems, their principles, components, performance evaluation, and energy scenario in India.

Module I (5 hours)

Introduction to different power plants, unconventional and non conventional power plants, Load duration curves, Location of power Plants, Power plant economics and their various terminology, Indian energy scenario.

Module II (15 hours)

Introduction to Carnot cycle Rankine cycle, Typical layout of steam power plant, Efficiencies in steam power plant, Different types of fuel and their properties, coal handling, ash handling of steam generation, Draught system, Natural Draught, Mechanical Draught. Pollution control technologies for coal.

Module III (13 hours)

a) Introduction to , Brayton cycle , Classification of different gas turbine power plants, Reheat, Intercooling and regeneration cycle, components of gas turbine plants, combined cycle power plants
b) Introduction to diesel cycle , working diesel engine, , Advantages and disadvantages of diesel engine power plant, General layout, Performance characteristics, Supercharging.

Module IV (12 hours)

a) Introduction, Classification of hydro-electric power plant, Site selection, Elements of hydro-electric power plant, Advantages of hydro-electric power plant, Classification of hydraulic turbines and its selection,
b) Introduction to nuclear engineering, Types of nuclear reactors, Pressurized water reactor, Boiling water reactor, CANDU reactor, Gas-cooled reactor, Liquid metal fast breeder reactor, India's nuclear power programme. Waste disposal for nuclear materials, Safety measures for nuclear power plants.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall the basic concepts, classifications, and layouts of various power plants including steam, gas, diesel, hydroelectric, and nuclear plants, as well as their operating cycles and component and various terminology use in economy of power plant(Remembering)

CO2: Explain the working principles, performance parameters, fuel properties, pollution control methods, and site selection criteria of different conventional and non-conventional power generation systems.(Understanding)

CO3: Solve load curve related problems and Apply thermodynamic cycles and plant performance analysis to evaluate the efficiency, of different power generation plants. (Applying)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	1								1	1	
CO2	3	2	2	2								1	2	
CO3	2	3	3	3							1	1	3	

Suggested Readings

1. P. K. Nag, Power Plant Engineering, Tata McGraw-Hill.
2. S.C. Arora and S. Domkundwar, A course in Power Plant Engineering, Dhanpat Rai and Co.
3. El Wakil M.M., Power Plant Technology, Tata McGraw Hill.
4. Black and Veatch, Power plant Engineering, McGraw-Hill.
5. S. Domkundwar, Solar energy and Non –conventional energy, Dhanpat Rai and Co.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/112107291 Power Plant Engineering	Prof. Ravi Kumar	IIT Roorkee

Emerging Materials**(3 credits-45 hours)(L-T-P: 3-0-0)**

Objective: To provide foundational knowledge of materials science, including crystal structures, mechanical properties, and phase diagrams. It aims to explore the properties, applications, and heat treatment of metals, alloys, polymers, ceramics, and composites. Additionally, it introduces advanced materials and their electrical, magnetic, and smart material applications.

Module I Engineering Materials and Classification (10 hours)

Metals, plastics, ceramics and composites; Relevant properties (physical, mechanical, thermal, electrical, chemical), cost; Range of applications; Material designation and standards; Ashby diagrams; Selection criteria and process.

Module II Mechanical Properties and Testing (10 hours)

Tensile, compression, torsion, fatigue, fracture and wear tests; Young's modulus; Relations between true and engineering stress-strain curves; Generalized Hooke's law; Yielding and yield strength; ductility, resilience, toughness and elastic recovery; Hardness measurement their relation to strength; SN curve, endurance and fatigue limits; Introduction to non-destructive testing (NDT).

Module III Metal and Alloys (10 hours)

Iron and steel; Stainless steel and tool steels; Copper & its alloys – brass, bronze & cupro-nickel; Aluminium & Al-Cu-Mg alloys; Nickel based superalloys & Titanium alloys; Phase diagrams and interpretation of microstructure; Iron-iron-carbide phase diagram and cooling (TTT) diagrams.

Module IV Heat Treatment (10 hours)

Heat treatment of Steel; Annealing, tempering, normalizing, spheroidising, austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening

Module V Polymers, Ceramics and Composites (10 hours)

Polymers – Classification and applications; Polymerization techniques; Ceramics – Oxide ceramics, ceramic insulators, bio-ceramics and Glasses; Composites – Reinforcement, matrix, metal matrix composites, ceramic composites, polymer composites; Other advanced materials – biomaterials, optical materials, high temperature materials, energy materials, and nanomaterials.

Module VI Electrical and Magnetic Materials(10 hours)

Conducting and resisting materials – types, properties and applications; Semiconducting materials – properties and applications; Magnetic materials – Soft and hard magnetic materials and applications; Superconductors and dielectric materials – properties and applications; Smart materials; Sensors and actuators; Piezoelectric, magnetostrictive and electrostrictive materials.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall fundamental concepts of crystal structures, defects, mechanical properties, and the classification of materials such as metals, ceramics, polymers, and composites.(Remembering)

CO2: Explain the microstructural evolution during phase transformations, heat treatment processes, and the relationships between material properties and their applications.(Understanding)

CO3: Analyze mechanical property measurements and phase diagrams to predict material behaviour under various loading and environmental conditions.(Applying)

CO4: Apply knowledge of advanced materials and their properties in designing solutions for engineering applications, including smart materials, biomaterials, and energy-efficient (Applying)

Mapping of CO with PO & PSO

CO/PO,PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	
CO2	3	2	3	2									3	
CO3	3	2	3	2		3							3	
CO4	3	2	3	3	3	3							3	

Suggested Readings

1. W. D. Callister, Materials Science & Engineering, Wiley India.
2. K. G. Budinski and M.K. Budinski, Engineering Materials, PHI India.
3. V. Raghavan, Material Science and Engineering, PHI India.
4. U. C. Jindal, Engineering Materials and Metallurgy, Pearson.
5. M.F. Ashby and D.R.H. Jones, Engineering Materials 1 - An Introduction to Properties, Applications and Design, Butterworth-Heinemann, USA, 201

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://onlinecourses.nptel.ac.in/noc22_me90/preview	Prof. Ratna Kumar Annabattula	IIT Madras
2			

Major project I

(2 Credit– 60 hours) (L-T-P: 0-0-4)

Objective:

Process:

1. Literature Review
2. Synopsis Presentation
3. Progress Presentation
4. Model/Prototype/ Software analysis Project Execution
5. Final Presentation and Demonstration of the Project

Course Outcomes

After completing the course successfully the students will be able to-

1. Apply practical knowledge within the chosen area of technology for project development. (Applying)
2. Demonstrate the skills to carry out research work independently. (Understanding)

3. Plan for executing projects with a comprehensive and systematic approach. (Applying)
4. Take part in development of technical projects as an individual or in a team. (Analyzing)
5. Develop effective communication skills for presentation of project related activities. (Creating)

Mapping of CO with PO & PSO

CO/PO,PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1	3	1	1									1		
CO2	3	2	2	2								1	2	
CO3	2	2	2	2								1	2	
CO4	2	2	1	1					2			1	1	1
CO5										2				

Scilab for Mechanical engineers

Objective: This course aims to equip mechanical engineering students with the essential skills to leverage SCILAB's powerful capabilities. By mastering the fundamental syntax, data manipulation techniques, and numerical methods, students will be empowered to solve complex engineering problems with efficiency and accuracy.

Module I: Introduction to SCILAB (8 hours)

Introduction to SCILAB and its working environment, Scripting and debugging techniques. Vectors and Matrices, Array operations, Function call, plots, Errors in Numerical computation.

Module II: Linear Algebra and Differential Equations using SCILAB (12 hours)

Basics of Linear Algebra, Gauss elimination and back substitution, LU decomposition and partial pivoting, Gauss Seidel method. Linear least square regression, nonlinear and functional regression. Differentiation of single variable, first order and second order ODEs and PDEs, SCILAB code applications.

Module III: Numerical Methods using SCILAB (10 hours)

Different numerical solutions of problems using Newton Raphson method, Euler's method, Runge-Kutta method. Fixed point iteration of single variable, Numerical integration.

Course Outcomes:

After completion of the subject the students will be able to-

CO 1: Apply built-in functions and user-defined scripts to solve engineering problems numerically.

CO 2: Evaluate data effectively with various plotting tools and techniques.

CO 3: Analyze and interpret engineering data using statistical methods.

CO/PO,PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12	PSO 1	PSO 2
CO1														
CO2														
CO3														

Suggested readings:

Anil Kumar Verma, SCILAB: A Beginner's Approach, 1 st edition, Cengage Learning India Pvt. Ltd.
Chetana Jain, Computing in Scilab, 1 st edition, Cambridge University Press.

B. S. Grewal, Numerical Methods in Engineering and Science, Khanna Publishers.

<https://www.scilab.org/scilab-for-beginners-tutorial>

Additive Manufacturing (3 credits-45 hours)(L-T-P: 3-0-0)

Objectives: This course provides an introduction to Additive Manufacturing (AM), covering its evolution, terminology, and classification of processes. Students will explore the principles and working mechanisms of key AM technologies. The course emphasizes identifying suitable materials and AM methods for diverse design and manufacturing needs, while illustrating the general process flow, encompassing pre-processing, printing, and post-processing stages. Additionally, students will learn to apply basic selection criteria to align AM processes with real-world industrial applications, preparing them to leverage AM technologies effectively.

Module 1: INTRODUCTION TO ADDITIVE MANUFACTURING (9 hours)

Overview of AM: Definition, evolution, and Industry 4.0 integration. AM vs. Subtractive (CNC) & Traditional Manufacturing: Key differences, economic and sustainability aspects. AM Process Chain: From CAD to final part, Types of materials for AM, Advantages, Limitations and Benefits of AM.

Module 2: EXTRUSION AND POWDER BED FUSION AM PROCESSES (9 hours)

Basic Principles of AM, Process parameters, working principle, Applications, Vat Photopolymerization Processes, Stereolithography Apparatus (SLA), Solid ground curing (SGC). Laminated Object Manufacturing (LOM), Fused Deposition Modeling (FDM), Bio extrusion, Selective laser Sintering (SLS), Electron Beam melting (EBM).

Module 3: DIRECTED ENERGY DEPOSITION & HYBRID AM (9 hours)

Process parameters of Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Friction stir AM (FSAM), Electron Beam Based Metal Deposition, construction, working principles, products, materials, advantages, limitations and applications - Functional effects and defects in AM.

Module 4: POST PROCESSING OF AM PARTS AND PROCESS (9 hours)

Post Processing of AM Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques. Guidelines for Process Selection, Selection Methods for a Part, Challenges of Selection.

Module 5: RECENT ADVANCEMENTS AND APPLICATIONS OF AM (9 hours)

Hybrid AM: Ultrasonic AM (UAM), Cold Spraying AM (CSAM), Wire Arc Additive Manufacturing (WAAM), construction, working principles, advantages, limitations and applications

AM Applications: Application of AM parts as Visualization Tools, Aerospace applications, Automotive applications, Bio-Medical Applications, Construction Industry and Retail applications.

Course Outcomes:

On successful completion of the course, the student will be able to:

1. Explain the basic principles of additive manufacturing. (Understand)
2. Apply the working principles of additive manufacturing processes to select appropriate techniques for specific applications. (Apply)
3. Analyze the process parameters, functional effects, and defects in directed energy deposition and hybrid additive manufacturing processes to optimize part quality. (Analyze)
4. Evaluate the post-processing techniques and recent advancements in additive manufacturing to enhance part accuracy. (Evaluate)

Mapping of CO with PO & PSO

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1	3	2	1				2					1	3	
CO2	3	2	2	1	1		1					1	3	

CO3	3	3	2	1	2		1					1	3	
CO4	3	3	3	1	2		2					1	3	1

Text Books:

1. Ian Gibson, David W Rosen, Brent Stucker., "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing", 2nd Edition, Springer, 2015.
2. Chua Chee Kai, Leong Kah Fai, "3D Printing and Additive Manufacturing: Principles & Applications", 4th Edition, World Scientific, 2015.
3. Manu Srivastava, Sandeep Rathee, Sachin Maheshwari and T. K. Kundra, "Additive Manufacturing Fundamentals and Advancements", 1st edition, CRC Press, 2019.

POWER PLANT ENGINEERING
(3 credits-45 hours)(L-T-P: 3-0-0)

Objective: To provide a comprehensive understanding of conventional and non-conventional power generation systems, their working principles, components, performance evaluation, and prospects in India.

Module I (5 hours)

Introduction to different power plants, conventional and non conventional power plants, Location of power Plants, Power plant economics, Load duration curves and Indian energy scenario.

Module II (15 hours)

Introduction to Rankine cycle, Typical layout of steam power plant, Efficiencies in steam power plant, Co-generation of power and process heat, Combined cycle power generation, Different types of fuel and their properties, coal handling, ash handling of steam generation, Draught system, Natural Draught, Mechanical Draught. Pollution control technologies for coal. Performance of steam power plant

Module III (10 hours)

- a) Introduction, Classification of different gas turbine power plants, Analysis of closed cycle and open cycle constant pressure gas turbine plant, Reheat, Intercooling and regeneration cycle, components of gas turbine plants, combined cycle power plants, gas turbine fuels and gas turbine materials. Performance of gas turbine power plant, Advantages and disadvantages of gas turbine power plant.
- b) Introduction, Application of diesel engines in power field, Advantages and disadvantages of diesel engine power plant, General layout, Performance characteristics of diesel power plant, Supercharging.

Module IV (10 hours)

- a) Introduction, Classification of hydro-electric power plant, Site selection, Elements of hydro-electric power plant, Advantages of hydro-electric power plant, Classification of hydraulic turbines and its selection, Hydrographs, Flow duration curves. Selection of water turbine for hydroelectric power plant. Introduction to micro hydel power plant.
- b) Introduction to nuclear engineering, Types of nuclear reactors, Pressurized water reactor, Boiling water reactor, CANDU reactor, Gas-cooled reactor, Liquid metal fast breeder reactor, India's nuclear power programme. Waste disposal for nuclear materials, Safety measures for nuclear power plants.

Module V (5 hours)

Prospect of renewable energy source: solar energy, Wind energy, Bio-mass energy, Geo-thermal energy, Tidal energy and Thermal energy storage systems, Origin and their types; Working principles.

Course Outcomes

After completing the course successfully the students will be able to-

CO1: Recall the classifications, components, layouts, and operating principles of conventional and non-conventional power plants, including steam, gas, diesel, hydroelectric, nuclear, basic terminology used in economy of power plant and indian energy sources.(remembering)

CO2: Explain the thermodynamic cycles, fuel handling systems, environmental impacts, and performance characteristics of various power plants along with their advantages, disadvantages, and suitability based on site and energy requirements.(understanding)

CO3: Solve load curve related problems and Apply thermodynamic cycles and plant performance analysis to evaluate the efficiency of different power generation plants. (Applying)

CO4: Analyze performance curves of various power plants, selection of water turbine for hydroelectric power plant economic analysis of power plant (Analysing)

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	1											1	1
CO2	2	2		1									1	1
CO3	2	2	3	1									1	2
CO4	2	2	3	2									1	2

Suggested Readings

1. P. K. Nag, Power Plant Engineering, Tata McGraw-Hill.
2. S.C. Arora and S. Domkundwar, A course in Power Plant Engineering, Dhanpat Rai and Co.
3. El Wakil M.M., Power Plant Technology, Tata McGraw Hill.
4. Black and Veatch, Power plant Engineering, McGraw-Hill.
5. S. Domkundwar, Solar energy and Non –conventional energy, Dhanpat Rai and Co.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/112107291 Power Plant Engineering	Prof. Ravi Kumar	IIT Roorkee
2	https://nptel.ac.in/courses/112103243 Fundamentals of Nuclear Power Generation	Prof. Dipankar N. Basu	IIT Guwahati

Electric Vehicle Technology
(3 credits-45 hours)(3L: 0T:0P)

Objective: This course provides an introduction to the dynamic behaviour and performance characteristics of electric vehicles. It includes study of traction motors, battery systems, drive cycles, and vehicle control strategies. After completing this course, students will be able to understand how electric vehicle components interact to influence motion, stability, and efficiency. With the increasing shift toward sustainable transportation, this course prepares students to contribute to the design, analysis, and improvement of advanced electric mobility systems.

Module I: Introduction to Electric Vehicle (15 hours)

History and benefits of Electric vehicles, Components of an EV, Comparison of IC engine vehicles and Electric vehicles, Vehicle layout and configuration, Types of electric vehicle, Types of Motors used in EV, Torque speed characteristics, Battery management systems, charging techniques and standards.

Module II: Fundamentals of Vehicle Dynamics (15 hours)

Design of Transmission system of EVs, Power train of HEV and EV.
Modelling and analysis of suspension systems, Braking and Steering systems for EVs, Stability and Control of EVs, Vehicle ride, Tire forces and Tire modelling of EVs.
Multi motor in wheel EVs, Safety of EVs.

Module III: Power Electronics and Control (15 hours)

Wiring Harness and architecture, HV and LV Harness design.

Basics of Induction motor, Open Loop v/f control, Basic pulse width modulation techniques, Vector control of IM drives.

Power converter design and PWM techniques, Modelling of PMSM drives, Vector Control of PMSM drives.

Course Outcomes:

After completion of the subject the students will be able to-

CO 1: Understand the architecture and the components, types, benefits, and configurations of electric vehicles.

CO 2: Analyze the fundamentals of vehicle dynamics.

CO 3: Apply principles of power electronics and control to electric vehicle systems.

CO 4: Design and interpret wiring architecture and control strategies for electric vehicle propulsion and safety systems using modern engineering tools.

Mapping of CO with PO & PSO

CO/PO, PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1														
CO2														
CO3														
CO4														

Suggested readings:

1. Iqbal Hussain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press.
2. Nitesh Tiwari, Shekhar Yadav, Electric Vehicle (Green and Sustainable Transportation), Katson Books.
3. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press.
4. Berker B., James W. J., A. Emadi, Switched Reluctance Motor Drives, IEEE Wiley Press.
5. Bimal K. Bose, Modern Power Electronics and AC drives, Prentice Hall PTR.

Renewable Energy Engineering (3 credits-45 hours)(L-T-P: 3-0-0)

Course objectives:

To facilitate the students to achieve a clear conceptual understanding of technical and commercial aspects of Wind, Solar, Biomass and Alternative Sources of Energy.

To enable the students to develop managerial skills to assess feasibility of alternative approaches and drive strategies regarding Wind, Solar, Biomass and Alternative Sources of Energy.

Module I INTRODUCTION (9 hours)

Global and national energy scenarios, concept of energy services, patterns of energy supply, energy resource availability, cultural, economic, and national security aspects of energy consumption, forms and characteristics of renewable energy sources, energy classification, source and utilization, thermodynamic power cycles and binary cycles.

Module II SOLAR ENERGY & BIOMASS ENERGY (9 hours)

Solar radiation, flat plate collectors, solar concentration, thermal applications of solar energy, photovoltaic technology and applications, energy storage. Energy from biomass, thermo-chemical, biochemical conversion to fuels, biogas, and its applications.

Module III WIND ENERGY (9 hours)

Wind characteristics, resource assessment, horizontal and vertical axis wind turbines, electricity generation and water pumping, Micro/Mini hydropower system, water pumping and conversion to electricity, hydraulic pump.

Module IV HYDROGEN & FUEL CELLS (9 hours):

Introduction to Fuel cell Technology, Various types of fuel cell systems, Low & high temperature fuel cells, Fuel cell thermodynamics, Fuel cell efficiency. Introduction to hydrogen economy, production, storage, and transportation systems, hydrogen from fossil fuels, transmission and infrastructure requirements, safety and environmental impacts, economics of transition to hydrogen systems.

Module V OTHER RENEWABLE SOURCES (9 hours)

Ocean thermal energy conversion, Geothermal, Tidal, Wave energy, MHD, environmental issues of energy sources.

Course outcomes:

After the completion of the course, the students will be able to:

Understand the fundamentals, availability, economics, and characteristics of the basic renewable energy sources.

Understand the fundamentals of solar energy and biomass energy.

Understand the fundamentals of wind energy.

Understand the fundamentals of hydrogen and fuel cells.

Understand the fundamentals of various renewable energy sources like geothermal, tidal, wave, etc.,

Mapping of CO with PO & PSO

CO/PO,P SO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	P O 12	PSO 1	PSO 2
CO1														
CO2														
CO3														
CO4														

Suggested Text books

1.Rai, G.D., Non-Conventional Energy Sources, Khanna Publishers (2005).

2.Rao, S. and Parulekar, B.B., Energy Technology: Non-Conventional, Renewable and Conventional, Khanna Publishers (2005).

References:

1.Wadhwa, C.L., Generation, Distribution and Utilization of Electric Energy, New Age International (P) Limited, Publishers (2007).

Major project II/ Internship

The major project phase II involves the students in realising their goal towards fulfilling the identified problem from the first phase of the major project. Accordingly students will design/ fabricate/analyse whichever is/are needed. The complete report of the work in proper format is prepared and finally the work is evaluated. The modality and components of the internal assessment and their weightages shall be notified at the beginning of each semester.

COURSE/LEARNING OUTCOMES

At the end of Project Phase II students will be able to

CO 1: Find potential gaps and needs related to mechanical engineering through study of existing literature. (Remembering)

CO 2: Interpret the potential gaps in mechanical engineering through literature review. (Understanding)

CO 3: Develop a feasibility study on the proposed topic. (Applying)

CO 4: Discover the problem statement. (Analysing)

CO 5: Assess the proposed topic by application of basic principles of mechanical engineering. (Evaluating)

CO 6: Evaluate and validate their respective results and propose further scope for advancement in that particular domain. (Evaluating)

CO 7: Compile their results using various engineering application tools. (Creating)

CO 8: Construct the mechanical engineering component using resources available. (Wherever applicable). (Creating)

CO 9: Build reports of the work. (Creating)

Honours Courses

Hydraulics Machine

(3Credits-45 hours)(L-3: T-0: P-0)

Objective: The course familiarizes students with basic facts relating to working principles of hydraulic machines and equipment used in all industrial fields. It deals with pumps, hydraulic turbines and fluid mechanisms such as hydraulic elements, hydraulic transmissions and couplings.

Module I: Impact of free jets (8 hours)

Force exerted on stationary flat plate held normal to jet and inclined to jet, force exerted on curved plate, force exerted on moving flat plate normal to jet and moving inclined to the direction of the jet, jet propulsion of jet.

Module II: Hydraulic Turbines (12 hours)

Definition of fluid machine and energy transfer machines, Review of classification of hydraulic turbines, Impulse and reaction turbines, work done and efficiency of Pelton wheel, Francis turbine, propeller turbine and Kaplan turbine, theory of draft tube, Concept of specific speed, unit quantities of hydraulics turbine, performance characteristics of hydraulic turbines, cavitation in the turbine, governing of turbines.

Module III: Centrifugal pumps (10 hours)

Introduction to Rotodynamic pump, Review of classification of centrifugal pumps, working principles and head of centrifugal pumps, losses and efficiencies of centrifugal pumps, effect of variation of discharge on efficiency, multi stage centrifugal pumps, Concept of specific speed, characteristics performance of centrifugal pumps, Net Positive Suction Head, cavitation and priming of centrifugal pumps.

Module IV: Reciprocating pumps (10 hours)

Introduction to positive displacement pump, Review of classification of reciprocating pumps, working principles of reciprocating pumps, discharge, work done, power for reciprocating pumps, single acting and double acting reciprocating pumps, slip of reciprocating pump, effect of acceleration of piston on velocity and pressure in the suction and delivery pipes, indicator diagram and their effect on acceleration and, friction of suction and delivery pipes, air vessels and its effect on work done for reciprocating pump

Module V: Miscellaneous hydraulic machines (5 hours)

Working principle of hydraulic accumulator, hydraulic intensifier, hydraulic press, hydraulic crane, hydraulic lift, hydraulic ram, hydraulic coupling, hydraulic torque converter, jet pump, submersible pump, gear pump.

Virtual Lab

- 1.Characteristic curves of Pelton wheel
- 2.Conducting experiments and drawing the characteristics curves of Francis turbine
- 3.Characteristic curves of Kaplan turbine
- 4.Characteristic curves of reciprocating pump
- 5.Drawing the characteristic curves of Gear pump
- 6.Performance Characteristics of Centrifugal Pump
- 7.Performance Characteristics of Hydraulic Ram
- 8.Double Acting Reciprocating Pump

Course Outcomes

After completing the course successfully the students will be able to-

At the end of the course students will be able to:

CO1: Classify various types of hydraulic machines, hydraulic turbines, pumps and various other hydraulic machines (*Remembering*)

CO2: Explain working principles of various hydraulics machines, impact of jet, theory of draft tube, Concept of specific speed, performance characteristics of hydraulic machines, cavitation in the turbine, pumps, governing of turbines, multistage pumps (*Understanding*)

CO3: Explain effect of acceleration of piston on velocity and pressure in the suction and delivery pipes, indicator diagram and their effect on acceleration and, friction of suction and delivery pipes, air vessels and its effect on work done for reciprocating pump(*Understanding*)

CO3: Solve problems of work done and various efficiencies of turbines, pumps, hydraulic machines and impact of jet . (*Applying*)

CO4: Analysis unit quantities of hydraulic turbines and centrifugal pumps (*Analysis*)

Suggested Readings

1. Sukumar Pati, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill.
2. Dr. R.K. Bansal, Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications.
3. R.K Rajput, Textbook on Fluid Mechanics and Hydraulic Machines, S. Chand.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/112105206 Fluid Machines	Prof.Suman Chakraborty	IIT Kharagpur
2	https://nptel.ac.in/courses/112105182 Introduction to Fluid Machines and Compressible Flow	Prof.Suman Chakraborty	IIT Kharagpur
3	https://fm-iitk.vlabs.ac.in/ Virtual Lab		IIT Kanpur
4	https://fmc-nitk.vlabs.ac.in/ Virtual Lab		NITK Surathkal

Advanced Engineering Thermodynamics (3 Credits – 45 hours) (L-T-P: 3-0-0)

Course Objective:

To provide students with the skills to apply advanced thermodynamic concepts, such as exergy analysis and combustion theory, to improve the performance and sustainability of real-world engineering systems.

Module I: Fundamental Concepts, Property Relations and Real Gases (12 hours)

First and Second Law for open and closed systems; entropy generation; Maxwell relations; Clapeyron equation; Joule-Thomson coefficient; introduction to real-gas behaviour and equations of state (van der Waals); use of thermodynamic property tables and charts.

Module II: Exergy Analysis and Thermodynamic Optimization (11 hours)

Concept of exergy (availability); exergy balance and exergy destruction; second-law efficiency; exergy analysis of simple engineering components; Entropy generation minimization principle; thermodynamic optimization of a heat exchanger and a simple heat engine; Gouy-Stodola theorem.

Module III: Mixtures and Psychrometrics (11 hours)

Ideal gas mixtures; Gibbs phase rule; fundamentals of psychrometrics; use of psychrometric charts for basic air-conditioning processes (heating, cooling, dehumidification, humidification).

Module IV: Thermodynamics of Reactive Systems and Combustion (11 hours)

Heats of formation and combustion; first-law analysis of reacting systems; adiabatic flame temperature; introduction to chemical equilibrium; overview of combustion concepts (premixed and diffusion flames, flame speed, ignition).

COURSE/LEARNING OUTCOMES

After completing the course successfully, the students will be able to –

- CO1: Analyze thermodynamic systems using fundamental laws and property relations.
- CO2: Apply exergy analysis and entropy generation minimization to optimize engineering systems.
- CO3: Evaluate properties of gas mixtures and analyze air-conditioning processes using psychrometrics.
- CO4: Perform first-law analysis for reactive systems and characterize basic combustion processes.

Suggested Readings

- Adrian Bejan, Advanced Engineering Thermodynamics, 4th Edition, John Wiley & Sons, 2016.
- Stephen R. Turns, An Introduction to Combustion: Concepts and Applications, 3rd Edition, McGraw-Hill, 2012.
- Michael J. Moran, Howard N. Shapiro et al., Fundamentals of Engineering Thermodynamics, 9th Edition, Wiley, 2018.
- Y.A. Çengel and M.A. Boles, Thermodynamics: An Engineering Approach, 9th Edition, McGraw-Hill, 2019.
- D. Kondepudi and I. Prigogine, Modern Thermodynamics: From Heat Engines to Dissipative Structures, 2nd Edition, Wiley, 2015.

Fluid Power Control

(3Credits-45 hours)(L-3: T-0: P-0)

Objective: *The course familiarizes students with basic facts relating to working principles of hydraulic and pneumatic equipment used in all industrial fields. It deals with fluid power system, hydraulic transmissions and actuators, control valves and safety and maintenance of those systems*

Module I: Introduction to fluid power systems (7 hours)

Introduction to fluid power systems Fluid power system: components, advantages and applications. Transmission of power at static and dynamic states. Pascal's law and its applications. Fluids for hydraulic system: types, properties, and selection. Additives, effect of temperature and pressure on hydraulic fluid. Seals, sealing materials, compatibility of seal with fluids. Types of pipes, hoses, and quick acting couplings. Pressure drop in hoses/pipes

Module II: Pumps and actuators (10 hours)

Pumps and actuators Pumps: Classification of pumps, Pumping theory of positive displacement pumps, construction and working of Gear pumps, Vane pumps, Piston pumps,. Accumulators: Types, and applications of accumulators. Types of Intensifiers, Actuators: Classification cylinder and hydraulic motors, Hydraulic cylinders, single and double acting cylinder, Construction and working of rotary actuators such as gear, vane, piston motors, and Hydraulic Motor. Symbolic representation of hydraulic actuators

Module III: Components and hydraulic circuit design Components (10 hours)

Components and hydraulic circuit design Components: Classification of control valves, Directional Control Valves-symbolic representation, Pressure control valves - types, Control Valves -compensated and non-compensated, needle valve, Hydraulic Circuit Design: Control of single and Double -acting hydraulic cylinder, regenerative circuit, pump unloading circuit, speed control of hydraulic cylinder Pilot pressure operated circuits.

Module IV: Pneumatic power systems and Pneumatic control circuits (13 hours)

Introduction to Pneumatic systems: Pneumatic power system, advantages, limitations, applications, Characteristics of compressed air and air compressors. Structure of pneumatic control System, fluid conditioners-dryers and FRL unit. Pneumatic Actuators: Linear cylinder – types of cylinders, working, and end position cushioning, seals, mounting arrangements, and applications, symbols. Pneumatic Control Valves: DCV such as poppet, spool, suspended seat type slide valve, pressure control valves, flow control valves, types

and construction, use of memory valve, Quick exhaust valve, time delay valve, shuttle valve, twin pressure valve, symbols. Simple Pneumatic Control: Direct and indirect actuation pneumatic cylinders, speed control of cylinders - supply air throttling and exhaust air throttling.

Module V: Safety and Maintenance (5 hours)

Hydraulic safety, Hydraulic maintenance principles, Fluid contamination and filtration, The effects of contamination on hydraulic components, Maintenance suggestions, System testing procedures, System testing methods

After completing the course successfully the students will be able to-

At the end of the course students will be able to:

CO1: Classify various types of fluids for hydraulic system, types of pipes and hoses, types of hydraulic and pneumatic pumps and actuators, pressure control valves, symbolic representation of hydraulic actuators (*Remembering*)

CO2: Explain working principles of hydraulic pumps, actuators, cylinders, hydraulic motor, hydraulic circuit design Components, valves, safety and maintenance, (*Understanding*) ,

CO3: Explain working pneumatic power system, pneumatic control system, pneumatic actuators, pneumatic control valves (*Understanding*)

CO4: Apply how a hydraulic/pneumatic circuit will work to accomplish the function. (*Applying*)

CO3: Solve problems of work done and various efficiencies of turbines, pumps, hydraulic machines and impact of jet . (*Applying*)

CO4: Design an appropriate hydraulic or pneumatic circuit or combination circuit like electro-hydraulics, electro-pneumatics for a given application. (*Analysis*)

Suggested Readings

1. Anthony Esposito, Fluid Power with applications, Pearson Education.
2. A. Alaudeen , K. H. Syed , N. Shanmugam, Fluid Power Transmission and Control, Charotar Publishing House Pvt. Ltd.
3. Ahmed Abu Hanieh, Fluid Power Control, VIVA BOOKS.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/112106175 Fluid Power Control	Prof. Jagadeesha T	IIT Madras
2	https://nptel.ac.in/courses/112105423 Industrial Hydraulics and Automation	Prof. Niranjan Kumar Prof. Ajit Kumar	IIT-ISM Dhanbad

Convective Heat Transfer Analysis

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective: To equip students with the skills to solve engineering problems in convective heat transfer by applying fundamental principles and standard correlations for internal, external, and natural flow scenarios.

Module I: Foundations and External Forced Convection (14 hours)

Introduction and applications of convective heat transfer; governing equations: derivation of continuity, momentum, and energy equations; the boundary layer concept: hydrodynamic and thermal boundary layers; similarity solutions: concepts and key results from the Blasius and Pohlhausen solutions; the Reynolds-Colburn analogy for momentum and heat transfer; laminar boundary layer over a flat plate: constant wall temperature and heat flux; introduction to turbulent boundary layers and the effect of Prandtl number.

Module II: Internal Flow Convective Heat Transfer (14 hours)

Internal flow fundamentals: hydrodynamic and thermal entry lengths; the concept of bulk mean temperature and energy balance; fully developed laminar flow: velocity and temperature profiles; heat transfer analysis

for classic cases: pipe flow with constant wall heat flux and constant wall temperature; introduction to turbulent internal flows and empirical correlations (e.g., Dittus-Boelter); application to non-circular ducts using the hydraulic diameter.

Module III: Natural and Mixed Convection (12 hours)

Fundamentals of natural convection: buoyancy and the Grashof number; scale analysis for natural convection flows; natural convection boundary layers on vertical and horizontal surfaces; integral method for natural convection over a vertical plate; introduction to natural convection in enclosures; overview of mixed convection and the Richardson number; application of common correlations for engineering geometries.

Module IV: Boiling, Condensation, and Conjugate Effects (5 hours)

Fundamentals of boiling heat transfer: pool boiling curve and regimes; fundamentals of condensation: Nusselt's theory for film condensation; introduction to conjugate heat transfer: coupled conduction and convection.

COURSE/LEARNING OUTCOMES

After completing the course successfully, the students will be able to –

- CO1:** Analyze external forced convection using boundary layer theory, similarity solutions, and analogies to calculate heat transfer and shear stress.
- CO2:** Evaluate internal convective heat transfer by analyzing entry lengths, fully developed flow, and applying correlations for ducts and pipes.
- CO3:** Solve natural and mixed convection problems using scale analysis, the integral method, and standard correlations.
- CO4:** Analyze phase-change heat transfer using the pool boiling curve and Nusselt's theory, and assess conjugate heat transfer effects.

Suggested Readings

W. M. Kays, E. M. Crawford, and B. Weigand, Convective Heat and Mass Transfer, Tata McGraw Hill, 4th Edition, 2012.
 Louis C Burmeister, Convective Heat Transfer, John Wiley and Sons, 2nd Edition, 1993.
 Adrian Bejan, Convective Heat Transfer, John Wiley and Sons, 4th Edition, 2013.
 P.H. Oosthuizen and D. Naylor, Introduction to Convective Heat Transfer Analysis, McGraw-Hill, 1999.

Alternative Energy Sources (3Credits-45 hours)(L-3: T-0: P-0)

Objective: To provide students with a comprehensive understanding of alternative and renewable energy sources, their technologies, applications, and sustainability considerations in the Indian and global context.

Module 1: Introduction to Alternative Energy Sources (8 Hours)

Energy scenario: global and Indian context, Limitations of conventional energy sources, Need for alternative/renewable energy, Classification of alternative energy sources, Sustainability, energy security, and environmental impacts, Policy framework and national missions (NEMMP, National Solar Mission, etc.)

Module 2: Solar Energy Technologies (10 Hours)

Principles of solar radiation: solar geometry, extraterrestrial & terrestrial radiation, Measurement of solar radiation; instruments and data,

Solar thermal systems: Flat plate collectors, evacuated tube collectors, Concentrating collectors (parabolic trough, dish, heliostat fields), Solar water heating, solar cooking, solar industrial heating,

Solar photovoltaic (PV) systems: V cell materials, I–V characteristics, PV modules, arrays, efficiency, Balance of system (inverters, batteries, controllers), Stand-alone and grid-connected PV systems, Recent advancements: BIPV, solar tracking, floating solar

Module 3: Wind, Hydro, and Geothermal Energy (9 Hours)

Wind Energy: Wind characteristics and resource assessment, Types of wind turbines, power and torque characteristics, Components: rotor, gearbox, generator, yaw, pitch, Wind farm design and layout, Challenges: intermittency, noise, environmental issues

Hydro Energy: Small hydro and micro-hydel systems, Site selection and components, Types of turbines (Pelton, Francis, Kaplan), Mini/micro hydro applications for rural electrification

Geothermal Energy: Origin and types of geothermal resources, Geothermal power plants: dry steam, flash steam, binary cycle, Geothermal heating/cooling systems, Environmental considerations

Module 4: Biomass, Biofuels, and Waste-to-Energy (9 Hours)

Biomass Energy: Types of biomass and characteristics, Thermochemical conversion: combustion, gasification, pyrolysis, Biochemical conversion: anaerobic digestion, biogas plants

Biofuels: Biodiesel production: transesterification, Bioethanol, biobutanol from biomass, Algal biofuels and advanced biofuels

Waste-to-Energy Technologies: Municipal solid waste energy recovery, Refuse-derived fuel (RDF), Incineration, gasification, plasma arc conversion

Sustainability & Policy: Biomass resource assessment, Environmental and socio-economic aspects

Module 5: Emerging Technologies, Energy Storage & Hybrid Systems (9 Hours)

Emerging Alternative Energy Technologies: Ocean energy: tidal, wave, OTEC, Hydrogen energy: production (electrolysis, thermochemical), storage, fuel cells, Green hydrogen and fuel cell electric vehicles (FCEVs)

Energy Storage: Battery storage systems (Li-ion, flow batteries, NaS, advanced chemistries), Mechanical storage: pumped hydro, flywheel, compressed air energy storage (CAES), Thermal energy storage: sensible, latent, thermochemical

Hybrid Renewable Energy Systems: Solar–wind hybrid systems, Solar–biomass hybrid, Microgrids, smart grids, and distributed generation

Case Studies & Future Trends: Global innovations, India's alternate energy roadmap and policies

Course Outcomes:

After completion of the subject the students will be able to-

CO1 :Explain the need, scope, and types of alternative energy sources.

CO2 :Analyze solar thermal and photovoltaic systems for various applications.

CO3 :Understand wind, hydro, geothermal energy technologies and their operation.

CO4 :Describe biomass, biofuel, and waste-to-energy conversion methods.

CO5 :Evaluate emerging technologies, storage systems, and hybrid renewable energy solutions.

Suggested Readings

D.P. Kothari, K.C. Singal, Rakesh Ranjan -Renewable Energy Sources and Emerging Technologies

B.H. Khan- Non-Conventional Energy Resources

S. Venkata Ramana- Renewable Energy Engineering and Technology

Duffie & Beckman - Solar Engineering of Thermal Processes

J.F. Manwell, J. McGowan, A. Roger- Wind Energy Explained

Energy Conservation and Waste Heat Recovery

(3Credits-45 hours)(L-3: T-0: P-0)

Objective: To provide students with a comprehensive understanding of energy management, conservation practices, and waste heat recovery technologies in industrial and commercial settings. It focuses on analyzing thermal and electrical systems for energy efficiency, conducting energy audits, designing waste heat recovery solutions, and applying emerging technologies and policies to promote sustainable, low-carbon, and environmentally responsible energy use.

Module 1: Introduction to Energy Conservation (9 Hours)

Energy scenario: Global and Indian energy demand, supply gap, challenges.

Types of energy: Conventional and renewable energy resources.

Principles of energy conservation: Need, objectives, and benefits in industrial and commercial sectors.

Energy audit: Types (preliminary and detailed), steps, tools, and instruments.

Energy performance indicators: Benchmarking, energy intensity, specific energy consumption.
Basics of energy economics: Payback period, NPV, IRR, life-cycle costing.

Module 2: Energy Conservation in Thermal Systems (9 Hours)

Boilers: Types, efficiency, performance evaluation, energy-saving opportunities.
Steam systems: Steam traps, condensate recovery, insulation, piping design for conservation.
Furnaces: Types, efficiency, heat distribution, losses, and best practices.
Kilns, dryers, and ovens: Operating principles and energy optimization.
Thermal insulation: Types, materials, selection, economic thickness of insulation (EOT).
Case studies on thermal energy savings.

Module 3: Energy Conservation in Electrical Systems (9 Hours)

Electric motors: Types, efficiency classes, load analysis, improving motor performance.
Power factor improvement: Capacitors, automatic power factor controllers, economic benefits.
Transformers: Losses, efficiency enhancement techniques.
Lighting systems: LED technologies, daylight integration, lighting audit.
Compressed air systems: Leak reduction, pressure control, energy-efficient compressors.
HVAC systems: Energy-efficient design, variable speed drives, building energy management.
Case studies on electrical energy conservation.

Module 4: Waste Heat Recovery Systems (9 Hours)

Introduction to waste heat: Sources of waste heat in industry, temperature levels, classification.
Waste heat quantification: Calculation of heat losses, efficiency assessment.
Heat exchangers: Types, design considerations, performance and applications.
Regenerators and recuperators: Working principles and industrial uses.
Waste heat recovery equipment: Economizers, Heat pumps, Heat wheels, Waste heat boilers, Organic Rankine Cycle (ORC)
Applications in cement, steel, glass, and power plants.
Environmental benefits of WHR.

Module 5: Emerging Technologies, Policies, and Case Studies (9 Hours)

Cogeneration and tri-generation: Principles, types (topping/bottoming cycles), efficiency benefits.
Combined heat and power (CHP) systems: Industrial relevance, performance metrics.
Advanced WHR technologies: Thermoelectric generators, Phase Change Materials (PCM), absorption chillers.
Green buildings and energy conservation building code (ECBC).
National and international energy policies: BEE, PAT scheme, ISO 50001 – Energy Management Systems.
Sustainability and climate resilience: Energy efficiency for low-carbon development.

Course Outcomes:

After completion of the subject the students will be able to-

- CO1:** Understand energy scenarios, principles of conservation, and conduct energy audits.
- CO2:** Identify and implement energy-saving measures in thermal and electrical systems.
- CO3:** Design and evaluate waste heat recovery systems for improved energy efficiency.
- CO4:** Apply emerging technologies and policies to promote sustainable, low-carbon energy use.

Suggested Readings

L.C. Witte, P.S. Schmidt, D.R. Brown -Industrial Energy Management and Utilization
Frank Kreith & D.Y. Goswami - Energy Conservation Handbook
Amlan Chakrabarti - Energy Engineering and Management
Bureau of Energy Efficiency (BEE), Government of India -Guidebook for Energy Auditors –
R.K. Rajput -Thermal Engineering –
H. Wayne Beaty -Electric Motor Handbook
Craig B. Smith- Energy Management Principles

DYNAMICS OF ELECTRIC VEHICLES

(3Credits-45 hours)(L-3: T-0: P-0)

Objective: *This course provides an introduction to the dynamic behaviour and performance characteristics of electric vehicles. It includes study of traction motors, battery systems, drive cycles, and vehicle control strategies. After completing this course, students will be able to understand how electric vehicle components interact to influence motion, stability, and efficiency. With the increasing shift toward sustainable transportation, this course prepares students to contribute to the design, analysis, and improvement of advanced electric mobility systems.*

Module I: Introduction to Electric Vehicle (15 hours)

History and benefits of Electric vehicles, Components of an EV, Comparison of IC engine vehicles and Electric vehicles, Vehicle layout and configuration, Types of electric vehicle, Types of Motors used in EV, Torque speed characteristics, Battery management systems, charging techniques and standards.

Module II: Fundamentals of Vehicle Dynamics (15 hours)

Design of Transmission system of EVs, Power train of HEV and EV.

Modelling and analysis of suspension systems, Braking and Steering systems for EVs, Stability and Control of EVs, Vehicle ride, Tire forces and Tire modelling of EVs.

Multi motor in wheel EVs, Safety of EVs.

Module III: Power Electronics and Control (15 hours)

Wiring Harness and architecture, HV and LV Harness design.

Basics of Induction motor, Open Loop v/f control, Basic pulse width modulation techniques, Vector control of IM drives.

Power converter design and PWM techniques, Modelling of PMSM drives, Vector Control of PMSM drives.

Course Outcomes:

After completion of the subject the students will be able to-

CO 1: Understand the architecture the components, types, benefits, and configurations of electric vehicle.

CO 2: Analyze the fundamentals of vehicle dynamics.

CO 3: Apply principles of power electronics and control to electric vehicle systems.

CO 4: Design and interpret wiring architecture and control strategies for electric vehicle propulsion and safety systems using modern engineering tools.

Suggested readings:

1. Iqbal Hussain, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press.
2. Nitesh Tiwari, Shekhar Yadav, Electric Vehicle (Green and Sustainable Transportation), Katson Books.
3. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press.
4. Berker B., James W. J., A. Emadi, Switched Reluctance Motor Drives, IEEE Wiley Press.
5. Bimal K. Bose, Modern Power Electronics and AC drives, Prentice Hall PTR.

ROTOR DYNAMICS

(3Credits-45 hours)(L-3: T-0: P-0)

Objective: *This course introduces the fundamental principles and dynamic behaviour of rotating machinery. It covers rotor vibration mechanisms, bearing characteristics, balancing methods, instability phenomena, FEM-based analysis, and condition monitoring techniques. By the end of the course, students will understand how mechanical, structural, and diagnostic factors interact to influence the stability, performance, and health of rotor systems.*

Module I: Fundamentals of Rotor Dynamics (15 hours)

Single Mass Rotors: Modelling, equation of motion, critical speed theory. Gyroscopic Effects in Rotors: Gyroscopic couples, whirling, forward/backward whirl. Torsional Vibrations: Torsional modelling, multi-degree systems, resonance. Transverse Vibrations: Bending modes, shaft flexibility, Campbell diagrams.

Module II: Bearings, Balancing & Rotor Instability (15 hours)

Fluid-film bearings, rolling element bearings, stiffness & damping. Experimental identification of stiffness, damping, cross-coupled terms. Balancing of Rotors: Static & dynamic balancing. Instability in Rotors: Oil-whirl, oil-whip, hysteretic instability, destabilizing cross-coupling.

Module III: Modelling, Analysis & Condition Monitoring (15 hours)

FEM Analysis of Rotors: Shaft element formulation, disk modelling, gyroscopic effects, critical speed prediction. Measurement & Signal Processing Techniques: Accelerometers, proximity probes, FFT, envelope analysis. Condition Monitoring of Rotors: Vibration signatures, fault diagnosis like misalignment, unbalance, rub, and looseness, Health monitoring.

Course Outcomes:

After completion of the subject the students will be able to-

CO 1: Explain the fundamental principles governing rotor vibrations, gyroscopic effects, and vibration modes in rotating systems.

CO 2: Analyze rotor behavior using torsional/transverse vibration models and evaluate rotor stability under various operating conditions.

CO 3: Apply balancing techniques, bearing dynamic coefficients, and FEM procedures to model and solve rotor dynamic problems.

CO 4: Evaluate and interpret vibration measurements using advanced signal processing techniques for rotor health assessment and condition monitoring.

Suggested readings:

1. Dara Childs, Turbomachinery Rotordynamics: Phenomena, Modeling, and Analysis, Texas A&M University.
2. J. S Rao, Rotor Dynamics, New Age International, 1996.
3. G. Genta, Dynamics of Rotating systems, Springer, 2005.
4. R Subbiah, J. E. Littleton, Rotor and Structural Dynamics of Turbomachinery, Springer, 2018.

DESIGN OF MEDICAL DEVICES (3Credits-45 hours)(L-3: T-0: P-0)

Objective: *This course covers the complete lifecycle of medical device innovation, from identifying clinical needs to regulatory compliance and commercialization. It explores design controls, risk management, bio-materials, and validation strategies. Students will learn to translate engineering concepts into safe, compliant medical products, preparing them to solve real-world clinical challenges in the MedTech industry.*

Module I: Clinical Needs, Regulations and Design Controls (10 hours)

Introduction to Medical Device Industry, Needs Finding and Concept generation-observation and problem identification. Introduction to Regulatory frameworks and standards: FDA, ISO and Design controls, Introduction to Intellectual Property: patents, trademarks and trade secrets.

Module II: Concept Generation, Risk and Human Factors (12 hours)

Ideation and Concept screening: SCAMPER, Morphological charts, Pugh Matrix. Risk Management: Hazard analysis, failure mode and effects analysis. Risk assessment: Severity and probability. Risk mitigation strategies. Human factors engineering: Usability standards, User Interface design for medical environment, Reduction of error. Design for Assembly and Design for Manufacturing, Ethics in medical device design.

Module III: Prototyping, Materials and Manufacturing (12 hours)

Biomaterials and their compatibility: Metals, polymers, ceramics. ISO standard biological evaluations: Cytotoxicity, Hemocompatibility, Sensitization. Surface modification and sterilization compatibility. Rapid Prototyping Techniques: 3D printing in medical applications. Laser cutting, CNC machining and soft tooling. PCB design basics. Manufacturing: Injection molding, Cleanroom standards and sterilization methods.

Module IV: Testing, Validation and Clinical Translation (11 hours)

Verification: Engineering testing, tensile electrical safety, fatigue. Validation: Simulation. Clinical Trials Strategy: Good clinical practice, phases of clinical trials. Reimbursement and business models: CPT and DRG codes. Value proposition for hospital procurement, Go-to-market strategies, Post-market surveillance requirements.

Course Outcomes:

After completion of the subject the students will be able to-

CO 1: Formulate a specific, validated clinical need statement by filtering observations and identifying stakeholders.

CO 2: Apply regulatory frameworks and design controls to categorize devices and plan the development pathway.

CO 3: Analyze device safety by executing a Risk Management plan (FMEA) and identifying failure modes.

CO 4: Select and justify appropriate biomaterials and manufacturing processes based on biocompatibility and cost constraints.

Suggested readings:

1. Zenios, Makower and Yock, Biodesign – The process of innovating medical technologies, Cambridge University Press, 2009.
2. Peter Ogradnik, Medical Device Design Innovation from Concept to Market, Elsevier, 2013.
3. Jagdish Chaturvedi, Inventing medical devices: A perspective from India, Create Space Independent Publishing Platform, 1st edition, 2015.
4. Gail Baura, Medical Device Technologies: A Systems Based Overview Using Engineering, Elsevier science, 2012.

**ADVANCED MECHANICS OF SOLIDS
(3Credits-45 hours)(L-3: T-0: P-0)**

Objective: This course provides an advanced understanding of deformation, stress analysis, and constitutive behaviour of solid materials using rigorous elasticity and continuum mechanics principles. It equips students with mathematical and analytical tools necessary to model complex stress-strain fields, evaluate structural behaviour under sophisticated loading, and solve boundary value problems involving bending,

torsion, curved members, and elastic foundations. By completing this course, students will be able to apply higher-level theoretical frameworks to analyze and design advanced structural components with enhanced precision.

Module I: Fundamentals of Stress, Strain & Mathematical Tools (15 Hours)

Introduction to Mechanics of Materials: Review of basic mechanics concepts. General approach to solving boundary value problems. Introduction to tensors: Stress and strain tensors. Gradient, divergence, and basic vector operators. Kinematics of Deformation: Motion and displacement fields, linearized strain measures, principal strains, strain transformation, compatibility conditions. Traction and Stress Concepts: Traction, Cauchy's stress theorem, octahedral shear stress and engineering stress.

Module II: Constitutive Relations & Basic Elasticity Solutions (15 Hours)

Equilibrium Equations: Derivation in Cartesian form, Physical interpretation. Generalized Hooke's law. Elementary Elasticity Boundary Value Problems: Displacement & stress formulation concepts. Airy's stress function. Bending of Prismatic Beams: Pure bending, symmetric vs asymmetric bending. Shear center. Shear stresses in thin-walled open sections.

Module III: Torsion, Curved Beams & Beam on Elastic Foundation (15 Hours)

Torsion of Beams: Thin-walled tubes & membrane analogy, warping effects. Bending of Curved Beams: Winkler-Bach formula, elasticity solution for simple curved beam cases. Beam on Elastic Foundation: Governing equation derivation, solution to beam on an elastic foundation subjected to a point load at the center, moment at the center.

Course Outcomes:

After completion of the subject the students will be able to-

CO 1: Explain fundamental concepts of stress, strain, material behavior, and deformation in elastic solids.

CO 2: Apply equilibrium equations, constitutive laws, and mathematical tools to analyze stresses and strains in basic structural components.

CO 3: Analyze bending, torsion, and complex loading conditions in prismatic and curved beams using appropriate elasticity methods.

CO 4: Evaluate structural responses and develop simplified elasticity-based models for engineering problems.

Suggested readings:

1. L.S. Srinath, "Advanced Mechanics of Solids" Tata McGraw Hill, 2007.
2. M.H. Sadd, "Elasticity: Theory, Applications and Numerics", Academic Press, 2006..
3. A. C. Ugural and S. K. Fenster, Advanced Strength and Applied Elasticity, Pearson, 2012.
4. S. P. Timoshenko and J. N. Goodier, Theory of Elasticity, McGraw-Hill, 1970.

Finite Element Methods in Mechanical Engineering (3Credits-45 hours)(L-3: T-0: P-0)

Objective: To introduce the fundamental concepts and theoretical basis of the Finite Element Method (FEM) as a powerful numerical technique for solving engineering problems, and to enable students to formulate and solve one-dimensional and two-dimensional structural problems using FEM.

Module 1: Mathematical Foundations and Basic Concepts (10 Hours)

Introduction to FEM: The need for numerical methods, advantages and applications of FEM in engineering.; Review of Mechanics of Solids: Basic concepts of stress and strain, stress-strain relations (constitutive equations), and strain-displacement relations.; Weighted Residual Methods: Introduction to the Weighted Residual Method (WRM), focusing on Galerkin's method as the primary formulation technique in FEM.; Variational Formulation: Concepts of Potential Energy, Principle of Minimum Potential Energy, and the Rayleigh-Ritz method for approximate solutions.

Module 2: One-Dimensional (1D) FEM Analysis (10 Hours)

Discretization and Shape Functions: Concept of discretization, different types of 1D elements. Coordinates (local and global) and the derivation of shape functions (linear and quadratic) for 1D elements.; Element Formulation: Derivation of the element stiffness matrix and element load vector using the Potential Energy and Galerkin's approaches for a general 1D bar element.; Assembly and Solution: Assembly of the Global Stiffness Matrix and Global Load Vector. Application of Boundary Conditions (e.g., displacement and force), and solving the resulting system of linear algebraic equations; Applications: Solving 1D bar problems and 1D heat conduction problems.

Module 3: Truss and Beam Elements (10 Hours)

Plane Truss Analysis: Formulation of the element stiffness matrix for a Plane Truss element in local coordinates.; Coordinate Transformation: Introduction to Local and Global Coordinate Systems and the use of the Transformation Matrix to transform the element stiffness matrix from local to global coordinates.; Solution of Truss Problems: Assembly and solution of Plane Truss problems (both determinate and indeterminate) including the effect of temperature change and initial strain.; Beam Element: Introduction to the Euler-Bernoulli beam theory. Derivation of the shape functions and the element stiffness matrix for a 1D beam element.

Module 4: Two-Dimensional (2D) FEM and Applications (10 Hours)

2D Plane Stress/Strain: Introduction to Plane Stress and Plane Strain conditions.; Element Types: Derivation of Shape Functions and the stiffness matrix for the Constant Strain Triangle (CST) element (the most basic 2D element). Introduction to the Four-Noded Quadrilateral element.; Higher-Order Elements and Numerical Integration: Brief introduction to Isoparametric Elements and the concept of Numerical Integration (e.g., Gauss Quadrature) for evaluating element matrices.; Field Problems and Post-Processing: Introduction to solving steady-state Heat Conduction problems in 2D. Brief discussion on Preprocessing (mesh generation) and Post-processing (result visualization and interpretation).

COURSE OUTCOME

Upon successful completion of this course, students will be able to:

CO1	Formulate the governing differential equations of a physical problem using the variational and weighted residual (Galerkin's) approaches.
CO2	Derive the element stiffness matrix and load vector for one-dimensional bar and truss elements using the Principle of Minimum Potential Energy.
CO3	Solve static 1D structural problems (bars and trusses) by assembling the global system of equations and imposing boundary conditions.
CO4	Apply the concept of shape functions and stiffness formulation to the basic two-dimensional Constant Strain Triangle (CST) element.

CO5	Interpret the results of FEM analysis (displacements, stresses, reactions) and relate them to the fundamental principles of solid mechanics.

Text/Reference**Books:**

Finite Element Analysis, S.S. Bhavikatti, 3rd Ed., New Age International Publishers
 Finite Element Procedures for Engg. Analysis by K J Bathe, PHI
 The Finite Element Methods by O C Zienkiewicz, TMH Edition.
 Introduction to Finite Element Methods by Abel and Desai, CBS Publishers.
 Concepts and Applications of finite elements analysis by Robert Cook, J Wiley Edition.

NON-LINEAR VIBRATIONS**(3Credits-45 hours)(L-3: T-0: P-0)**

Objective: *This course introduces the behavior of mechanical systems under nonlinear vibration, covering modeling techniques, nonlinear governing equations, approximate analytical methods, stability and bifurcation analysis, and numerical tools. It enables students to understand, analyze, and predict complex nonlinear responses in real-world engineering systems, preparing them to apply advanced vibration theories to design, diagnostics, and modern mechanical applications.*

Module I: Fundamentals of Nonlinear Vibrations (12 Hours)

Mechanical vibration: linear vs. nonlinear systems, types of forces & responses. Conservative and non-conservative systems. Equilibrium points & qualitative analysis: potential wells, center, focus, saddle. Common nonlinear phenomena: multiple responses, bifurcations, jump phenomena.

Module II: Nonlinear System Modelling & Governing Equations (12 Hours)

Derivation of nonlinear equations of motion: Force & moment approach, Lagrange principle, Extended Hamilton's principle, Multibody approach. Linearization techniques. Galerkin's method for continuous systems. Ordering techniques, scaling parameters, book-keeping parameter. Common nonlinear equations: Duffing, Van der Pol, Mathieu, Hill.

Module III: Approximate & Perturbation Methods (9 Hours)

Straightforward expansions & nonuniformity. Harmonic balance method, Linstedt–Poincaré method, Method of Averaging, Method of Multiple Scales, Method of Normal Forms. Incremental Harmonic Balance. Modified Linstedt–Poincaré method.

Module IV: Stability Analysis, Numerical Techniques & Applications (12 Hours)

Lyapunov stability criteria. Stability analysis from perturbed & reduced equations. Bifurcation of fixed-point responses: pitchfork, saddle-node, trans-critical. Hopf bifurcation. Stability & bifurcation of periodic responses, monodromy matrix, Poincaré section. Numerical methods: Runge-Kutta, Wilson-Beta. Frequency response curves; polynomial & algebraic solution methods. Basin of attraction (point-to-point & cell-to-cell mapping). Lyapunov exponents, FFT analysis, fractal dimensions. Applications: Duffing oscillator, Van der Pol oscillator. Multi DOF non linear systems.

Course Outcomes:

After completion of the subject the students will be able to-

CO 1: Explain the fundamental characteristics of nonlinear vibratory systems, including equilibrium behaviour, nonlinear responses, and bifurcation phenomena.

CO 2: Derive and construct nonlinear equations of motion for mechanical and continuous systems using energy principles and modelling techniques.

CO 3: Apply approximate and perturbation methods to investigate nonlinear vibration responses, including resonance, jump, and parametric excitation.

CO 4: Evaluate stability, bifurcation patterns, and numerical simulations of nonlinear systems and interpret results for engineering applications.

Suggested readings:

1. S. S. Rao, Mechanical Vibrations, Pearson, 2011.
2. A. H. Nayfeh and D. T. Mook, Nonlinear Oscillations, Wiley, 1995.
3. J. S. Rao, Nonlinear Vibrations, New Age International, 2012.
4. D. J. Inman, Engineering Vibrations, Pearson, 2013.
5. G. Genta, Vibration Dynamics and Control, Springer, 2008.

Welding Technology

(3Credits-45 hours)(L-3: T-0: P-0)

Objectives: To familiarize the students with the fundamentals of arc welding processes, weld joint design, metallurgical aspects in welding of steel, and assessing the quality and suitability of weld joints., To equip the students' technological input for handling the problems in welding of selected metals and alloys.

Module 1: (6 Hours)

- a) Introduction: Evolution of welding; classification of welding processes; heat sources and shielding methods.
- b) Physics of Welding Arc: Welding arc; voltage distribution along the arc; thermionic and non-thermionic cathodes; theories of cathode and anode mechanism; arc characteristics and its relationship with power source; arc efficiency; heat generation; effect of type of shielding gas on arc; isotherms of arcs.
- c) Welding Power Sources: Conventional welding power sources; constructional features; static and dynamic characteristics; duty cycle; influence of inductance on arc and power source characteristics; internal and external regulation; specific power source requirements; special welding power sources.

Module 2: Arc Welding Processes (6 Hours)

Consumable electrode welding processes. Manual metal arc (MMA) welding; Gas metal arc welding; pulsed MIG welding; Submerged arc welding, Significance of flux-metal combination; Electroslag welding; heat generation; principle; Gas tungsten arc welding; selection of polarity, Plasma arc welding; transferred and nontransferred plasma arc welding; selection of gases; welding parameters; keyhole technique.

Module 3: Heat flow in welding (8 Hours)

Effect of welding parameter on heat distribution; calculation of peak temperatures; thermal cycles; cooling rate and solidification; Residual stresses and their distribution in welds; influence of residual stresses in static and dynamic loading, distortion.

Module 4: Design of weld joints (8 Hours)

Introduction to design; engineering properties of steels; Type of welds and weld joints; description of welds: terminology, definitions and weld symbols; edge preparation; sizing of welds in structure; Design for Static loading, Weld Calculations in lap, butt and fillet welds; design for fatigue loading, Introduction to Fatigue; nature of the fatigue process; fatigue strength; factors affecting fatigue life; improvement methods for fatigue strength; reliability analysis and safety factors applied to fatigue design.

Module 5: Testing and inspection of weld joints (6 Hours)

Chemical tests; Metallographic tests; Hardness tests; Mechanical test for groove and fillet welds-full section, reduced section and all-weld- metal tensile tests, root, face and side bend tests, fillet weld break tests,

creep and fatigue testing. Non-Destructive Testing of Weldments; Visual inspection; Dye-penetrant inspection; Magnetic particle inspection; Ultrasonic inspection principle of ultrasonic testing, Radiographic inspection –principle of radiography, X-ray tubes, gamma-ray sources, defect discernibility; Eddy current inspection; Leak tests: N.D.T. Standard procedure for specification and qualification of welding procedure.

Module 6: Weldability of metals (8 Hours)

Solidification of weld metal; heat affected zone (HAZ), factors affecting properties of HAZ; gas-metal, slag-metal and solid state reactions in welding and their influence on soundness of weld joint; lamellar tearing and hydrogen damage; weldability; definition, factor affecting the weldability of steel Carbon equivalent. weldability of steel, cast iron and aluminium alloys of commercial importance, failure analysis of welded joints.

Suggested Readings

1. The Metallurgy of Welding, 6th Edition, Lancaster, William Andrew Publishing, NY.
2. Principles of Welding (Processes, Physics, Chemistry and Metallurgy), Robert and Messler, Wiley Interscience Publishers.
3. Welding Hand Book Vol. 5; 7th edition, AWS, 1984.
4. Welding METALLURGY, S Kou, John Wiley, USA, 2003.
5. NPTEL LINK: <https://nptel.ac.in/courses/112/107/112107090/>
6. NPTEL LINK: <https://nptel.ac.in/courses/112/103/112103263/>
7. NPTEL LINK: <https://nptel.ac.in/courses/112/107/112107090/>

Course Outcomes:

After completing the course the student will be able

CO1: To define the welding process.

CO2: To classify the different types of welding.

CO3: To identify suitable processes for producing quality weldments based on materials and applications.

CO4: To inspect the quality of weldments and suggest methods of producing quality joints.

CO5: To compare the selection and design of appropriate consumables for welding involving different types of materials.

CO6: To an environment for developing and adopting in energy saving and eco-friendly techniques in welding industries.

Mechanical Micromachining

(3Credits-45 hours)(L-3: T-0: P-0)

Objective: To introduce the fundamental physical principles governing manufacturing at the micro-scale, enable students to analyze the mechanics of material removal in mechanical micromachining processes, and describe the associated tooling, machine systems, and metrology used in fabricating micro-components.

Module 1: Fundamentals and Scaling Effects (10 Hours)

Introduction to Micro-Manufacturing: Definition, necessity, historical perspective, and scope of micro-products. Overview of micro-manufacturing methods (subtractive, additive, and hybrid).; Scaling Laws: Understanding the role of scale (component size: 1–1000 μm). Analysis of how physical parameters scale down: comparison of surface forces vs. volume forces, inertia, surface tension, friction, and thermal effects; Difference between Macro and Micro Machining: Comparison based on process mechanics (chip formation, ductility), machine components, overall machine structure, and operating environment.; Classification of Micro-Manufacturing: Differentiation between non-lithography-based (Mechanical) and lithography-based (MEMS) processes.

Module 2: Micro-Cutting Mechanics and Process Phenomena (10 Hours)

Micro-Machining Mechanism: Mechanics of micro-cutting, elastic deformation vs. plastic deformation, and ductile regime cutting.; Minimum Chip Thickness (MCT): Concept, influence of tool edge radius, and its significance in determining the material removal threshold.; Process Anomalies: Detailed study of Burr formation (types and control), Built-Up Edge (BUE) (formation and consequences), and their effects on

precision.; Surface Quality: Surface roughness generation mechanisms in micro-cutting. Role of cutting fluids and their effectiveness at the micro-scale.; Material Considerations: Influence of workpiece grain size relative to chip thickness.

Module 3: Micromachining Systems and Tooling (10 Hours)

Micro Tooling: Requirements of micro cutting tools (size, material, precision). Fabrication of Micro Cutting Tools (Focused Ion Beam, Wire EDM, Laser-based methods).; Micro Machine Structure: Structural requirements for high precision and stiffness. Design considerations for controlling thermal drift and vibration.; Miniature Machine Tools: Introduction to specialized miniature and desktop machine tools. Kinematic design and challenges in miniaturization.; Actuators and Drives: High-speed spindles (air bearings, magnetic bearings) and high-resolution motion control systems (piezoelectric actuators, linear motors). Importance of Spindle Run-out.

Module 4: Diamond Turning, Metrology, and Applications (10 Hours)

Diamond Turning: Detailed study of the Single Point Diamond Turning (SPDT) process for generating smooth, complex surfaces (e.g., optics). Machine configurations, mechanism, and applications (optical components, molds).; Metrology for Micromachining: Challenges in micro-metrology. Measurement of micro-features, surface roughness, and form errors.; Measurement Techniques: Introduction to necessary measurement tools: Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), and optical interferometry.; Applications and Future Trends: Case studies in various fields: Optics (free-form optics, microlens arrays), Biomedical (micro-implants, micro-fluidics), Automotive (injection nozzles), and future development trends.

Textbooks

- V. K. Jain, *Introduction to Micromachining* (2nd Edition), Narosa Publishing House. (Core textbook based on NPTEL recommendation)
 K. Cheng and D. Huo, *Micro-Cutting: Fundamentals and Applications*, Wiley.
 D. A. Dornfeld and D. E. Lee, *Precision Manufacturing*, Springer US.

Course Outcomes (COs)

Upon successful completion of this course, students will be able to:

CO1	Analyze the behavior of scaling laws (e.g., thermal, inertial) and differentiate between macro- and micro-machining mechanics.
CO2	Predict and explain the effects of minimum chip thickness, burr formation, and BUE on the quality of a micro-machined surface.
CO3	Describe the architecture, functional components, and tooling requirements for high-precision micro-machine tools.
CO4	Apply the principles of Single Point Diamond Turning (SPDT) and select appropriate metrology techniques (e.g., AFM, SEM) for inspecting micro-components.

Manufacturing Guidelines for Product Design
(3Credits-45 hours)(L-3: T-0: P-0)

Objective: *To enable students to understand the relationship between product design and manufacturing processes, and to develop the ability to design components and assemblies that are efficient to produce, assemble, and inspect by applying principles of DFM, DFA, and process-capability-based design.*

Module I (10 hours):

Introduction to product design and manufacturing: product life-cycle; traditional vs integrated design-manufacturing thinking; process capabilities; overview of manufacturing processes and their limitations; material selection principles.

Module II (10 hours):

Robust design and design for “X” (DFX) concepts; design for manufacturability and assembly (DFMA); ergonomics in product design; design for manual assembly.

Module III (10 hours):

Process-specific design guidelines: casting (sand, die), injection molding and extrusion, sheet-metal working, machining, powder metallurgy.

Module IV (10 hours):

Joining and assembly design: design for adhesive bonding, welding, brazing/soldering, mechanical fastening; design guidelines for plastics joining (induction, ultrasonic, spin, vibration welding); hole-making guidelines.

Module V (Optional / Project Module – integrated within the 40 hours):

Design for environment; product architecture; rapid prototyping (SLA, SLS, etc.); sustainability and manufacturing perspective in product design; concurrent design-manufacture approach.

Learning Outcomes (Course Outcomes)

After completing the course successfully the students will be able to-

CO 1: Explain how manufacturing processes influence product design and apply design-for-manufacturability (DFM) & design-for-assembly (DFA) principles.

CO 2: Develop design guidelines for different manufacturing processes (casting, machining, molding, joining) to minimize cost and increase quality.

CO3: Evaluate design alternatives from a manufacturing and environmental perspective, using process capability, robustness, and sustainable design thinking.

Suggested Readings / References:

Boothroyd, Dewhurst & Knight, *Product Design for Manufacture and Assembly*

Design for Manufacturability Handbook by James G. Bralla, *McGraw-Hill*

Integrated Product and Process Design and Development, Edward B. Magrab et al. *CRC Press*

Advanced Manufacturing Methods
(3Credits-45 hours)(L-3: T-0: P-0)

Objective: To make the learner familiar with various advanced manufacturing processes; their need and capabilities. To make them aware about the modern trends in the field of manufacturing.

Module I : Introduction (3 hours)

Introduction to Modern Manufacturing Methods, their needs in today's manufacturing scenario, identification and characteristics of these processes, conventional versus modern manufacturing methods.

Module II: Mechanical Processes (8 hours)

Abrasive jet machining, Water jet machining, Abrasive water jet machining, Abrasive flow machining, Ultrasonic machining, Ultrasonic welding, their working principles, equipments, process capabilities, applications, advantages and limitations.

Module III: Chemical and Electrochemical Processes (8 hours)

Chemical machining, Photo chemical machining, Electrochemical machining, drilling, grinding, deburring, their working principles, equipments, process capabilities, applications, advantages and limitations.

Module IV: Electrothermal Processes (8 hours)

Electrodischarge machining (EDM), Electrodischarge wire cutting or wire EDM, Electrodischarge grinding, Electrochemical discharge grinding, their working principles, equipment, process capabilities, applications, advantages and limitations. Electron Beam Machining, Electron Beam welding, Plasma arc cutting, Ion beam machining.

Module V: Laser Processing (8 hours)

Process principle, type of laser, equipment, and laser processes: drilling, cutting, machining, welding, heat treating, cladding; applications, advantages and limitations.

Module VI: Introduction to some emerging trends in manufacturing (5 hours)

Micromanufacturing, manufacturing processes lead towards micro-manufacturing, micro electro mechanical systems (MEMS), LIGA, Rapid prototyping, 3D printing, concept of nanotechnology and nano-processing techniques.

COURSE/LEARNING OUTCOMES

After completing the course successfully the students will be able to-

CO1: Define and characterise advanced manufacturing and machining processes, their evolution and usefulness of them & compare with conventional manufacturing. Acquire fundamental knowledge about some emerging trends like rapid prototyping, 3D printing, micro-manufacturing etc.

CO2: Know the working and process capabilities of Mechanical processes like Abrasive jet machining, Water jet machining, Abrasive water jet machining, Abrasive flow machining, Ultrasonic machining etc.

CO3: Know the working and process capabilities of Chemical and Electrochemical Processes like chemical machining, Photo chemical machining, Electro-chemical machining etc.

CO4: Know the working and process capabilities of Electro-thermal Processes like

Suggested Readings

1. V.K. Jain, **Advanced Machining processes**, Allied publishing pvt. Ltd.
2. G. F. Benedict, **Nontraditional manufacturing processes**, Marcel Dekker Inc.
3. J.A McGeogh, **Advanced Methods of Machining**, Chapman and Hall.
4. PK. Mishra, **Nonconventional Machining**, Narosa Publishing House.
5. G.Boothroyd and W.A. Knight, **Fundamentals of Machining and Machine Tools**, CRC Press T&F Group.
6. NPTEL LINK: <https://nptel.ac.in/courses/112/103/112103202/>
7. NPTEL LINK: <https://nptel.ac.in/courses/112/104/112104028/>

Surface Engineering

(3Credits-45 hours)(L-3: T-0: P-0)

Objective: The course is designed to have systematic and comprehensive understanding on various aspects related with surface engineering of metallic components for enhanced tribological life.

Module 1: Introduction (9 hours)

Purpose and need of surface engineering, Surface sub-surface regions, Classification of surface modification techniques, Scope of surface engineering, Role of surface properties on friction and wear

Module 2: Wear mechanisms (10 hours)

- a) Advantages and limitations of surface engineering, Materials properties and its effect on performance of components, Fundamentals of wear mechanism: Adhesive wear, Fundamentals of wear mechanism: Abrasive wear, Fundamentals of wear mechanism: Surface fatigue wear.
- b) Fundamentals of wear mechanism: Corrosion wear, Fundamentals of wear mechanism: Cavitation wear, Fundamentals of wear mechanism: Erosion wear and Fretting wear, Fundamentals of wear mechanism: Diffusive wear and Seizure, Evaluation of damage on wear surfaces

Module 3: Materials for controlling wear (9 hours)

- a) Material properties for controlling wear: Material properties for specific type of wear, Structure and wear relationship for materials of commercial importance, New coating system: Functionally Graded Thermal Barrier Coatings (FGM), Thermal Barrier Coatings (TBCs), Guidelines for selection of materials for engineering the surface.

Module 4: Processes for controlling wear: Structure and Composition Modification (11 hours)

- a) Fundamental approaches of structural modification, Candidate materials for structural modification, Processes: Localised plastic deformation Processes: Localised plastic deformation, Shot peening, Burnishing
- b) Transformation hardening, Laser Hardening Processes, Induction hardening. Advantages, limitations and application, Fundamental approach of changing chemical composition, Candidate material for controlling wear.
- c) Carburizing and plasma carburizing, Carbo-nitriding and Cyaniding, Nitriding and plasma nitriding, Chromizing and Aluminizing V. Boronizing
- d) Laser Plasma TIG alloying, Vapor deposition and Ion implantation, Chemical vapour deposition (CVD) and Ion beam assisted CVD, Physical vapour deposition, Advantages, limitations and application

Module 5: Processes for Controlling Wear (8 hours)

- a) Coatings and Overlays: Fundamentals of approach, Heat input, and dilution, Welding based methods, Laser cladding Thermal spray based methods.
- b) Coatings and Characterization: Electrolysis based methods, Advantages, limitations and application Purpose, Characterization of soundness, Thickness measurement, Surface roughness measurement
- c) Characterization of Engineered Surfaces: Mechanical properties, Chemical properties, Metallurgical properties, Wear properties.

Course outcomes:

After completing the course successfully the students will be able to-

1. Define and the different types of surface engineering, and wear mechanisms. .
2. Classify and compare the surface engineering methodologies.
3. Analyze the processes for controlling wear.
4. Identify the suitable surface engineering technique as per the requirement.
5. Find methods to improve the surface characteristics.

Suggested Readings

1. ASM Handbook, Surface Engineering, ASM, (1995) Ohio.
2. D K Dwivedi, Surface Engineering: Enhancing life of tribological components, Springer (2017) New Delhi.
3. Materials and Surface Engineering in Tribology, Willey (2007).
4. Materials Degradation and its control by surface engineering, Imperial College Press, (2006),
5. Surface engineering in metals, CRC Press (1999) London.
6. <https://nptel.ac.in/courses/112/107/112107248/>

**Mechanical Micromachining
(3Credits-45 hours)(L-3: T-0: P-0)**

Objective: To introduce the **fundamental physical principles** governing manufacturing at the micro-scale, enable students to **analyze the mechanics** of material removal in mechanical micromachining processes, and describe the associated **tooling, machine systems, and metrology** used in fabricating micro-components.

Module 1: Fundamentals and Scaling Effects (10 Hours)

Introduction to Micro-Manufacturing: Definition, necessity, historical perspective, and scope of micro-products. Overview of micro-manufacturing methods (subtractive, additive, and hybrid).; **Scaling Laws:** Understanding the role of scale (component size: 1–1000 μm). Analysis of how physical parameters scale down: comparison of surface forces vs. volume forces, inertia, surface tension, friction, and thermal effects; **Difference between Macro and Micro Machining:** Comparison based on process mechanics (chip formation, ductility), machine components, overall machine structure, and operating environment.; **Classification of Micro-Manufacturing:** Differentiation between non-lithography-based (Mechanical) and lithography-based (MEMS) processes.

Module 2: Micro-Cutting Mechanics and Process Phenomena (10 Hours)

Micro-Machining Mechanism: Mechanics of micro-cutting, elastic deformation vs. plastic deformation, and ductile regime cutting.; **Minimum Chip Thickness (MCT):** Concept, influence of tool edge radius, and its significance in determining the material removal threshold.; **Process Anomalies:** Detailed study of **Burr formation** (types and control), **Built-Up Edge (BUE)** (formation and consequences), and their effects on precision.; **Surface Quality:** Surface roughness generation mechanisms in micro-cutting. Role of cutting fluids and their effectiveness at the micro-scale.; **Material Considerations:** Influence of **workpiece grain size** relative to chip thickness.

Module 3: Micromachining Systems and Tooling (10 Hours)

Micro Tooling: Requirements of micro cutting tools (size, material, precision). **Fabrication of Micro Cutting Tools** (Focused Ion Beam, Wire EDM, Laser-based methods).; **Micro Machine Structure:** Structural requirements for high precision and stiffness. Design considerations for controlling thermal drift and vibration.; **Miniature Machine Tools:** Introduction to specialized miniature and desktop machine tools. Kinematic design and challenges in miniaturization.; **Actuators and Drives:** High-speed spindles (air bearings, magnetic bearings) and high-resolution motion control systems (piezoelectric actuators, linear motors). Importance of **Spindle Run-out**.

Module 4: Diamond Turning, Metrology, and Applications (10 Hours)

Diamond Turning: Detailed study of the **Single Point Diamond Turning (SPDT)** process for generating smooth, complex surfaces (e.g., optics). Machine configurations, mechanism, and applications (optical components, molds).; **Metrology for Micromachining:** Challenges in micro-metrology. Measurement of micro-features, surface roughness, and form errors.; **Measurement Techniques:** Introduction to necessary measurement tools: **Atomic Force Microscopy (AFM)**, **Scanning Electron Microscopy (SEM)**, and optical interferometry.; **Applications and Future Trends:** Case studies in various fields: **Optics** (free-form optics, microlens arrays), **Biomedical** (micro-implants, micro-fluidics), **Automotive** (injection nozzles), and future development trends.

Textbooks

V. K. Jain, *Introduction to Micromachining* (2nd Edition), Narosa Publishing House. (Core textbook based on NPTEL recommendation)

K. Cheng and D. Huo, *Micro-Cutting: Fundamentals and Applications*, Wiley.

D. A. Dornfeld and D. E. Lee, *Precision Manufacturing*, Springer US.

Course Outcomes (COs)

Upon successful completion of this course, students will be able to:

CO1	Analyze the behavior of scaling laws (e.g., thermal, inertial) and differentiate between macro- and micro-machining mechanics.
CO2	Predict and explain the effects of minimum chip thickness, burr formation, and BUE on the quality of a micro-machined surface.
CO3	Describe the architecture, functional components, and tooling requirements for high-precision micro-machine tools.
CO4	Apply the principles of Single Point Diamond Turning (SPDT) and select appropriate metrology techniques (e.g., AFM, SEM) for inspecting micro-components.

Minor Courses

ENGINEERING MECHANICS

(3 Credits – 45 hours) (L-T-P: 2-1-0)

Objective: To provide foundational knowledge of statics, dynamics, and mechanics of rigid bodies, including force systems, friction, and equilibrium analysis. It aims to develop skills in analysing Truss, motion, energy principles, and vibrations in mechanical systems. Additionally, it introduces the application of virtual work, stability, and dynamics of rigid and particle systems in engineering contexts.

Module I (9 hours)

- Force Systems Basic concepts, Particle equilibrium in 2-D and 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.
- Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack and differential screw jack.

Module II (9 hours)

Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams and types of beams; Frames and Machines.

Module III (9 hours)

Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone.

Module IV (10 hours)

- Particle dynamics- Rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). 3-D curvilinear motion; Relative and constrained motion; Newton's 2nd law (rectangular, path, and polar coordinates). Work, kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).
- Introduction to Kinetics of Rigid Bodies- Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Module V (7 hours)

Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums.

Course Outcomes

After completing the course successfully the students will be able to-

CO1 : Identify and recall the basic principles of engineering mechanics, including force systems, friction, equilibrium, motion, vibrations, and the fundamental governing laws and equations. (Remembering)

CO2 : Interpret and explain the concepts of 3D equilibrium, centroid, moment of inertia, virtual work, and energy methods, and illustrate their relevance in engineering problem-solving. (Understanding)

CO3 : Use the principles of mechanics to solve engineering problems involving force analysis, trusses, beams, particle motion, and vibration systems. (Applying)

CO4 : Evaluate and analyze complex mechanical systems considering stability, motion, and energy interactions through techniques such as D'Alembert's principle, work-energy methods, method of joints, method of sections, and rigid-body dynamics. (Analyzing)

Suggested Readings

1. R.K. Bansal, Engineering Mechanics, Laxmi Publication (P) Ltd.
2. S. Timoshenko and D.H. Young, Engineering Mechanics McGraw Hill Int
3. Mariam and Craig, Engineering Mechanics, Wiley.
4. K.L. Kumar, Engineering Mechanics, McGraw Publishing Co.
5. Irving H. Shames , Engineering Mechanics, 4th Edition, Prentice Hall
6. F. P. Beer and E. R. Johnston , Vector Mechanics for Engineers, Vol I - Statics, Vol II, Dynamics, Tata McGraw Hill
7. Shanes and Rao , Engineering Mechanics, Pearson Education
8. Hibler and Gupta , Engineering Mechanics (Statics, Dynamics), Pearson Education.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://nptel.ac.in/courses/112106286	Prof. K. Ramesh, Prof. Tarkes Dora Pallicity	IIT Madras
2	https://nptel.ac.in/courses/112106180	Prof. Anubhab Roy	IIT Madras
3.	https://nptel.ac.in/courses/112103108	Prof. U.S. Dixit, Dr. G. Saravana Kumar	IIT Guwahati

FLUID MECHANICS AND FLUID MACHINES (Minor)

(3Credits – 45hours) (L-T-P: 3-0-0)

Objective: To introduce fundamental concepts of fluid properties, pressure measurement, and fluid forces, teach principles of fluid static and dynamics including flow types, boundary layers, and dimensional analysis, and explore the working principles, pumps, and turbines.

Module I (13 hours)

Definition of fluid, Units and dimensions-Properties of fluids, Pascal law, Pressure measurement manometer, types of manometer and its application, Newton's law of viscosity, Forces on submerged plane and curved surfaces, buoyant force, metacentre, centre of buoyancy, equilibrium of floating and submerged body. Types of fluid flow: steady, unsteady, uniform, non-uniform, laminar, turbulent, compressible, incompressible, rotational, irrotational, one, two, three dimensional flows, velocity, acceleration, Velocity potential function, Stream function. Bernoulli's equation and its applications to Venturimeter, Orificemeter and Pitot tube.

Module II (10 hours)

Introduction to laminar flow, Reynolds No, laminar flow through circular pipe and parallel plate. Turbulent flow: Reynold's experiment, laws of fluid friction, shear stress, types of boundary, Prandtl length concept, velocity distribution, mean velocity, velocity profile, Darcy Weisbach equation, friction factor.

Module III(6 hours)

Concept of boundary layer, laminar boundary layer, turbulent boundary layer, Laminar sub layer, Boundary layer thickness, displacement thickness, momentum thickness, energy thickness. Flow around submerged bodies- Streamlined and Bluff bodies.

Module IV (4 hours)

Introduction dimensional analysis. Need for dimensional analysis, Buckingham's pi theorem and its application.

Module V (12 hours)

Introduction to Fluid machines, types of fluid machines, classification of pumps, Centrifugal pumps, working principle, work done by the impeller, Reciprocating pump – working principle, types of reciprocating pump, Work done and power of reciprocating pump. Classification of water turbines, heads and efficiencies, velocity triangles- Pelton wheel, Francis turbine and Kaplan turbines.

Virtual Lab

Verification of Bernoulli's equation
Determination of coefficient of discharge of Venturimeter
Characteristic curves of Pelton wheel
Characteristic curves of Francis turbine
Characteristic curves of Reciprocating pump

Course Outcomes

After completing the course successfully the students will be able to-

At the end of the course students will be able to:

CO1: Define types of fluid and flow, the properties of fluids, basic law of fluid mechanics, basic fundamental theories of fluid mechanics, types of turbines, pumps and various hydraulic equipment, function and characteristic of hydraulics machines. (*Remembering*)

CO2: Explain different types of fluids, types of fluid flow, fundamental law of fluid mechanics, basic fundamental theories of fluid mechanics, various fluid mechanic equipment and hydraulics machines (*Understanding*)

CO3: Solve problems of fundamental law of fluid mechanics and work done and various efficiencies of turbines, pumps and hydraulic machines. (*Applying*)

Mapping of CO with PO & PSO**Suggested Readings**

1. Sukumar Pati, Fluid Mechanics and Hydraulic Machines, Tata McGraw Hill.
2. Dr. R.K. Bansal, Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications.
3. R.K Rajput, Textbook on Fluid Mechanics and Hydraulic Machines, S. Chand.
4. Y. A. Cengel, Fluid Mechanics Fundamentals and Applications, Tata McGraw Hill.
5. P.N. Modi and S.M. Seth, Hydraulics and fluid Mechanics including hydraulics machines, Standard Book House.

Alternative NPTEL/SWAYAM Course:

Sr. No	NPTEL/SWAYAM COURSE NAME	Name of Instructor	Hosting Institute
1	https://www.vlab.co.in/index.php		

2	https://nptel.ac.in/courses/112105171 Fluid Mechanics	Prof. Chakraborty Suman	IIT Kharagpur
3	https://nptel.ac.in/courses/112104118 Fluid Mechanics	Prof. Gautam Biswas, Prof. Chakraborty Suman	IIT Kanpur
4	https://nptel.ac.in/courses/112105206 Fluid Machines	Prof. Chakraborty Suman	IIT Kharagpur

BASIC THERMODYNAMICS**(3Credits-45 hours)(L-3: T-0: P-0)**

Objective: To provide an in-depth understanding of thermodynamic principles, including the laws of thermodynamics, entropy, and thermodynamic properties of substances. It aims to develop knowledge on air standard cycles and internal combustion engines, along with their performance and efficiency.

Module I: Fundamentals of Thermodynamics (10 Hours)

Thermodynamic systems and control volumes; properties, states, and processes; exact and inexact differentials; thermodynamic definition of work and displacement work; path dependence of work; thermodynamic equilibrium. Temperature, thermal equilibrium, Zeroth Law, temperature scales, and common thermometers. Definition of heat; examples of heat and work interactions.

First Law of Thermodynamics for cyclic and non-cyclic processes; limitations of the First Law; internal energy and enthalpy.

Module II: First and Second Laws for Flow and Non-Flow Processes (10 Hours)

General energy equation for a control volume; steady-state and steady-flow processes; applications to common flow devices; unsteady flow processes.

Second Law of Thermodynamics: heat engines and refrigerators; efficiency and COP; Kelvin–Planck and Clausius statements; reversible and irreversible processes; Carnot cycle and Carnot theorems.

Clausius theorem, entropy definition, Clausius inequality, and principle of entropy increase; entropy changes in various processes.

Module III: Properties of Pure Substances and Ideal Gases (10 Hours)

Pure substances: p-v, p-T, p-v-T, T-s, and h-s (Mollier) diagrams; dryness fraction; thermodynamic property charts. Equation of state of ideal gases; specific heats; internal energy, enthalpy, and entropy relations for ideal gases. Equations of state, compressibility factor and charts; gas mixtures—Dalton's Law, mixture properties, internal energy, enthalpy, and specific heats of mixtures.

Module IV: Thermodynamic Cycles and IC Engines (10 Hours)

Air-standard cycle assumptions; working and efficiency of Otto, Diesel, Dual, IC engines: definition, classification, performance parameters; construction and working principles of 2-stroke and 4-stroke engines; petrol and diesel engines; comparison of petrol and diesel engines.

Course Outcomes:

After completing the course successfully the students will be able to-

CO1: Explain the fundamental concepts of thermodynamic systems, properties, energy interactions, and the First and Second Laws of Thermodynamics.

CO2: Apply the principles of thermodynamics to analyze flow and non-flow processes, evaluate entropy changes, and interpret thermodynamic property diagrams and charts.

CO3: Analyze ideal gas behavior, gas mixtures, thermodynamic cycles, and internal combustion engines to determine performance parameters and compare cycle efficiencies.

Suggested Readings

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., Fundamentals of Thermodynamics, John Wiley and Sons
2. Nag, P.K, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd,
3. Cengel, Boles, Thermodynamics An Engineering Approach, McGraw-Hill Publishing Co. Ltd
4. <https://archive.nptel.ac.in/courses/112/106/112106310/> (Engineering Thermodynamics)

Theory of Machines

(3Credits-45 hours)(L-3: T-0: P-0)

Objective: To introduce students to the fundamental principles of **Kinematics and Dynamics of Machinery**, enabling them to identify, analyze, and understand the motion and force transmission characteristics of basic machine elements and common mechanisms.

Module 1: Fundamentals of Mechanisms (10 Hours)

Introduction: Definition of **Link, Kinematic Pair, Kinematic Chain, Mechanism, and Machine**. Differentiating between a mechanism and a machine.

Kinematic Pairs: Classification based on the type of relative motion and nature of contact ; lower and higher pairs.

Degrees of Freedom (DOF): Concept of **Mobility. Grubler's Criterion** (without detailed derivation) for calculating the DOF of planar mechanisms.

Kinematic Chains and Inversions: **Four-bar chain** and its common inversions. **Single Slider Crank Chain** and its inversions. **Double Slider Crank Chain** and its inversions

Steering Gear mechanism fundamentals

Module 2: Velocity and Acceleration Analysis (10 Hours)

Kinematic Analysis: Need for velocity and acceleration analysis.

Velocity Analysis (Graphical): **Relative Velocity Method** applied to the four-bar mechanism and the slider-crank mechanism. Concept of **Instantaneous Centre of Velocity (IC)** and the **Aronhold-Kennedy Theorem of Three Centres**.

Acceleration Analysis (Graphical): Components of acceleration: tangential, radial (centripetal), and **Coriolis** acceleration (qualitative understanding and application). Relative Acceleration Method applied to the four-bar mechanism.

Module 3: Power Transmission and Control Elements (10 Hours)

Gears and Gear Trains: Kinematics of gears. **Law of Gearing** (qualitative). Standard terminology; Classification of gears (Spur, Helical, Bevel, Worm); **Gear Trains:** Simple, compound, and **epicyclic (planetary) gear trains**. Calculation of **Velocity Ratio** for simple and compound gear trains, and basic analysis of epicyclic trains using the tabular method.

Cams and Followers: Classification of cams and followers. Standard types of follower motion (Uniform Velocity, Simple Harmonic Motion). Drawing the **Displacement Diagram** for various motions

Clutches and Brakes: Basic working principle and classification of clutches (single plate, centrifugal). Basic working principle and classification of brakes (block, internal expanding shoe).

Module 4: Dynamics of Machines (10 Hours)

Dynamics Introduction: Flywheel: Function and location. Calculation of **Mass Moment of Inertia** of a flywheel **Turning Moment Diagram (TMD)** for single-cylinder I.C. engine. **Fluctuation of Energy** and **Coefficient of Fluctuation of Speed.**;

Governors: Function of a governor. Classification: **Centrifugal Governors** (Watt, Porter, Proell). Simple problems on Porter Governor (defining height and speed change). Differentiating between a **Governor** and a **Flywheel.**;

Balancing of Rotating Masses: Concept of **Static and Dynamic Balancing**. Balancing of a single rotating mass by a single mass in the same plane and in a different plane.

Textbooks

S. S. Rattan, *Theory of Machines*, McGraw Hill Education.

Ghosh and Mallik, *Theory of Mechanisms and Machines*, East West Press Pvt. Ltd.

V.P Singh, *Theory of Machines*, Dhanpat Rai Publisher

R. S. Khurmi and J. K. Gupta, *Theory of Machines*, S. Chand Publishing.

Course Outcomes (COs)

Upon successful completion of this course, students will be able to:

CO1	Determine the Degrees of Freedom (DOF) of planar mechanisms and classify them based on their kinematic pairs and inversions.
CO2	Analyze the velocity of various points on a planar mechanism using the graphical Instantaneous Centre and Relative Velocity methods.
CO3	Calculate the velocity ratio and torque ratio for basic simple and epicyclic gear trains ; explain working of cam and follower, brake, clutch
CO4	Explain the function and operating principles of flywheels and centrifugal governors in controlling machine speed fluctuations and do balancing of rotational mass for a given situation

STRENGTH OF MATERIALS

3Credits-45 hours)(L-3: T-0: P-0)

Objective: To develop an understanding of the behaviour of solid materials under various types of loads by studying stress–strain relations, beam bending, torsion, deflection, and pressure vessel analysis, enabling students to apply fundamental mechanics principles to the design and analysis of structural and machine components.

Module I – Introduction to Stress, Strain and Deformation (8 Hours)

Deformation in solids; Hooke's law; stress and strain under tension, compression and shear; elastic constants and their relations; linear, shear and volumetric strains; principal stresses and principal planes; Mohr's circle for stress analysis.

Module II – Shear Force & Bending Moment in Beams (8 Hours)

Beams and types of supports; transverse loading on beams including point and distributed loads; shear force and bending moment diagrams for simply supported, cantilever and overhanging beams; theory of bending; bending stress distribution and neutral axis; shear stress distribution in beams.

Module III – Moment of Inertia & Beam Deflection (8 Hours)

Moment of inertia of sections and polar moment of inertia; deflection of beams using the double integration method; computation of slopes and deflections; Maxwell's reciprocal theorems.

Module IV – Torsion and Helical Springs (8 Hours)

Torsion of circular and hollow shafts; stresses, angle of twist and deformation; stepped and compound shafts; shafts fixed at both ends; stresses and deflection in helical springs.

Module V – Thin Shells (8 Hours)

Axial and hoop stresses in thin cylinders under internal pressure; deformation of thin-walled pressure vessels; thick cylinders and Lamé's theory; stress distribution and deformation in thick cylinders; spherical shells subjected to internal pressure.

Course outcomes:

After completing the course successfully the students will be able to-

CO1: Apply fundamental concepts of stress, strain, and material properties to analyze deformation and stress states in structural and mechanical components.

CO2: Determine shear forces, bending moments, stresses, torsion effects, and deflections in beams, shafts, springs, and pressure vessels using relevant theories and analytical methods.

CO3: Evaluate the strength and stability of engineering components under different loading conditions to support safe and effective design decisions.

Suggested Readings

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
3. Ferdinand P. Beer, Russell Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGraw Hill Publishing Co. Ltd., New Delhi 2005.
4. https://onlinecourses.nptel.ac.in/noc19_ce18/

MANUFACTURING PROCESSES

(3Credits-45 hours)(L-3: T-0: P-0)

Objective: To provide students with a broad understanding of how engineering materials are shaped, machined, formed, and joined using various manufacturing processes, and to equip them with the knowledge needed to select and analyse appropriate processes for producing quality components.

Module I (10 hours)

Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses, Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; forging, rolling, extrusion, drawing and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

Module II (10 hours)

Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

Module III (10 hours)

Additive manufacturing: Rapid prototyping and rapid tooling, Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

Module IV (10 hours)

AJM, WJM, AWJM, USM-principles and key process parameters; EDM and Wire EDM-MRR, surface finish, tool wear, dielectric and power circuits; ECM-process parameters and MRR; LBM, PAM, and EBM—fundamentals and applications.

COURSE/LEARNING OUTCOMES

After completing the course successfully the students will be able to-

CO1: Describe the principles and operations of casting, forming, machining, joining, and additive manufacturing processes used in engineering production.

CO2: Apply the fundamental principles of casting, forming, machining, joining, and additive manufacturing to explain how engineering components are produced.

CO3: Select suitable manufacturing processes for specific applications based on accuracy, productivity, material characteristics, and design requirements.

Suggested Readings

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Ed.), Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
3. Degarmo, Black and Kohser, Materials and Processes in Manufacturing
4. OP Khanna, Foundry technology, Dhanpat Rai
5. Manufacturing Processes by B.H. Amsteal, Philip F. Ostwald and Myron L. Begeman, John Wiley & Sons.
6. P.K. Mishra, Non-Conventional Machining, Narosa Publishing House.
7. A.B. Chattopadhyay, Machining and Machine Tools, Wiley India Pvt Ltd
8. <https://nptel.ac.in/courses/112/107/112107258/>
9. <https://nptel.ac.in/courses/112/103/112103248/>
10. <https://nptel.ac.in/courses/112/105/112105233/>

SCHOOL OF TECHNOLOGY

DEPARTMENT OF COMPUTER APPLICATIONS

PROGRAMME: FIVE-YEAR BCA-MCA INTEGRATED PROGRAMME

DEGREE: INTEGRATED MASTER OF COMPUTER APPLICATIONS (iMCA)

VISION OF THE DEPARTMENT

Imparting knowledge of Computer Applications to mould individuals into IT professionals, researchers and entrepreneurs who are innovative, versatile and committed to society.

MISSION OF THE DEPARTMENT

1. To prepare students for professional career and higher studies by providing conducive teaching, learning and research environment.
2. To produce skilled individuals and entrepreneurs in emerging areas of technologies by academia-industry collaboration.
3. To instill in individuals a sense of commitment to work for the betterment of society using technology.

Program Outcomes (POs)

Upon successful completion of the IMCA programme, graduates will be able to:

PO1 – Computational Knowledge: Apply knowledge of computing fundamentals, mathematics, and advanced computer science concepts to model, analyze, and solve complex computing problems.

PO2 – Problem Analysis: Identify, formulate, and analyze complex computing and real-world problems using mathematical reasoning, research methods, and analytical skills.

PO3 – Design & Development of Solutions: Design, develop, and evaluate software solutions, systems, and processes that meet user needs, performance requirements, and societal considerations.

PO4 – Research and Innovation: Use research methodologies including literature review, experiment design, data analysis, and interpretation to generate innovative solutions and contribute to knowledge creation.

PO5 – Modern Tool Usage: Select, adapt, and apply modern computing tools, programming frameworks, and emerging technologies for solving complex tasks with an understanding of their limitations.

PO6 – Professional Ethics: Apply ethical principles, professional standards, and cybersecurity best practices while addressing legal, social, and environmental issues in computing.

PO7 – Communication and Presentation Skills: Communicate effectively with technical and non-technical audiences, prepare clear documentation, and deliver impactful presentations and reports.

PO8 – Individual & Team Work: Function effectively as an individual contributor, member, or leader in diverse professional teams, demonstrating collaboration and responsibility.

PO9 – Project Management & Entrepreneurship: Demonstrate knowledge of project management principles and entrepreneurial skills to plan, execute, and manage software projects and innovative ventures.

PO10 – Lifelong Learning: Recognize the need for continuous learning and adapt to technological advancements, industry trends, and professional development opportunities.

Program Specific Outcomes (PSOs)

PSO1 – Software System Design & Development: Design, implement, test, and deploy full-fledged software applications—including web, mobile, and enterprise systems using modern development frameworks, programming paradigms, and DevOps practices.

PSO2 – Intelligent Computing & Data-Driven Decision-Making: Apply data science, artificial intelligence, and machine learning techniques to extract insights, build predictive models, and design intelligent solutions for real-world applications.

PSO3 – Secure & Ethical Computing Practices: Apply security principles, ethical guidelines, and cybersecurity tools to protect systems, networks, data, and applications from threats and vulnerabilities.

BHARATIYA BHASHA INTEGRATION (NEP 2020):

In alignment with NEP 2020 recommendations promoting Bharatiya Bhashas, the laboratory courses support the

use of **Assamese, Hindi, and/or English** for programming comments, documentation, interface labels, and student submissions wherever pedagogically appropriate.

Course Category Definition and Code:

Course Category Code	Definitions
MC	Major Course
MDE	Multi-Disciplinary Elective course
SEC	Skill Enhancement courses
CVBC	Common Value Based Course
AEC	Ability Enhancement Course
DSE	Discipline Specific Elective
OE	Open Elective
CE	Community Engagement Course
VAC	Value Added Course

SEMESTER-WISE COURSE STRUCTURE

Semester	Category	Course Code	Course Name	L	T	P	Credits	Page No
FIRST SEMESTER	THREE-WEEK COMPULSORY INDUCTION PROGRAMME							
	Major Course 1	CAMF101T	Mathematical Foundation of Computer Science I	3	0	0	3	1307
	Major Course 2	CACA102T	Computer Architecture	3	0	0	3	1308
	Major Course 2	CACA103P	Computer Architecture Lab	0	0	4	2	1309
	Skill Enhancement Course 1	CAPS104T	Problem Solving Techniques	3	0	0	3	1311
	Skill Enhancement Course 1	CAPS105P	Problem Solving Techniques Lab	0	0	4	2	1312
	Multi-Disciplinary Elective 1	CAIK107T	Indian Knowledge System	2	0	0	2	1315
	Common Value Based Course 1	CBES101T	Environmental Studies	1	0	0	1	1318
	Ability Enhancement Course 1	CAGE106T	General English – I	1	1	2	2	1316
	Ability Enhancement Course 2	AECH100T	Communicative Hindi-I	2	0	0	2	1319
		AECA100T	Communicative Assamese-I	2	0	0	2	1320
		AEFR100T	French Beginner Level I	2	0	0	2	1321
		AEGR100T	Introduction to German Language – I	2	0	0	2	1322
	TOTAL CREDIT						20	
SECOND SEMESTER	Major Course 3	CAMF111T	Mathematical Foundation of Computer Science II	3	0	0	3	1323
	Major Course 4	CADS112T	Data Structures	3	0	0	3	1324
	Major Course 4	CADS113P	Data Structures Lab	0	0	2	1	1326
	Major Course 5	CAOS114T	Operating Systems	3	0	0	3	1326
	Major Course 5	CAOS115P	Operating Systems Lab	0	0	2	1	1328
	Skill Enhancement Course 2	CAOP116T	Object-Oriented Programming using Java	2	0	0	2	1328
	Skill Enhancement Course 2	CAOP117P	Object-Oriented Programming using Java Lab	0	0	2	1	1330
	Skill Enhancement Course 3	CAWT118T	Web Technologies	2	0	0	2	1330
	Skill Enhancement Course 3	CAWT119P	Web Technologies Lab	0	0	2	1	1331
	Common Value Based Course 2	CBUI104T	Understanding India	1	0	0	1	1332

	Ability Enhancement Course 3	AECH101T	Communicative Hindi-II	1		0	2	1333
		AECA101T	Communicative Assamese-II	2	0	0	2	1336
		AEFR101T	French Beginner Level II	2	0	0	2	1337
		AEGR101T	Introduction to German Language – II	2	0	0	2	1338
	TOTAL CREDIT						20	
THIRD SEMESTER	Major Course 6		Probability and Statistics	3	0	0	3	
	Major Course 7		Database Management System	3	0	0	3	
	Major Course 7		Database Management System Lab	0	0	4	2	
	Major Course 8		Software Engineering	3	0	0	3	
	Skill Enhancement Course 4		Python Programming	1	0	0	1	
	Skill Enhancement Course 4		Python Programming Lab	0	0	4	2	
	Common Value Based Course 3		Health and Wellness, Yoga Education, and Sports and Fitness	1	0	0	1	
	Community Engagement Course 1		Service Learning Theory	2	0	0	2	
	Specialization- I: Full Stack Web Development							
	Discipline Specific Elective 1		UI/UX Engineering and Component Design Systems	1	0	0	1	
	Discipline Specific Elective 1		UI/UX Engineering and Component Design Systems Lab	0	0	4	2	
	Specialization- II: Artificial Intelligence & Machine Learning							
	Discipline Specific Elective 1		Feature Engineering	1	0	0	1	
	Discipline Specific Elective 1		Feature Engineering Lab	0	0	4	2	
	Specialization- III: Cybersecurity							
	Discipline Specific Elective 1		Introduction to Cybersecurity	1	0	0	1	
	Discipline Specific Elective 1		Cybersecurity Fundamentals Lab	0	0	4	2	
TOTAL CREDIT						20		

FOURTH SEMESTER	Major Course 9		Entrepreneurship and Startup Ecosystem	1	1	0	2	
	Major Course 10		Computer Networks	3	0	0	3	
	Major Course 10		Computer Networks Lab	0	0	4	2	
	Major Course 11		Design and Analysis of Algorithm	3	0	0	3	
	Major Course 12		Introduction to Artificial Intelligence	3	0	0	3	
	Major Course 12		Introduction to Artificial Intelligence Lab	0	0	4	2	
	Skill Enhancement Course 5		Design Thinking and Innovation	1	0	0	1	
	Community Engagement Course 2		Service-Learning Practice	0	0	2	2	
	Specialization- I: Full Stack Web Development							
	Discipline Specific Elective 2		Server-Side Web Development using Django	1	0	0	1	
	Discipline Specific Elective 2		Server-Side Web Development using Django Lab	0	0	4	2	
	Specialization- II: Artificial Intelligence & Machine Learning							
	Discipline Specific Elective 2		Machine Learning	1	0	0	1	
	Discipline Specific Elective 2		Machine Learning Lab	0	0	4	2	
	Specialization- III: Cybersecurity							
	Discipline Specific Elective 2		Network Security	1	0	0	1	
	Discipline Specific Elective 2		Network Security & Packet Analysis Lab	0	0	4	2	
	TOTAL CREDIT						21	
FIFTH SEMESTER	Major Course 13		Quantitative Techniques	2	0	0	2	
	Internship		Industry Internship	-	-	-	2	
	Project		Mini Project	0	0	6	3	
	Specialization- I: Full Stack Web Development							
	Discipline Specific Elective 3		ReactJS Fundamentals	3	0	0	3	
	Discipline Specific Elective 3		ReactJS Fundamentals Lab	0	0	4	2	
	Discipline Specific Elective 4		Microservices & API Engineering	3	0	0	3	
	Discipline Specific Elective 4		Microservices & API Engineering Lab	0	0	2	1	

SIXTH SEMESTER	Discipline Elective 5	Specific		Advanced Data Management Systems	3	0	0	3	
	Discipline Elective 5	Specific		Advanced Data Management Systems Lab	0	0	2	1	
	Specialization- II: Artificial Intelligence & Machine Learning								
	Discipline Elective 3	Specific		Neural Network	3	0	0	3	
	Discipline Elective 3	Specific		Neural Network Lab	0	0	4	2	
	Discipline Elective 4	Specific		Digital Image Processing	3	0	0	3	
	Discipline Elective 4	Specific		Digital Image Processing Lab	0	0	2	1	
	Discipline Elective 5	Specific		Natural Language Processing	3	0	0	3	
	Discipline Elective 5	Specific		Natural Language Processing Lab	0	0	2	1	
	Specialization- III: Cybersecurity								
	Discipline Elective 3	Specific		Ethical Hacking & Penetration Testing	3	0	0	3	
	Discipline Elective 3	Specific		Ethical Hacking & Kali Linux Lab	0	0	4	2	
	Discipline Elective 4	Specific		Cryptography & Secure Communication	3	0	0	3	
	Discipline Elective 4	Specific		Cryptography Algorithms Implementation Lab	0	0	2	1	
	Discipline Elective 5	Specific		Security Operations & Incident Response Management	3	0	0	3	
	Discipline Elective 5	Specific		Security Operations Center Tools & Incident Response Lab	0	0	2	1	
	TOTAL CREDIT							20	
	Major Course 14			Generative AI	2	0	0	2	
	Major Course 14			Generative AI Lab	0	0	4	2	
	Ability Enhancement Course 3			Soft Skills	1	1	0	2	
	Project			Minor Project	0	0	8	4	
	Specialization- I: Full Stack Web Development								
	Discipline Elective 6	Specific		Server-Side Development with Node.js and NestJS	3	0	0	3	
	Discipline Elective 6	Specific		Server-Side Development with Node.js and NestJS Lab	0	0	4	2	
	Discipline Elective 7	Specific		DevOps and Automation Engineering	2	0	0	2	

Discipline Elective 7	Specific		DevOps and Automation Engineering Lab	0	0	4	2	
Specialization- II: Artificial Intelligence & Machine Learning								
Discipline Elective 6	Specific		Deep Learning for Computer Vision	3	0	0	3	
Discipline Elective 6	Specific		Deep Learning for Computer Vision Lab	0	0	4	2	
Discipline Elective 7	Specific		Predictive Analysis	3	0	0	3	
Discipline Elective 7	Specific		Predictive Analysis Lab	0	0	2	1	
Specialization- III: Cybersecurity								
Discipline Elective 6	Specific		Cloud & Web Application Security	3	0	0	3	
Discipline Elective 6	Specific		Cloud Security & Web Application Testing Lab	0	0	4	2	
Discipline Elective 7	Specific		Digital Forensics and Cyber Investigations	3	0	0	3	
Discipline Elective 7	Specific		Digital Forensics Analysis Lab	0	0	2	1	
TOTAL CREDIT							19	

After successful completion of the first three years of the Integrated MCA programme, students shall be automatically promoted to the MCA component of the programme. However, students who wish to exit the programme after completing the three-year curriculum will be awarded the BCA degree, as per the approved exit policy.

LIST OF COURSES – INTEGRATED MCA

1.1	Mathematical Foundation of Computer Science I
1.2	Computer Architecture
1.3	Computer Architecture Lab
1.4	Problem Solving Techniques
1.5	Problem Solving Techniques Lab
1.6	Indian Knowledge System
1.7	Environmental Studies
1.8	General English – I
1.9	Communicative Hindi-I / Communicative Assamese-I / French Beginner Level I / Introduction to German Language – I
2.1	Mathematical Foundation of Computer Science II
2.2	Data Structures
2.3	Data Structures Lab
2.4	Operating Systems
2.5	Operating Systems Lab
2.6	Object-Oriented Programming using Java

2.7	Object-Oriented Programming using Java Lab
2.8	Web Technologies
2.9	Web Technologies Lab
2.10	Understanding India
2.11	Communicative Hindi-II / Communicative Assamese-II / French Beginner Level II / Introduction to German Language – II
3.1	Probability and Statistics
3.2	Database Management System
3.3	Database Management System Lab
3.4	Software Engineering
3.5	Python Programming
3.6	Python Programming Lab
3.7	Health and Wellness, Yoga Education, and Sports and Fitness
3.8	Service Learning Theory
3.9A	UI/UX Engineering and Component Design Systems
3.10A	UI/UX Engineering and Component Design Systems Lab
3.9B	Feature Engineering
3.10B	Feature Engineering Lab
3.9C	Introduction to Cybersecurity
3.10C	Cybersecurity Fundamentals Lab
4.1	Entrepreneurship and Startup Ecosystem
4.2	Computer Networks
4.3	Computer Networks Lab
4.4	Design and Analysis of Algorithm
4.5	Introduction to Artificial Intelligence
4.6	Introduction to Artificial Intelligence Lab
4.7	Design Thinking and Innovation
4.8	Service Learning Practice
4.9A	Server-Side Web Development using Django
4.10A	Server-Side Web Development using Django Lab
4.9B	Machine Learning
4.10B	Machine Learning Lab
4.9C	Network Security
4.10C	Network Security & Packet Analysis Lab
5.1	Quantitative Techniques
5.2	Industry Internship
5.3	Mini Project
5.4A	ReactJS Fundamentals
5.5A	ReactJS Fundamentals Lab
5.6A	Microservices & API Engineering
5.7A	Microservices & API Engineering Lab
5.8A	Advanced Data Management Systems
5.9A	Advanced Data Management Systems Lab
5.4B	Neural Network
5.5B	Neural Network Lab
5.6B	Digital Image Processing
5.7B	Digital Image Processing Lab

5.8B	Natural Language Processing
5.9B	Natural Language Processing Lab
5.4C	Ethical Hacking & Penetration Testing
5.5C	Ethical Hacking & Kali Linux Lab
5.6C	Cryptography & Secure Communication
5.7C	Cryptography Algorithms Implementation Lab
5.8C	Security Operations & Incident Response Management
5.9C	Security Operations Center Tools & Incident Response Lab
6.1	Generative AI
6.2	Generative AI Lab
6.3	Soft Skills
6.4	Minor Project
6.5A	Server-Side Development with Node.js and NestJS
6.6A	Server-Side Development with Node.js and NestJS Lab
6.7A	DevOps and Automation Engineering
6.8A	DevOps and Automation Engineering Lab
6.5B	Deep Learning for Computer Vision
6.6B	Deep Learning for Computer Vision Lab
6.7B	Predictive Analysis
6.8B	Predictive Analysis Lab
6.5C	Cloud & Web Application Security
6.6C	Cloud Security & Web Application Testing Lab
6.7C	Digital Forensics and Cyber Investigations
6.8C	Digital Forensics Analysis Lab

A: Specialization-I, B: Specialization-II, C: Specialization-III

DETAILED SYLLABUS**SEMESTER – I****CAMF101T: Mathematical Foundation of Computer Science – I
(3 credits - 45 hours) (L-T-P: 3-0-0)****Course Objective:**

The objective of this course is to introduce students to the fundamental mathematical concepts, structures, and reasoning techniques that form the theoretical foundation of computer science. It aims to develop their ability to apply logic, set theory, relations, functions, combinatorics, and graph theory in solving computational problems. The course also seeks to strengthen students' analytical thinking and problem-solving skills, enabling them to model, analyze, and reason about algorithms, data structures, and various aspects of computer system design.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1:** Provide a basic understanding of fundamental mathematical concepts such as sets, functions, matrix algebra, and discrete mathematics. (Understanding, Remembering)
- CO2:** Enable the students to use mathematical models and techniques to analyze and understand problems in computer science. (Applying, Analyzing)
- CO3:** Demonstrate how the mathematical principles give succinct abstraction of computer science problems and help them to efficiently analyze. (Analyzing, Creating)

Course Content:**MODULE I: Set, Relation and Function (12 Hours)**

Set, Set Operations, Properties of Set operations, Subset, Venn Diagrams, Cartesian Products. Relations on a Set, Properties of Relations, Representing Relations using matrices and digraphs, Types of Relations, Equivalence Relation, Equivalence relation and partition on set, Closures of Relations, Warshall's algorithm.

Functions, properties of functions (domain, range), composition of functions, surjective (onto), injective (one-to-one) and bijective functions, inverse of functions.

Some useful functions for Computer Science: Exponential and Logarithmic functions, Polynomial functions, Ceiling and Floor functions.

MODULE II: Counting and Recurrence Relation (10 Hours)

Basics of counting, Pigeonhole principle, permutation, combination, Binomial coefficients, Binomial theorem.

Recurrence relations, modelling recurrence relations with examples, like Fibonacci numbers, the tower of Hanoi problem. Solving linear recurrence relation with constant coefficients using characteristic equation roots method.

MODULE III: Elementary Graph Theory (11 Hours)

Basic terminologies of graphs, connected and disconnected graphs, subgraph, paths and cycles, complete graphs, digraphs, weighted graphs, Euler and Hamiltonian graphs.

Trees, properties of trees, concept of spanning tree. Planar graphs. Definitions and basic results on the topics mentioned.

MODULE IV: Matrix Algebra: (12 Hours)

Types of matrices, algebra of matrices—addition, subtraction, and multiplication of matrices, determinant of a matrix, symmetric and skew-symmetric matrices, orthogonal matrix, rank of a matrix, inverse of a matrix, applications of matrices to solve system of linear equations, Eigen values and Eigen vectors, Caley-Hamilton theorem.

Text Books

1. Garg, Reena, Engineering Mathematics, Khanna Book Publishing Company, 2024. (AICTE Recommended Textbook)
2. Garg, Reena, Advanced Engineering Mathematics, Khanna Book Publishing Company, 2023.
3. Kolman, B., Busby, R. and Ross, S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
4. Vasishtha, A. R. and Vasishtha, A. K., Matrices, Krishna Prakashan, 2022.

Reference Books

1. Grimaldi Ralph P. and Ramana B. V., Discrete and Combinatorial Mathematics: An Applied Introduction, Fifth Edition, Pearson Education, 2007.
2. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
3. West Douglas B., Introduction to Graph Theory, Second Edition, Pearson Education, 2015

Web Resources

<https://nptel.ac.in/courses/106103205>

<https://nptel.ac.in/courses/111101115>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	H
CO2	M	H	H	H
CO3	M	H	H	M

CACA102T: Computer Architecture
(3 credits - 45 hours) (L-T-P: 3-0-0)
Course Objective:

The course aims to provide foundational understanding of digital electronics and number systems, enable students to design and analyze combinational and sequential circuits, Introduce the organization and functioning of basic computers and CPUs, and develop conceptual clarity on memory organization and parallel processing techniques.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Explain the basics of Digital Electronics and Binary Number System (*Understanding*)
 CO2: Learn the designing and implementation of combinational circuit. (*Applying, Creating*)
 CO3: Learn the designing and implementation of sequential circuit. (*Applying, Creating*)
 CO4: Describe the organization and functioning of basic computers. (*Understanding, Analyzing*)
 CO5: Explain the concept of parallel processing and memory organization (*Understanding, Applying*)

Course Content:**MODULE I: Digital Principles and Number Systems (12 Hours)**

Digital Principles: Definition for Digital signals, Digital logic, Digital computers, Von Neumann Architecture, Boolean Laws and Theorems, K-Map: Truth Tables to K-Map, 2, 3 and 4 variable K Map, K-Map Simplifications, Don't Care Conditions, SOP and POS.

Number Systems: Decimal, Binary, Octal, Hexadecimal, Number System Conversions, Binary Arithmetic, Addition and subtraction of BCD, Octal Arithmetic, Hexadecimal Arithmetic, Binary Codes, Decimal Codes, Error detecting and correcting codes, ASCII, EBCDIC, Excess- 3 Code, The Gray Code.

MODULE II: Combinational and Sequential Circuits and Registers (11 Hours)

Combinational Circuits: Half Adder and Full Adder, Subtractor, Decoders, Encoder, Multiplexer, Demultiplexer

Sequential Circuits: Flip-Flops- SR Flip- Flop, D Flip-Flop, J-K Flip-Flop, T Flip-Flop.

Register: 4- bit register with parallel load, Shift Registers- Bidirectional shift register with parallel load
Binary Counters-4 bit synchronous and Asynchronous binary counter.

MODULE III: Basic Computer Organization and Design and CPU (12 Hours)

Basic Computer Organization and Design: Instruction Codes, Computer Registers, Computer Instructions, Timing and Control, Instruction Cycle, Memory-Reference Instructions, Input- Output Interrupt, Complete Computer Description, Design of Basic Computer, Design of Accumulator logic. **Central Processing Unit:** Introduction, General Register Organization, Stack Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Reduced Instruction Set Computer (RISC), RISC Vs CISC.

MODULE IV: Pipeline and Vector Processing and Memory Organization (10 Hours)

Pipeline and Vector Processing: Parallel Processing, Pipelining, Arithmetic Pipeline, Instruction Pipeline, RISC Pipeline. Input-Output Organization: Peripheral Devices, Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt, Direct memory Access, Input-Output Processor (IOP).

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory, Virtual Memory, Memory Management Hardware.

Text Books:

1. Donald P Leach, Albert Paul Malvino, Goutam Saha- "Digital Principles & Applications", Tata McGraw Hill Education Private Limited, 2011 Edition.
2. M. Morris Mano- "Computer System Architecture", Pearson/Phi, Third Edition.

Reference Books:

1. William Stallings- "Computer Organization and Architecture", Pearson/PHI, Sixth Edition.
2. Andrew S. Tanenbaum- "Structured Computer Organization", PHI /Pearson 4th Edition,
3. M. V. Subramanyam, "Switching Theory and Logic Design", Laxmi Publications (P) Ltd.
4. Ikvinderpal Singh, Computer Organization Architecture, Khanna Book Publishing.

Web Resources

<https://nptel.ac.in/courses/106105163>

<https://nptel.ac.in/courses/108105113>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	
CO2	L	H	M	
CO3	L	M	H	
CO4		L	M	H
CO5			L	H

CACA103P: Computer Architecture Lab

(2 credit - 60 hours) (L-T-P: 0-0-2)

Course Objective:

The course aims to provide hands-on experience in digital logic circuit design, verification of fundamental logic gates and sequential circuits, as well as practical knowledge of computer hardware organization and troubleshooting. It helps students gain competency in both theoretical concepts of computer architecture and practical system-level skills including assembly, installation, and configuration.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Design, implement, and test combinational and sequential logic circuits using basic logic gates, flip-flops, counters, adders, decoders, and multiplexers. (Applying, Creating)
- CO2: Apply Boolean algebra and coding techniques (BCD, Gray, Excess-3) to realize digital functions and verify their truth tables. (Applying, Analyzing)
- CO3: Demonstrate knowledge of computer hardware components, perform system assembly, installation, configuration, and troubleshoot common hardware/software issues. (Applying, Evaluating)

MODULE I:

Verify logic behaviour of AND, OR, NAND, NOR, EX-OR, EX-NOR, Invert and Buffer gates

To study and verify NAND as a Universal Gate

To verify De- Morgan's theorem for 2 variables

Design and test of an S-R flip-flop using NAND/NOR gate

Convert BCD to Excess-3 code using NAND gate

To Convert Binary to Grey Code

Verification of Truth Tables of J-K Flip-Flop using NAND/NOR gate

Realize Decoder and Encoder circuit using Basic Gates

Design and implement the 4:1 MUX using gates

Implementation of 4-Bit Parallel Adder Using 7483 IC

Design and verify operation of half adder and full adder

Design and verify operation of half subtractor

Design and implement a 4-bit shift register using Flip flops

Implement Boolean function using logic gates in both SOP and POS

Design and implement a 4-bit synchronous counter

Design and verify 4-bit asynchronous counter

MODULE II:

Familiarize the computer system layout: marking positions of SMPS, motherboard, FDD, HDD, CD, DVD and add on cards

Identify the Computer Name and Hardware Specification (RAM capacity, Processor type, HDD, 32 bit/ 64 bit)

Identify and troubleshoot the problems of RAM, SMPS and motherboard

Configure BIOS settings- disable and enable USB and LAN

Adding additional RAM to the system. (Expanding RAM size)

To Study mother board layout of a system

Demonstrate the assembly of a PC

Demonstration of various ports: CPU, VGA port, PS/2 (keyboard, mouse), USB, LAN, Speaker, Audio

Install and configure windows OS

To study the installation of Printer and trouble shooting

Textbook

1. Morris Mano, *Digital Logic and Computer Design*, Prentice Hall of India
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, *Computer Organization*, McGraw Hill
3. B. Govindarajalu, *Computer Architecture and Organization: Design Principles and Applications*, Tata McGraw Hill
4. Thomas C. Bartee, *Digital Computer Fundamentals*, Tata McGraw Hill

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	
CO2	H	
CO3		H

CAPS104T: Problem Solving Techniques
(3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The objective of this course is to equip students with the skills and strategies required for effective problem analysis, algorithm design, and program development. It aims to introduce the fundamentals of computer systems, problem-solving methodologies, and programming language concepts, with a focus on structured programming using C. Students will learn to translate problem requirements into precise specifications, design solutions using structured constructs, implement algorithms in C, and apply debugging and testing techniques to ensure program correctness and efficiency.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Understand basic terminology of computers, problem solving, programming Languages and their evolution (Understanding)
- CO2: Create specification from problem requirements by asking questions to disambiguate the requirement statement. (Creating)
- CO3: Design the solution from specification of a problem and write pseudo code of the algorithm using basic building blocks or structured programming constructs (Sequence, Selection and Repetition statement). (Creating)
- CO4: Translate an algorithm into a C computer program (Creating)
- CO5: Testing and analysing programs using debugging tools. (Analyzing)

Course Content:

MODULE I: (11 Hours)

Problems And Problem Instances, Generalization and Special Cases, Types of Computational Problems, Classification of Problems, Analysis of Problems, Solution Approaches, Algorithm Development, Analysis of Algorithm, Efficiency, Correctness, Role of Data Structures in Problem Solving, Problem-Solving Steps (Understand the Problem, Plan, Execute, And Review), Breaking the Problem into Subproblems, Input/Output Specification, Input Validation, Pre and Post Conditions.

MODULE II: (12 Hours)

Structured Programming Concepts: Sequence (Input/Output/Assignment), Selection (If, If-Else) And Repetition (For, While, Do-While) Statements, Control Structure Stacking and Nesting.

Different Kinds of Repetitions: Entry Controlled, Exit Controlled, Counter Controlled, Definite, Indefinite and Sentinel-Controlled Repetitions.

Pseudocode and Flowcharts. Definition And Characteristics of Algorithms, Standard Algorithm Format.

Problems Involving Iteration and Nesting: Displaying Different Patterns and Shapes Using Symbols and Numbers, Generating Arithmetic and Geometric Progression, Fibonacci and Other Sequences, Approximate Values For π , $\sin(x)$, $\cos(x)$, Etc. Using Taylor Series. Different Kinds of Data in The Real World and How They are Represented in The Computer Memory.

Representation of Integers: Signed Magnitude Form, 1's Complement And 2's Complement. Representation of Real Numbers: IEEE 754 Floating Point Representation. Representation of Characters: ASCII, UNICODE.

C Language: Introduction To Programming Languages, Different Generations of Programming Languages. Typed Vs Typeless Programming Languages, History of C Language, An Empty C Program. C Language Counterparts for Input (scanf()), Output (printf()) Statements, Assignment, Arithmetic, Relational and Logical Operators. If, If-Else Statements, For, While, Do-While Statements.

Data Types, Translating Pseudocode/Algorithm to C Program. Incremental Compilation and Testing of The C Program. Simple Problems Involving Input, Output, Assignment Statement, Selection and Repetition. Good Coding Practices.

MODULE III: (10 Hours)

Problems on Numbers: Extracting Digits of a Number (Left to Right and Right to Left), Palindrome, Prime Number, Prime Factors, Amicable Number, Perfect Number, Armstrong Number, Factorial, Converting

Number from One Base to Another. Statistics (Maximum, Minimum, Sum and Average) on a Sequence of Numbers which are Read using Sentinel- Controlled Repetition using only a few Variables.

C Language: else-if Ladder, switch Case, Increment/Decrement Operators, break and continue Statements.

MODULE IV: (12 Hours)

Modular Programming, Top-Down and Bottom-Up Approaches to Problem Solving. Recursion. Problems on Arrays: Reading and Writing of Array Elements, Maximum, Minimum, Sum, Average, Median and Mode. Sequential And Binary Search. Any one Sorting Algorithm. Matrix Operations.

C Language: Function Definition and Declaration (Prototype), Role of Return Statement, One Dimensional and Two-Dimensional Arrays. String Functions. Other Operators, Operator Precedence and Associativity. Debugging.

Text Books

1. Venkatesh, Nagaraju Y, Practical C Programming for Problem Solving, Khanna Book Publishing Company, 2024.
2. AICTE's Programming for Problem Solving (with Lab Manual), Khanna Book Publishing Company, 2024.
3. Harvey Deitel and Paul Deitel, C How to Program, 9th edition, Pearson India, 2015.
4. R G Dromey, How to Solve It by Computer.

Reference Books

1. Brian W. Kernighan and Dennis Ritchie, The C Programming Language, 2nd edition, Pearson, 2015.
2. Jeri Hanly and Elliot Koffman, Problem Solving and Program Design in C, 8th edition, Pearson, 2015.

Web Resources

<https://nptel.ac.in/courses/106105171>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	M	M
CO2	H	H	M	M
CO3	M	H	H	H
CO4		H	H	H
CO5		M	H	H

CAPS105P: Problem Solving Techniques Lab

(2 credits – 60 Hours) (L-T-P: 0-0-2)

Course Objective:

The objective of this course is to provide students with practical experience in applying problem-solving strategies, algorithmic thinking, and structured programming concepts to develop efficient solutions using the C programming language. Through a variety of programming exercises, students will strengthen their skills in control structures, modular programming, recursion, and data manipulation, as well as in implementing mathematical, logical, and pattern-based problems. The lab also aims to enhance students' ability to test, debug, and optimize programs while fostering computational thinking and creativity in approaching real-world problems.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Develop algorithms for solving computational and mathematical problems using systematic problem-solving strategies. (*Applying*)

CO2: Implement algorithms in C using appropriate programming constructs such as sequence, selection,

repetition, and modularization. *(Creating)*

CO3: Apply recursion and modular programming techniques to design efficient and reusable solutions. *(Creating)*

CO4: Test, debug, and validate C programs to ensure correctness, reliability, and efficiency. *(Analyzing)*

CO5: Translate real-world problem statements into functional C programs with appropriate input/output handling and code documentation. *(Applying)*

Course Content:

MODULE I:

Converting degrees Celsius to Fahrenheit and vice versa

Display three input numbers in sorted (non-decreasing) order

Given a positive integer value n ($n \geq 0$) display number, square and cube of numbers from 1 to n in a tabular format?

Given an input positive integer number, display odd numbers from in the range $[1, n]$

Display the following patterns of n rows ($n > 0$), for the below examples $n = 5$

Hollow square pattern:	Triangle Patterns with numbers:	Square with diagonals:	Diamond Pattern
##### # # # # # # #####	1 121 12321 1234321 123454321	* *	* *** ***** *** *

Display first mathematical tables, each table up to 10 rows? Generalise this to display first n ($n > 0$) mathematical tables up to m ($m > 0$) rows

Given the first term (a), difference/multiplier (d) and number of terms ($n > 0$), display the first n terms of the arithmetic/geometric progression

Display following patterns of n rows ($n > 0$), For the below examples $n = 5$? For each pattern write a separate algorithm/program

\$	\$	12345	12345
\$\$	\$\$	1234	1234
\$\$\$	\$\$\$	123	123
\$\$\$\$	\$\$\$\$	12	12
\$\$\$\$\$	\$\$\$\$\$	1	1

Display the first n ($n > 0$) terms of the fibonacci sequence

Display the first n ($n > 0$) terms of the Tribonacci sequence

Given two positive integer numbers $n1$ and $n2$ check if the numbers are consecutive numbers of the fibonacci sequence

Compute approximate value of π considering first n ($n > 0$) terms of the Taylor series for π

Compute approximate value of e^x considering first n ($n > 0$) terms of the Taylor series for e^x

Compute approximate value of $\sin(x)/\cos(x)$ considering first n ($n > 0$) terms of the Taylor series for $\sin(x)/\cos(x)$

MODULE II:

Extract digits of an integer number (left to right and right to left)

Given a sequence of digits form the number composed of the digits. Use sentinel-controlled repetition to read the digits followed by -1. For example, for the input 2 7 3 2 9 -1 the output number is 27329

Check if a given positive integer number is a palindrome or not

Compute character grade from the marks ($0 \leq \text{marks} \leq 100$) of a subject. Grading Scheme: 80-100: A, 60 - 79: B, 50 - 59: C, 40-49: D, 0-39: F. Solve this using both else-if ladder and switch case?

Compute the sum of a sequence of numbers entered using sentinel-controlled repetition

Extract digits of an integer number (left to right and right to left)

Check if a given positive integer number is a prime number or not

Compute prime factors of a positive integer number

Check if two positive integer numbers are amicable numbers or not

Check if a given positive integer number is a perfect number or not

Check if a given positive integer number Armstrong number or not

Converting a positive integer number ($n > 0$) from one base (inputBase) to another base (outputBase) ($2 \leq \text{input Base}$, $\text{outputBase} \leq 10$). Input number should be validated before converting to make sure the number uses only digits allowed in the input base

Write a program to display a number in text form. For example: If the number is 5432 the output should be "FIVE FOUR THREE TWO"

Using the grading scheme described in the question 4 (MODULE III), Compute how many students awarded each grade and display the frequency as a bar chart (horizontal) using single "*" for each student. Use sentinel-controlled repetition (-1 as sentinel value) in reading the students marks. Use else-if ladder/switch case to compute the grade and the corresponding frequency.

Compute Body mass index (BMI), where

$\text{BMI} = \text{weight\_inKGs} / \text{Height\_inMeters} * \text{Height\_inMeters}$

Both weight and height values are positive real numbers. Your program should display BMI value followed by whether the person is Underweight, Normal, Overweight or Obese using the below ranges:

BMI Values

Underweight: less than 18.5

Normal: ≥ 18.5 and < 25

Overweight: ≥ 25 and < 30

Obese: ≥ 30

MODULE III:

Design a modularized algorithm/program to check if a given positive integer number is a circular prime or not

Design a modularized algorithm/program to compute a maximum of 8 numbers

Design a modular algorithm/program which reads an array of n integer elements and outputs mean (average), range (max-min) and mode (most frequent elements)

Design a modular algorithm/program which reads an array of n integer elements and outputs median

Implement your own string length and string reversal functions

Design algorithm/program to perform matrix operations addition, subtraction and transpose

Write a recursive program to count the number of digits of a positive integer number

Recursive solutions for the following problems:

Factorial of a number

Display digits of a number from left to right (and right to left)

Compute x^y using only multiplication

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO1	H	M	H
CO2	H	H	H
CO3		M	H
CO4	M	H	H
CO5	M	H	H

AIK107T: Indian Knowledge System
(2 Credits - 30 Hours) (L-T-P: 2-0-0)

Course Objectives

- * To introduce fundamentals of Ancient Indian Educations to understand the pattern and purpose of studying vedas, vedangas, upangas, upveda, purana & Itihasa
- * To help students to trace, identify and develop the ancient knowledge systems.
- * To help to understand the apparently rational, verifiable and universal solution from ancient Indian knowledge system for the holistic development of physical, mental and spiritual wellbeing
- * To build in the learners a deep-rooted pride in Indian knowledge, committed to universal human right, well-being and sustainable development.

Course Outcomes

After completing the course, the students will be able to:

- CO1:** Identify the foundational elements of Bhāratiya civilization, including its knowledge systems, educational institutions, and philosophical traditions. (*Understanding*)
- CO2:** Apply traditional Indian approaches to language, logic, measurement systems, and physical reality to modern interdisciplinary contexts. (*Applying*)
- CO3:** Analyse the contributions of key scholars and literary figures in the development of Indian arts, sciences, and philosophy. (*Analysing*)
- CO4:** Evaluate the scientific principles and technological innovations from ancient India in the areas of mathematics, astronomy, medicine, and environmental studies. (*Evaluating*)

Detailed Syllabus

Module-I: Foundations of Indian Knowledge Systems and Civilisational Heritage

Bhāratiya Civilization and Development of Knowledge System (4 hours)

Genesis of the land, Antiquity of civilization, On the Trail of the Lost River, Discovery of the Saraswatī River, the Saraswatī-Sindhu Civilization, Traditional Knowledge System, The Vedas, Main Schools of Philosophy, Ancient Education System, the Takṣaśilā University, the Nālandā University, Alumni, Knowledge Export from Bhārata.

Arts, Literature, and Scholars (3 hours)

Art, Music, and Dance, Naṭarāja– A Masterpiece of Indian Art, Literature, Life and works of Agastya, Lopāmudrā, Vālmīki, Patañjali, Vedavyāsa, Yājñavalkya, Gārgī, Maitreyī, Bodhāyana, Caraka, Suśruta, Jīvaka, Nāgārjuna, Kaṇāda, Patañjali, Kauṭīlya, Pāṇini, Āryabhaṭa, Varāhamihira, Ādi Śaṅkarācārya, Bhāskarācārya, Mādhavācārya.

Science, Astronomy, and Mathematics (5 hours)

Concept of Matter, Life and Universe, Gravity, Sage Agastya's Model of Battery, Velocity of Light, Vimāna: Aeronautics, Vedic Cosmology and Modern Concepts, Bhāratiya Kāla-gaṇanā, Kerala School for Mathematics and Astronomy, History and Culture of Astronomy, Sun, Earth, Moon, and Eclipses, Earth is Spherical and Rotation of Earth, Archaeoastronomy; Concepts of Zero and Pi, Number System, Pythagoras Theorem, and Vedic Mathematics.

Life, Environment, and Health (3 hours)

Ethnic Studies, Life Science in Plants, Anatomy, Physiology, Agriculture, Ecology and Environment, Āyurveda, Integrated Approach to Healthcare, Medicine, Microbiology, Medicine, Surgery, and Yoga, etc.

Module-II: Scientific Traditions and Technological Innovations in Indian Knowledge Systems

Foundation concept for Science & Technology (7 hours)

Linguistics & Phonetics in Sanskrit (panini's), Computational concepts in Astadhyayi Importance of Verbs, Role of Sanskrit in Natural Language Processing, Number System and Units of Measurement, concept of zero and its importance, Large numbers & their representation, Place Value of Numerals, Decimal System, Measurements for time, distance and weight, Unique approaches to represent numbers (Bhūta Saṃkhyā

System, Kaṭapayādi System), Pingala and the Binary system, Knowledge Pyramid, Prameya – A Vaiśeṣikan approach to physical reality, constituents of the physical reality, Pramāṇa, Saṃśaya.

Indian Science & Technology in IKS (8 hours)

Pre-Harappan and Sindhu Valley Civilization, Laboratory and Apparatus, Juices, Dyes, Paints and Cements, Glass and Pottery, Engineering Science and Technology in the Vedic Age and Post-Vedic Records. Indian Science and Technology Heritage, sixty-four art forms and occupational skills (64 Kalas). Metals and Metalworking technology: Copper, Gold, Zinc, Mercury, Lead, Silver, Iron & Steel. Dyes and Painting Technology, Town & Planning Architecture in India, Temple Architecture, Vastu Sastra.

References:

1. Textbook on IKS by Prof. B Mahadevan, IIM Bengaluru.
2. Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of sankaracharya, Central chinmay mission trust, Bombay, 1995.
3. Nair, Shantha N. Echoes of Ancient Indian Wisdom. New Delhi: Hindology Books, 2008.
4. SK Das, The education system of Ancient hindus, Gyan publication house, India.
5. BL Gupta, Value and distribution system in india, Gyan publication house, India.
6. Reshmi ramdhoni, Ancient Indian Culture and Civilisation, Star publication, 2018.
7. Supriya Lakshmi Mishra, Culture and History of Ancient India (With Special Reference of Sudras), 2020.
8. Gambirananda, Swami, Tr. Upanishads with the Commentary of Sankarachrya. Kolkata: Advaita Ashrama publication Department, 2002.
9. Ranganathananda, Swami. The Massage of the Upanishads. Bombay: Bharathya Vidya Bhaven, 1985.
10. Om Prakash, Religion and Society in Ancient India, Bhariya Vidhya Prakashan, 1985.
11. J Auboyer, Daily Life in Ancient India from Approximately 200 BC to AD 700, Munshi ram Manoharlal publication, 1994.
12. DK Chakkrabarty, Makkhan Lal, History of Ancient India (Set of 5 Volumes), Aryan book International publication, 2014.
13. Dr. Girish Nath Jha, Dr. Umesh Kumar Singh and Diwakar Mishra, Science and Technology in Ancient Indian Texts, DK Print World limited.
14. Chatterjee, S.C. The Nyaya Theory of Knowledge. Calcutta: University of Calcutta Press, 1950.
15. Dasgupta, Surendra. A History of Indian Philosophy. Delhi: Motilal Banarsidass, 1991. Vols. III & IV.

CAGE106T: GENERAL ENGLISH - I **(2 credit: 30 hours) (L-T-P: 1-1-0)**

Course Objective:

The course aims to strengthen the foundational skills of English language learning by developing competence in listening, speaking, reading, and writing. It focuses on improving vocabulary, grammar, writing style, and oral communication through structured modules, practice sessions, and applied tasks, thereby enabling learners to enhance both academic and Discipline Specific communication skills.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Provide learning environment to practice listening, speaking, reading and writing skills. (*Applying, Analyzing*)
- CO2: Assist students to carry on the tasks and activities through guided instructions and materials. (*Understanding, Applying*)
- CO3: Effectively integrate English language learning with employability skills and training. (*Applying, Evaluating*)
- CO4: Provide hands-on experience through case-studies, mini-projects, group and individual presentations. (*Creating, Evaluating*)

Course Content:**Module I: Vocabulary Building (5 Hours)**

The concept of Word Formation, Root words from foreign languages and their use in English, Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives, Synonyms, antonyms, and standard abbreviations.

Module II: Basic Writing Skills (6 Hours)

Sentence Structures, Use of phrases and clauses in sentences, Importance of proper punctuation, Creating coherence, Organizing principles of paragraphs in documents, Techniques for writing precisely

Module III: Identifying Common Errors in Writing (5 Hours)

Subject-verb agreement, Noun-pronoun agreement, Misplaced modifiers, Articles, Prepositions, Redundancies

Module IV: Nature and Style of sensible Writing (6 Hours)

Describing, Defining, Classifying, providing examples or evidence, writing introduction and conclusion, Module V: Writing Practices, Comprehension, Précis Writing, Essay Writing

Module V: Oral Communication (This Module involves interactive practice sessions in Language Lab) (8 Hours)

Listening Comprehension, Pronunciation, Intonation, Stress and Rhythm, Common Everyday Situations: Conversations and Dialogues, Communication at Workplace, Interviews, Formal Presentations

Text/Reference Books:

1. AICTE's Prescribed Textbook: Communication Skills in English (with Lab Manual), Anjana Tiwari, Khanna Book Publishing Co., 2023.
2. Effective Communication Skills. Kul Bhushan Kumar, Khanna Book Publishing, 2022.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. Remedial English Grammar. F.T. Wood. Macmillan.2007
5. On Writing Well. William Zinsser. Harper Resource Book. 2001
6. Study Writing. Liz Hamp-Lyons and Ben Heasley. Cambridge University Press. 2006.
7. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.

Alternative NPTEL/SWAYAM Course:

S. No.	NPTEL/SWAYAM Course Name	Instructor	Host Institute
1	English language for competitive exams	Prof. Aysha Iqbal	IIT MADRAS
2	Technical English for engineers	Prof. Aysha Iqbal	IITM

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	M	H		H	H
CO2		M	H	H	H
CO3	L		M	H	
CO4		M		H	H

CBES101T: ENVIRONMENTAL STUDIES
(1 credit: 15 hours) (L-T-P: 1:0:0)

Course Objective:

The course aims to create awareness and a holistic understanding of the environment by introducing students to its multidisciplinary nature, natural resources, ecosystems, biodiversity, environmental pollution, and social issues. It seeks to instill ecological literacy, promote sustainable practices, and develop a sense of responsibility among learners to evaluate and address environmental challenges at both local and global scales.

Course Outcomes:

After successful completion of this course, students will be able to:

- CO1: Recall the multidisciplinary nature of environmental studies. (*Remembering*)
- CO2: Explain ecological processes of natural resources. (*Understanding*)
- CO3: Categorize different types of natural resources. (*Analysing*)
- CO4: Evaluate the global scale of environmental pollution. (*Evaluating*)

Module I: The Multidisciplinary Nature of Environmental Studies (1 Hour)

Definition, scope and importance, need for public awareness.

Module II: Natural Resources (2 Hours)

- a. Different types of natural resources and associated problems - forest resources, water resources, mineral resources, food resources, energy resources and land resources.
- b. Conservation of natural resources.

Module III: Ecosystems (2 Hours)

- a. Concept of an ecosystem, structure and function of an ecosystem, producers, consumers and decomposers, energy flow in the ecosystem, food chains, food webs.
- b. Structure of following ecosystems - forest ecosystem, grassland ecosystem, desert ecosystem, aquatic ecosystems.

Module IV: Biodiversity and Its Conservation (2 Hours)

Types of biodiversity – genetic, species and ecosystem, value of biodiversity, global biodiversity, India as a mega-diversity nation, threats to biodiversity, conservation of biodiversity - in-situ and ex-situ conservation.

Module V: Environmental Pollution (3 Hours)

- a. Definition, causes, effects and control measures of - air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards and e-pollution.
- b. Solid waste management.
- c. Disaster management.

Module VI: Social Issues and the Environment (3 Hours)

- a. From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, climate change, global warming, acid rain, ozone layer depletion.
- b. Environment protection act.
- c. Introduction to environmental impact assessment.

Module VII: Human Population and the Environment (2 Hours)

Population growth and sex ratio; Population explosion - family welfare programme; Environment and human health; HIV/AIDS; Role of information technology in environment and human health.

Suggested Readings

1. Textbook for Environmental Studies, E. Bharucha, UGC, New Delhi.
2. Fundamentals of Environmental Studies, S. Somvanshi and R. Dhupper, S.K. Kataria and Sons Publisher.
3. Environmental Chemistry, A. K. De, New age publishers.
4. Environmental Studies, Third edition, J. P. Sharma, University Science Press.
5. Comprehensive Environmental Studies, K. G. Bhattacharyya and A. Sarma, Narosa Publishing

House Pvt, Ltd.

Web Resources

<https://www.youtube.com/watch?v=zuSFs85kuJs&list=PLIC0i9IRboHb19v2dF0yuenG7xDOGJLeP>
<https://www.youtube.com/watch?v=tMwFNMfjFuU&list=PL8dPuuaLjXtOikZljhKAe28AkupJXnS2u>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H				H		H
CO2		M	H				
CO3				M		H	
CO4							H

AECH100T: COMMUNICATIVE HINDI - I**(2 credits – 30 hours) (L-T-P: 2-0-0)****Course Outcomes**

After successful completion of this course, students will be able to:

- CO1: Grasp the basic script of Devnagari for communicative usage (Remembering)
- CO2: Learn the vocabulary, grammar and sentence formation for day-to-day communication in Hindi (Understanding)
- CO3: Use the vocabulary, idiom and proverbs in communicative Hindi writing (Applying)
- CO4: Understand Hindi used in common public places & offices as National Language (Applying)

Course Content**Module I: Introduction to Hindi language and pronunciation**

Introduction to evolution of Hindi as National language of connectivity

Introduction to Hindi alphabet (Devanagari script) - vowels and consonants with their pronunciation

Basic greetings and expressions

- ✓ हिंदी भाषा का राष्ट्रीय भाषा के रूप में उत्थान: परिचयात्मक विश्लेषण
- ✓ हिंदी बारह बड़ी (देवनागरी लिपि) का ज्ञान – स्वर, व्यंजन एवं उनका उच्चारण
- ✓ सामान्य शब्दभंडार एवं उद्बोधन ज्ञान

Module II: Vocabulary building and basic sentence formation

Vocabulary building for daily use

Basic sentence formation using simple verbs and nouns

Introduction to daily inter personal communications / asking questions/ daily use conversations

- ✓ दैनिक प्रयोग की शब्दावली एवं शब्दकोष का ज्ञान
- ✓ संज्ञा एवं क्रिया के उपयोग से सामान्य वाक्यों की संरचना
- ✓ दैनिक उपयोगी सम्बोधन, स्व-सम्बोधन, प्रश्न इत्यादि पूछना एवं सामान्य बोलचाल सम्बन्धी ज्ञान

Module III: Basic level conversational practice and grammar

Introduction to Hindi grammar: noun, pronoun, adjective, verb, adverb

Sentence formation using different tenses: present, past, future

Use of prepositions and conjunctions in sentences

Role-play exercises for different situations: shopping, ordering food, asking for directions, etc.

Group discussion and conversation practice for grammar, sentence formation and effective communication in Hindi

- ✓ हिंदी व्याकरण – संज्ञा, सर्वनाम, विशेषण, क्रिया, क्रिया-विशेषण इत्यादि
- ✓ विभिन्न काल सम्बन्धी वाक्य संरचना – वर्तमान, भविष्य एवं भूत काल
- ✓ संबंध सूचक अव्यय / पूर्वसर्ग / शब्द एवं समुच्चयबोधक / संयोजक शब्द – वाक्य संरचना में उनका उपयोग

- ✓ अभिनय-नाटक / वार्तालाप गतिविधि / नाटक रचना के माध्यम से विभिन्न दैनिक परिस्थितियों के वार्तालाप का ज्ञान – दैनिक खान-पान सम्बन्धी, खरीददारी सम्बन्धी, पता-ठिकाना / दिशा सम्बन्धी इत्यादि
- ✓ सामूहिक परिचर्चा एवं वार्तालाप के माध्यम से व्याकरण के उपयोग, वाक्य संरचना एवं प्रभावी वार्तालाप का ज्ञान तथा अभ्यास

Module IV: Intermediate level vocabulary and grammar

- a. Vocabulary building for intermediate level topics: travel, health, environment, etc.
- b. Intermediate level sentence formation: complex sentences, conditional sentences, etc.
- c. Idioms & proverbs and their usage in communication
 - ✓ माध्यमिक स्तर के वार्तालाप हेतु शब्दावली निर्माण जैसे यात्रा, स्वास्थ्य, वातावरण इत्यादि क्षेत्रों में उपयोगी शब्दावली का ज्ञान
 - ✓ माध्यमिक स्तर के वार्तालाप हेतु वाक्य संरचना का ज्ञान: संयुक्त वाक्य, उपबंध वाची वाक्य इत्यादि
 - ✓ दैनिक वार्तालाप तथा उपयोग में आने वाली कहावतों एवं मुहावरों का ज्ञान

Module V: Advanced level conversation and writing practice

Advanced conversation practice on different Discipline Specific topics

Writing practice: Paragraph writing, message writing, letter writing, essay writing, etc.

- ✓ विभिन्न कार्यकारी क्षेत्रों से सम्बंधित उच्च स्तरीय वार्तालाप का ज्ञान एवं अभ्यास
- ✓ लेखन अभ्यास: पत्र लेखन, सन्देश, निबंध, अनुच्छेद / वाक्यखंड लेखन इत्यादि

Suggested Readings

1. Richard Delacy, Sudha Joshi (2009), Elementary Hindi: Learn to Communicate in Everyday Situations -Tuttle Publishing (a work book -e-book with MP4 video)
2. Sunita Narain Mathur, Madhumita Mehrotra (2017), Hindi for Beginners: A Guide to Conversational Hindi (Audio Disc Included), Tuttle Publishing
3. Surendra Kumar Gambhir (2003), Communicative Hindi for Beginners: Cultural Appropriateness, Vocabulary, Grammatical Accuracy Google book
4. DRISHTI IAS BLOG (2023), Hindi Language: Its Journey So Far, <https://www.drishtias.com/blog/hindi-language-its-journeyso-far>
5. Britannica blog(nd), Hindi language- history, variety, grammar and vocabulary, <https://www.britannica.com/topic/Hindilanguage>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			
CO2	L	M	H		
CO3				H	M
CO4			M	M	H

AECA100T: COMMUNICATIVE ASSAMESE I

(2 Credits: 30 hours) (L-T-P: 2-0-0)

Course Objectives

To give basic idea about the Assamese Language alphabets, wordings and also to make them learn about sentence formation, tense and writing skills of Assamese

Course Outcomes

After successful completion of this course, students will be able to:

- CO1: Understand the basic concept of Assamese language. (*Understanding*)
- CO2: Remembering the conversational language. (*Remembering*)

CO3: Analyse the reading skills of Assamese. (*Analysing*)

CO4: Apply the writing skills in daily life activities. (*Applying*)

Module I: Introduction to Assamese language and pronunciation (8 Hours)

History and geography of Assam; Introduction to Assamese alphabet and pronunciation of vowels and consonants; Basic greetings and expressions

Module II: Vocabulary building and basic sentence formation (8 Hours)

Vocabulary building for daily use; Basic sentence formation using simple verbs and nouns; Introducing oneself and asking questions

Module III: Grammar Basics and Conversational Practice (6 Hours)

Introduction to Assamese grammar: noun, pronoun, adjective, verb, adverb; Sentence formation using different tenses: present, past, future; Use of prepositions and conjunctions

Role-play exercises for different situations: shopping, ordering food, asking for directions, etc.; Group discussion and conversation practice

Module IV: Intermediate level vocabulary and basic writing practice (8 Hours)

Vocabulary building for intermediate level topics: travel, health, environment, etc.; Intermediate level sentence formation: complex sentences, conditional sentences, etc.

Use of idioms and proverbs; Advanced conversation practice on different topics; Writing practice: letter writing, essay writing, etc.

Project Phase-I: Group discussion, project identification; Case study along with group discussion

Suggested Readings

- ১) অসমীয়া ভাষাৰ উত্তৰ আৰু অভিযান- ই-ৰিচাৰ্জ।
- ২) যোগাযোগমূলক অসমীয়া ভাষা – লেখক ডঃ হেমন্ত শৰ্মা।
- ৩) অসমীয়া বৰ্ণমালা আৰু যুক্তাক্ষৰ-
- ৪) অসমীয়া বাক্যৰ লেখক সতানাত্ৰ বৰা।
- ৫) অসমীয়া কুইজ পাঠ- কুৰ্বেৰ পৰিচালন।
- ৬) অকন হাইন- কুৰ্বেৰ পৰিচালন, শ্ৰী বাবুল শৰ্মা।

AEFR100T: FRENCH BEGINNER LEVEL I

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objective

French Beginner level I is a course of 30 learning hours designed to help learners to acquire basic speaking, listening, writing and reading skills in French. The course introduces pronunciation, common vocabulary and basic grammar to learners with no previous knowledge of French language. This knowledge prepares students to effectively communicate in French on topics related to everyday situations. Students practice listening and speaking in real-life situations, learn to read short and practical texts in French, and gain an insight into francophone cultures. By the end of the session, learners are expected to be able to engage in some general, everyday types of conversation.

Course Outcomes

After successful completion of this course, students will be able to:

- CO1: Recall, name and identify the vocabulary and phrases related to who, when, where and other key question words, explain and interpret their meanings and select appropriate response. (*Remembering, Analyzing, Evaluating*)
- CO2: Use the vocabulary and sentence structures learned to converse and discuss on a range of topics related to everyday situations. (*Understanding, Applying*)
- CO3: Demonstrate a basic understanding of francophone countries' cultures, describe and summarize basic cultural values. (*Applying, Understanding, Evaluating*)

- CO4: Analyse cultural differences and choose appropriate ways to interact with speakers from Franco-phone countries. (*Analysing, Evaluating*)
- CO5: Design and compose meaningful situational dialogues and perform them; invent skits by using the language skills learned. (*Creating*)

Course Content:

Module I: Introduction to French phonetics and pronunciation drills (8 hours)

Phonetic alphabet; Vowels, semi-vowels and consonants; Silent letters; Pronunciation rules

Module II: Everyday common phrases and basic sentence structures (16 hours)

Greeting; Self-introduction (nationality, profession, age, family); Making requests
Talking about one's likes and dislikes; Making invitation; Describing personnel

Module III: Introduction to Francophone cultures (6 hours)

French and its speakers; Pop culture: music, movies, TV, dramas; Lifestyles

Suggested Readings

Amical A1, CLE International, Paris, 2011

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III
CO1	M	H	
CO2		H	
CO3			H
CO4			H
CO5		H	

AEGR100T: Introduction to German Language I (2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objective

The course aims at covering the basics of German language. It also covers a few basic grammar topics and an application of grammar in day-to-day life that is in reading, writing, listening, and speaking. On the completion of the first semester, one can understand and use familiar, everyday expressions and very simple sentences, can introduce him/her and others as well as ask others about themselves – e.g., where they live, who they know and what they own – and can respond to questions of this nature.

Course Outcomes

After successful completion of this course, students will be able to:

- CO1: Demonstrate the ability to use basic German vocabulary and grammar (personal pronouns, articles, verbs, negation, and prepositions) for everyday communication. (*Understanding, Applying*)
- CO2: Engage in simple conversations by introducing oneself, discussing family, occupations, hobbies, food, travel, and time-related contexts in German. (*Applying, Analysing*)
- CO3: Interpret and construct short dialogues and written expressions using correct sentence structures (nominative/accusative, possessive articles, expressions of time) to communicate effectively in familiar situations. (*Applying, Creating*)

Course Content

	Topic	Grammar
1	Greetings	Personal pronouns and verbs in the present tense
2	Introduce yourself/countries/occupations/Family	Artikel: der/die/das
3	The alphabet and the numbers	Verbs
4	Languages and countries	The negation
5	People and hobbies	Expression of time (am, um, von..bis)
6	In the city	Possessive Artikel
7	Food and drink and in the restaurant	Nominative and Accusative sentences, verbs and prepositions
8	Time and season	

Suggested Reading

Netzwerk Deutsch als Fremdsprache A1, Textbook + Workbook by Stephanie Dengler

SEMESTER –II**CAMF111T: Mathematical Foundation of Computer Science – II**

(3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The course aims to provide students with a strong mathematical foundation essential for advanced studies in computer science. It focuses on developing rigorous analytical and logical reasoning skills, enabling students to construct valid arguments and proofs. Through exposure to key topics such as logic, algebraic structures, numerical methods, and optimization techniques, the course builds the ability to apply mathematical concepts to computational and real-world problem-solving scenarios. By integrating theoretical understanding with practical applications, it prepares students to model, analyze, and optimize complex systems in the field of computer science.

Course Outcomes

After successful completion of this course, students will be able to:

- CO1: Construct valid arguments and proofs using appropriate logical and mathematical reasoning. *(Creating)*
- CO2: Apply fundamental mathematical techniques to understand and implement advanced computational methods, including numerical and optimization algorithms. *(Applying)*
- CO3: Employ effective problem-solving strategies to address both theoretical and practical challenges in computer science. *(Applying, Analyzing)*

Course Content:

Module I: Logic and Methods of Proofs (14 Hours)

Propositions, logical operations (basic connectives), compound statements, construction of truth table, quantifiers, conditional statements, tautology, contradiction, contingency, logical equivalence. Conjunctive Normal Forms (CNF) and Disjunctive Normal Forms (DNF).

Methods of proofs: Rules of inference for propositional logic, modus ponens, modus tollens, syllogism, proof by contradiction, Mathematical Induction.

Module II: Algebraic Structures: (8 Hours)

Semi-group, Monoid, Group, Subgroup, Cyclic group.

Module III: Numerical Methods: (12 Hours)

Concept and importance of errors in numerical methods.

Solution of algebraic and transcendental equations: Bisection method and Newton-Raphson methods.

Numerical Interpolation: Newton's Forward and Newton's Backward interpolation formula and Lagrange's formula.

Numerical Integration: Trapezoidal rule and Simpson's 1/3 rule

Only formula and problem solving for all the topics mentioned above.

Module IV: Optimization Techniques: (11 Hours)

Linear programming: Introduction, LP formulation, Graphical method for solving LPs with two variables, Special cases in graphical methods, Simplex method, Duality.

Transportation problem: Definition, Linear form, North-west corner method, least cost method, Vogel's approximation method for finding feasible solution, MODI method for finding optimum solution.

Text Books

1. Kolman B., Busby R. and Ross S., Discrete Mathematical Structures, 6th Edition, Pearson Education, 2015.
2. Sastry S. S., Introductory Methods of Numerical Analysis, Fifth Edition, PHL, 2022.
3. Taha Hamdy A., Operations Research: An Introduction, Eighth Edition, Pearson Prentice Hall, 2003.
4. S.B. Singh, Discrete Structures, Khanna Book Publishing, 2023 (AICTE Recommended Textbook)

Reference Books

1. Rosen Kenneth H. and Krithivasan Kamala, Discrete Mathematics and its Applications, McGraw Hill, India, 2019.
2. Chakravorty J. G. and Ghosh P. R., Linear Programming and Game Theory, Moulik Library, 2017.
3. Sharma J. K., Operations Research: Theory and Applications, Fourth Edition, Macmillan Publishers, 2007.

Web Resources

<https://nptel.ac.in/courses/111107127>

<https://www.math.iitb.ac.in/~siva/si50716/SI507lecturenotes.pdf>

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2			H	H
CO3	H	M	H	H

CADS112T: Data Structures

(3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The objective of this course is to develop a strong foundation in the concepts, design, and implementation of fundamental data structures. Students will learn how various linear and nonlinear data structures operate, how they are stored and manipulated in memory, and how they support efficient algorithmic problem-solving. The course emphasizes analytical thinking, algorithmic efficiency, and hands-on implementation using the C programming language, enabling students to choose and apply appropriate data structures for solving computational problems effectively.

Course Outcomes:

After successful completion of this course, students will be able to:

CO1: Understand the fundamental concepts, operations, and applications of various data structures.

(Understanding)

CO2: Apply suitable data structures and algorithmic techniques to solve computational problems. (Applying)

CO3: Implement linear and nonlinear data structures using the C programming language. (Applying)

Prerequisite:

Programming Fundamentals: Understanding the basic syntax and semantics of C programming language.

Problem-Solving Skills: Ability to break down a problem into smaller steps and devise a step-by-step solution and familiarity with simple algorithms.

Course Content:

Module I: (12 Hours)

Introduction and Overview: Definition, Classification and Operations of Data Structures. Algorithms: Complexity, Time-Space Tradeoff

Arrays: Definition and Classification of Arrays, Representation of Linear Arrays in Memory, Operations on Linear Arrays: Traversing, Inserting, Deleting, Searching, Sorting and Merging. Searching: Linear Search and Binary Search, Comparison of Methods. Sorting: Bubble Sort, Selection Sort, and Insertion Sort. Two-Dimensional Arrays, Representation of Two- Dimensional Arrays in Memory, Matrices and Sparse Matrices, Multi-Dimensional Arrays.

Module II: (10 Hours)

Linked Lists: Definition, Comparison with Arrays, Representation, Types of Linked lists, Traversing, Inserting, Deleting and Searching in Singly Linked List, Doubly Linked List and Circular Linked List. Applications of Linked Lists: Addition of Polynomials.

Hashing and Collision: Hashing, Hash Tables, Types of Hash Functions, Collision, Collision Resolution with Open Addressing and Chaining

Module III: (12 Hours)

Stacks: Definition, Representation of Stacks using Arrays and Linked List, Operations on Stacks using Arrays and Linked List, Application of Stacks: Arithmetic Expressions, Polish Notation, Conversion of Infix Expression to Postfix Expression, Evaluation of Postfix Expression.

Recursion: Definition, Recursive Notation, Runtime Stack, Applications of Recursion: Factorial of Number, GCD, Fibonacci Series and Towers of Hanoi.

Queues: Definition, Representation of Queues using Array and Linked List, Types of Queue: Simple Queue, Circular Queue, Double-Ended queue, Priority Queue, Operations on Simple Queues and Circular Queues using Array and Linked List, Applications of Queues.

Module IV: (11 Hours)

Graphs: Definition, Terminology, Representation, Traversal.

Trees: Definition, Terminology, Binary Trees, Traversal of Binary Tree, Binary Search Tree, Inserting, Deleting and Searching in Binary Search Tree, Height Balanced Trees: AVL Trees, Insertion and Deletion in AVL Tree.

Text Books

1. R.B. Patel, *"Expert Data Structures with C"*, Khanna Book Publishing Company, 2023 (AICTE Recommended Textbook)
2. Seymour Lipschutz, *"Data Structures with C"*, Schaum's Outlines, Tata McGraw-Hill, 2011.
3. Yashavant Kanetkar, *"Data Structures Through C"*, 4th Edition, BPB Publications, 2022.

Reference Books

1. Reema Thareja, *"Data Structures Using C"*, Second Edition, Oxford University Press, 2014.
2. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, *"Fundamentals of Data Structures in C"*, Second Edition, Universities Press, 2007.

Web Resources

GeeksforGeeks - Data Structures Tutorial
Khan Academy - [Algorithms Course](#)

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H		
CO2	H		H	H
CO3	H	M	H	H

CADS113P: Data Structures Lab
(1 credit - 30 hours) (L-T-P: 0-0-1)

Course Objective:

The objective of this lab course is to enable students to apply and implement fundamental data structures using the C programming language. Through hands-on exercises, students will develop practical skills in designing, coding, debugging, and analyzing data structure operations. The lab reinforces concepts learned in theory and prepares students to choose appropriate data structures for effective problem-solving in real-world applications.

Course Outcomes:

After successful completion of the lab course, students will be able to:

CO1: Implement basic and advanced operations on linear and nonlinear data structures using C. (Applying)

CO2: Analyze the behavior and performance of data structure operations through practical experimentation. (Analyzing)

CO3: Develop efficient solutions to computational problems by selecting and integrating appropriate data structures. (Applying/Creating)

List of Lab Programs:

Module I: Array and Matrix Operations: (10 Hours)

Insertion and deletion in arrays; Linear search and binary search; Bubble sort and selection; Merging of arrays; Addition, subtraction, and multiplication of matrices

Module II: Linked List Implementations (10 Hours)

Singly Linked List - Insertion: beginning, end, specific position; Deletion: beginning, end

Doubly Linked List – Create, Search

Circular Linked List – Create, Delete from end

Module III: Stacks and Queues (5 Hours)

Stacks - Implement stack using array; Implement stack using linked list

Queues - Simple queue using array; Circular queue using array

Module IV: Trees and Binary Search Trees (5 Hours)

Traversals: preorder, inorder, postorder

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2		M	H	H
CO3		H	H	H

CAOS114T: Operating Systems

(3 credits - 45 hours) (L-T-P: 3-0-0)

Course Objective:

The primary objective of this course is to introduce students to the fundamental concepts, design principles, and functioning of modern operating systems. The course aims to build a strong understanding of process management, CPU scheduling, memory management, I/O handling, synchronization, and file systems, enabling students to analyze, compare, and apply operating system functionalities effectively.

Course Outcomes:

At the end of the course, students will be able to:

CO1: Explain the fundamentals of the operating system. (*Understanding*)

CO2: Comprehend multithreaded programming, CPU scheduling, process management, process synchronization, memory, deadlocks, and storage management. (*Understanding, Applying*)

CO3: Compare the performance of CPU scheduling algorithms (*Analyzing, Evaluating*)

CO4: Identify the features of I/O and File handling methods. (*Remembering / Understanding*)

Course Content:**Module I: (10 Hours)**

Operating Systems Overview: Definition, Evaluation of O.S, Components & Services of OS, Structure, Architecture, types of Operating Systems, Batch Systems, Concepts of Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems.

Operating Systems Structures: Operating system services and systems calls, system programs, operating system structure, operating systems generations.

Module II: (12 Hours)

Process Management: Process Definition, Process states, Process State transitions, Process Scheduling, Process Control Block, Threads, Concept of multithreads, Benefits of threads, Types of threads.

Process Scheduling: Definition, Scheduling objectives, Scheduling algorithms, CPU scheduling Preemptive and Non-preemptive Scheduling algorithms (FCFS, SJF and RR), Performance evaluation of the scheduling Algorithms

Module III: (10 Hours)

Process Synchronization: Introduction, Inter-process Communication, Race Conditions, Critical Section Problem, Mutual Exclusion, Semaphores, Monitors.

Deadlocks: System model, deadlock characterization, deadlock prevention, avoidance, Banker's algorithm, Deadlock detection, and recovery from deadlocks.

Module IV: (13 Hours)

Memory Management: Logical and Physical address map, Swapping, Memory allocation, MFT, MVT, Internal and External fragmentation and Compaction, Paging, Segmentation.

Virtual Memory: Demand paging, Page Replacement algorithms, Allocation of frames, thrashing.

I/O Management: Principles of I/O Hardware: Disk structure, Disk scheduling algorithms.

Text Books:

1. Ekta Walia, Operating Systems Concepts, Khanna Publishing House, 2022 (AICTE Recommended Textbook)
2. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne (2006), Operating System Principles, 7th edition OR Later edition, Wiley India Private Limited, New Delhi.
3. Stallings (2006), Operating Systems, Internals and Design Principles, 5th edition, Pearson Education, India.

Reference Books:

1. Andrew S Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall India.
2. Sumitabha Das, UNIX Concepts and Applications, 4th Edition, Tata McGraw-Hill.

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	L	L
CO2	M	H	H	H
CO3	L	H		
CO4	L	H		

CAOS115P: Operating Systems Lab
(1 credit - 30 hours) (L-T-P: 0-0-1)

Course Objective:

The objective of this laboratory course is to provide hands-on experience with operating system concepts such as CPU scheduling, process synchronization, inter-process communication, deadlock avoidance, memory management, file allocation, and page replacement. Students will learn to implement core OS algorithms using C programming, enhancing their understanding of internal OS mechanisms.

Course Outcomes (COs):

At the end of the course, students will be able to:

- CO1: Implement CPU scheduling algorithms. *(Applying)*
- CO2: Understand and demonstrate solutions for critical section problems. *(Understanding, Applying)*
- CO3: Apply concepts of memory and file allocation techniques. *(Applying)*
- CO4: Implement and compare page replacement algorithms. *(Applying, Analyzing)*

Course Content:

Module I: Process Scheduling, Synchronization & IPC (15 Hours)

- Write a C program to simulate the FCFS CPU Scheduling algorithm.
- Write a C program to simulate the SJF CPU Scheduling algorithm.
- Write a C program to simulate the Round Robin (RR) CPU Scheduling algorithm.
- Write a C program to simulate Banker's Algorithm for deadlock avoidance.
- Write a C program to implement the Producer–Consumer problem using semaphores.
- Write a C program to illustrate IPC mechanism using Pipes.
- Write a C program to illustrate IPC mechanism using FIFOs.
- Write a C program to simulate the Dining Philosophers problem.

Module II: Memory Management, Page Replacement & File Allocation (15 Hours)

- Write a C program to simulate Paging memory management technique.
- Write a C program to simulate Segmentation memory management technique.
- Write a C program to simulate the Best Fit memory allocation technique.
- Write a C program to simulate the First Fit memory allocation technique.
- Write a C program to implement FIFO page replacement technique.
- Write a C program to implement Sequential file allocation method.

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	L
CO2	H	M
CO3	L	H
CO4	L	H

CAOP116T: Object Oriented Programming using Java
(2 credits - 30 hours) (L-T-P: 3-0-0)

Course Objective:

The objective of this course is to introduce students to the foundational principles of object-oriented programming, Java syntax and semantics, modular program development, and the use of JDK for creating, debugging, and executing Java applications.

Course Outcomes:

At the end of the course, students will be able to:

CO1: Describe the fundamental concepts of Object-Oriented Programming. (*Remembering, Understanding*)

CO2: Apply basic Java syntax to write simple programs. (*Applying*)

CO3: Use classes, objects, methods, and arrays to develop small modular Java programs. (*Applying*)

CO4: Set up and use the JDK environment to compile and run Java programs. (*Applying*)

Prerequisite: Knowledge of Problem Solving Techniques using C programming language

Course Content:

Module I: OOP Basics and Java Fundamentals (15 Hours)

Fundamentals of Object-Oriented Programming: Basic Concepts of Object-Oriented Programming (OOP) - objects, classes, abstraction, encapsulation, inheritance, polymorphism (overview only); Benefits and applications of OOP.

Java Basics: Java Features, Difference between Java, C and C++, Java Environment, structure of a simple Java Program, compiling & executing using command line; Java tokens - identifiers, keywords, literals, operators, separators; Variables, constants, data types, typecasting

Control Structures: Decision Making with Control Statements, Looping statements, Jump in loops, Labelled loops.

Module II: Classes, Methods, Arrays & Basic Packages (15 Hours)

Classes and Objects: Defining classes, creating objects, member methods, constructors, method overloading (only)

Arrays and Strings: 1D and 2D arrays, simple String operations

Inheritance: Simple Single Inheritance

Packages: Basics of packages, Creating user defined packages

Text Books

1. Balaguruswamy E. (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education
2. Schildt, H. (2022). Java: The Complete Reference. 12th edition. McGraw-Hill Education.

Reference Books

1. Arunesh Goyal, The Essentials of JAVA, Khanna Book Publishing Company Private Limited, 2012.
2. Tanweer Alam, Core JAVA, Khanna Book Publishing Company Private Limited, 2015.
3. Y. Daniel Liang, Introduction to Java Programming, 7th Edition, Pearson, 2008.
4. S. Malhotra and S. Choudhary, Programming in Java, 2nd Edition, Oxford University Press, 2014.

Web Resources

<https://www.w3schools.com/java/>

<http://www.java2s.com/>

https://onlinecourses.nptel.ac.in/noc22_cs47/preview

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	M
CO2	H	H
CO3	M	H
CO4	H	L

CAOP117P: Object Oriented Programming using Java Lab
(1 credit - 30 hours) (L-T-P: 0-0-1)

Course Objective:

The objective of this lab course is to provide hands-on experience in writing, compiling, and executing Java programs while applying basic object-oriented concepts and handling simple program structures.

Course Outcomes:

At the end of the course, students will be able to:

- CO1: Apply basic Java syntax to develop simple programs. (Applying)
- CO2: Implement classes, objects, and basic OOP concepts in Java. (Applying)
- CO3: Use arrays, strings, and methods to write modular Java programs. (Applying)
- CO4: Handle simple exceptions during program execution. (Applying)

Module I: Basic Java & OOP Foundations (15 hours)

- Write a program to read two numbers and print their product.
- Write a program to print the square of a number using command-line arguments.
- Write a program to find the largest number among n numbers.
- Write a program to generate Fibonacci series and factorial (recursive & non-recursive).
- Write a program to check whether a given string is a palindrome.
- Write a program to sort a list of names in ascending order.
- Write a program to multiply two matrices.
- Write a program to read n values in an array and display them in reverse.

Module II: Classes, Inheritance & Exception Handling (15 hours)

- Program with classes AddSub (add, subtract) and derived class MulDiv (multiply, divide).
- Create a *Student* class (USN, Name, Branch, Phone, Percentage) and create n objects.
- Program with class Shape and subclass Circle overriding getArea() and getPerimeter().
- Program with Employee as base class and subclasses Manager and Programmer overriding calculateSalary().
- Program using an interface Bank with implementations SBI and PNB printing rates of interest.
- Program demonstrating divide-by-zero exception handling.
- Program that throws an UnderAge exception if age < 18 and handles it in main().

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	M
CO2	M	H
CO3	H	M
CO4	L	H

CAWT118T: Web Technologies
(2 credits - 30 hours) (L-T-P: 2-0-0)

Course Objective:

The objective of this course is to introduce students to fundamental web technologies, including HTML, CSS, JavaScript, and XML, enabling them to design and develop responsive, interactive, and modern web applications.

Course Outcomes:

At the end of the course, students will be able to:

- CO1: Understand the concepts and architecture of the WWW, markup languages, and CSS. (*Understanding*)

- CO2: Apply event handling and data validation techniques using JavaScript. (*Applying*)
 CO3: Understand client-side dynamic scripting and basic full-stack concepts. (*Understanding*)
 CO4: Develop simple, responsive, and interactive web applications. (*Applying / Creating*)

Course Content:**Module I: Basics of HTML and CSS (15 Hours)**

Basics of HTML: Introduction to Web browsers, WWW, protocols and HTML, history of HTML, basic Structures of HTML, Header Tags, body tags, Paragraph Tags; Tags for TABLE, FORM, TEXTAREA, SELECT, IMG, IFRAME FIELDSET, ANCHOR; Lists in HTML, Introduction to DIV tag, NAVBAR Design, Introduction to XHTML

Introduction to CSS: Types of CSS, Selectors, and Responsiveness of a web page; Background, text and font properties; table and list properties; Introduction to Bootstrap

Module II: JavaScript Basics and XML (15 Hours)

Introduction to JavaScript: Functions and Events, Document Object model traversing using JavaScript. Output System in JavaScript i.e. Alert, throughput, Input box, Console. Variables and Arrays in JavaScript. Date and String handling in JavaScript.

Manipulating CSS through JavaScript: Form Validation like Required validator, length validator, Pattern validator. Advanced JavaScript, Combining HTML, CSS and JavaScript events and buttons, controlling your browser

Introduction to XML: Uses, Key concepts, DTD & schemas, XSL, XSLT, and XSL Elements and transforming with XSLT.

Text Books

1. Laura Lemay, Mastering HTML, CSS & Java Script Web Publishing, BPB Publications, 2016
2. Thomas A. Powell, The Complete Reference HTML & CSS, Fifth Edition, 2017

Reference Books

1. Silvio Moreto, Bootstrap 4 By Example, ebook, 2016.
2. Tanweer Alam, Web Technologies, Khanna Book Publishing, 2011.

Web Resources

www.javatpoint.com
www.w3schools.com
<https://www.geeksforgeeks.org/web-technology/>

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	M
CO2	L	H
CO3	M	H
CO4	M	H

CAWT119P: Web Technologies Lab
(1 credit - 30 hours) (L-T-P: 0-0-1)
Course Objective:

The objective of this course is to provide hands-on experience in creating static and interactive web pages using HTML, CSS, JavaScript, XML, and related web technologies. Students will learn to design responsive layouts, validate input data, work with client-side scripting, and utilize structured data formats.

Course Outcomes (COs)

At the end of the course, students will be able to:

- CO1: Design web pages using HTML and CSS. (*Applying*)
 CO2: Implement interactivity and input validation using JavaScript. (*Applying*)

CO3: Use XML, DTD, XSD, and XSLT for structured data handling. (*Understanding / Applying*)

CO4: Develop small web applications integrating HTML, CSS, JavaScript, and XML/JSON. (*Applying / Creating*)

LIST OF PROGRAMS:

Module I: HTML & CSS BASICS (15 Hours)

Create your class timetable using the HTML table tag.

Design a descriptive webpage for your college (courses, departments, library, etc.) using lists, links, and anchor tags.

Create a webpage layout using frames with rows and columns (header, left menu, right content, status bar).

Create your personal Resume using HTML text formatting, links, colours, and lists.

Design a Supermarket homepage using internal CSS.

Apply external CSS to format your timetable.

Use all CSS types (inline, internal, external) to format the college webpage designed earlier.

Create a mobile-friendly webpage for your college (responsive basic layout).

Module II: JavaScript and XML (15 Hours)

Create an HTML/JavaScript Login Page with basic validations.

Develop a Simple Calculator using JavaScript (add, subtract, multiply, divide).

Apply Regular Expressions for login form validation.

Retrieve data from a text file and display it using AJAX.

Create an XML file to store student information (Register No, Name, Mobile, DOB, Email).

Create a DTD for the XML file.

Create an XML Schema (XSD) for the XML file.

Create an XSL file to convert XML to XHTML.

Write a JavaScript program using switch case.

Write a JavaScript program using built-in objects (Date, Math, String, Array).

Mapping of COs to Modules

Course Outcomes	Module I	Module II
CO1	H	L
CO2	L	H
CO3	L	H
CO4	M	H

CBUI104T: Understanding India (1 credit - 15 hours) (L-T-P: 1-0-0)

Course Outcomes:

At the end of this course, students will be able to:

CO1: Explain the social, cultural and religious diversity of India and its impact on Indian psyche.

CO2: At the end of this course, students will be able to evaluate the political and economic system of India.

Module 1: India and its Diversity (8 hours)

Overview of India's geography, diversity, demographics and development indicators

A brief survey of India's history, highlighting key events, personalities and movements that shaped its identity and destiny

An exploration of India's rich and varied cultural heritage, including its languages, religions, arts, literature and philosophy

An overview of India's social structure, institutions, norms and values, with a focus on issues such as caste, gender, class and ethnicity

Module 2: Indian Political System (7 hours)

A study of India's political system, institutions, parties and ideologies

India's role in regional and global affairs

A review of India's economic performance; the challenges and opportunities for growth;

An overview of sectors such as agriculture, industry, services, and trade.

A discussion of India's environmental problems & the solutions for sustainable development

A discussion on India's journey towards a developed nation.

Suggested Readings

1. Thapar, R. (2015). The Penguin History of Early India: From the Origins to AD 1300. India: Penguin Books Limited.
2. Kosambi, D. D. (2022). The Culture and Civilization of Ancient India in Historical Outline. United Kingdom: Taylor & Francis.
3. Zimmer, H. R. (2020). Philosophies of India. United States: Princeton University Press.
4. Mohanty, M. (2004). Class, Caste, Gender. India: SAGE Publications.
5. Mitra, S. K. (2017). Politics in India: Structure, Process and Policy. United Kingdom: Taylor & Francis.
6. Kothari, R. (1970). Politics in India. India: Orient Longman.
7. Balasubramanyam, V. N. (2019). The Economy of India. United Kingdom: Taylor & Francis.
8. Fisher, M. H. (2018). An Environmental History of India: From Earliest Times to the Twenty-First Century. United Kingdom: Cambridge University Press.

Suggested Software/Learning Websites:

<https://www.constitution.org/cons/india/const.html>

<http://www.legislative.gov.in/constitution-of-india>

<https://www.sci.gov.in/constitution>

<https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/>

AECH101T: COMMUNICATIVE HINDI II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Outcomes

On completion of this course successfully, students will be able to:

CO1: Conceptualize vocabulary used in professional sectors (remembering)

CO2: Apply advance level grammatical concepts in communicative usage (applying)

CO3: Understand the cultural and regional influences on communicative Hindi (understanding)

CO4: Effectively use Hindi in public, professional and social platforms

Module I: Advanced vocabulary building

Review of concepts: Review of basic level Hindi vocabulary, pronunciation and sentence formation

Review of intermediate level vocabulary, conversation and grammar

Vocabulary building for advanced topics: politics, economics, technology, etc.

Understanding and usage of synonyms, antonyms, and homonyms words

सामान्य हिंदी ज्ञान एवं अवधारणाओं की समीक्षा: शब्द कोष, उच्चारण, वाक्य संरचना इत्यादि

माध्यमिक स्तर के वार्तालाप हेतु शब्दावली, वार्तालाप व्याकरण एवं इत्यादि की समीक्षा

उच्च स्तरीय वार्तालाप हेतु शब्दकोष निर्माण जैसे राजनीति, अर्थशास्त्र, विज्ञान व तकनीकी आदि क्षेत्रों में उपयोगी शब्दावली

समानार्थी, विरुद्धार्थी एवं सामान्य शब्दों का ज्ञान एवं उपयोग

Module II: Advanced grammar concepts

Advanced sentence formation: passive voice, direct and indirect speech, etc.

Use of conjunctions, interjections, and transitional words

Figures of speech (Alankar) and their effective usage in communicative Hindi

उच्च स्तरीय वाक्य संरचना: कर्तृवाच्य और कर्मवाच्य, प्रत्यक्ष कथन और अप्रत्यक्ष कथन इत्यादि

संज्ञोक्त, विस्मयादिबोधक, सकर्मक-अकर्मक शब्दों का उपयोग

अलंकारों का ज्ञान एवं प्रभावशाली वार्तालाप में उनका प्रयोग

Module III: Conversational practice and Writing practice

Role-play exercises for advanced situations: negotiating, debating, expressing opinions, etc.

Group discussion and conversation practice

Writing practice for advanced topics: newspaper articles, book/magazine articles, reports, etc.;

rhetorical usage in Hindi writing

अभिनय-नाटक / वाद-विवाद / वार्तालाप गतिविधि / नाट्य-रचना के माध्यम से उच्च स्तरीय परिस्थितियों के वार्तालाप का ज्ञान:

वाद-विवाद, सामूहिक परिचर्चा, व्यक्तित्व अभिव्यक्ति एवं वार्तालाप अभ्यास

लेखन अभ्यास: आलेख, पत्र, समाचार, पुस्तकीय आलेख, प्रतिवेदन इत्यादि; उच्च स्तरीय लेखन कार्य में आलंकारिक / शब्दाडंबरपूर्ण भाषा का उपयोग

Module IV: Cultural and social influences on communication

Analytical understanding of Cultural and social aspects of communication in Hindi-speaking regions

Major communication styles: across generations, cultures and regions

Major Hindi Dialects of different regions of India

विभिन्न हिंदी भाषी क्षेत्र एवं वार्तालाप सम्बद्ध सामाजिक एवं सांस्कृतिक दृष्टिकोण एवं विवेचन

विभिन्न वार्तालाप पद्धतियाँ: सांस्कृतिक, क्षेत्रीय एवं पीढ़ी दर पीढ़ी परिवर्तन के सन्दर्भ में

विभिन्न भारतीय क्षेत्रों की प्रमुख हिंदी उपभाषाएँ एवं बोलियाँ

Module V: Professional communication and specialized communication

Communication in professional contexts: Vocabulary building for professional use, Writing emails, letters and memos in Hindi

Communication used in core business sectors for specific purposes: tourism, healthcare, education, etc.

Vocabulary building and sentence formation for specialized professional communication

Role-play exercises for specialized communication scenarios viz. institutional, administrative, professional, legal, corporate and business communications etc.

व्यावसायिक वार्तालाप सन्दर्भ: व्यावसायिक वार्तालाप हेतु शब्दकोश का ज्ञान, ई-मेल/पत्र, व्यावसायिक पत्र, ज्ञापन आदि

प्रमुख व्यावसायिक क्षेत्रों जैसे भ्रमण, स्वास्थ्य, शिक्षा इत्यादि क्षेत्रों में उपयोग में आने वाली शब्दावली का ज्ञान

व्यावसायिक वार्तालाप/सूचनाओं के आदान-प्रदान में उपयोगी शब्दावली, वाक्य संरचना एवं शब्दकोश का ज्ञान

अभिनय-नाटक/वार्तालाप गतिविधि/ नाटक रचना के माध्यम से विभिन्न/विशेषीकृत परिस्थितियों के वार्तालाप का ज्ञान — जैसे व्यावसायिक, प्रबंधकीय, संस्थागत, व्यावहारिक, संगठित/नियमित व्यापार सम्बन्धी एवं कानूनी वार्तालाप

Module VI: Use of Hindi in digital communication

Opportunities and Usage of Hindi language in social media and digital communication

Writing online content, public contents and professional contents in Hindi through in class activities.

सामाजिक संचार माध्यम/सोशल मीडिया, अंकीय माध्यम/डिजिटल मीडिया में हिंदी भाषा का प्रयोग एवं संभावनाएं

सीधा संचार संपर्क/ आन लाइन के सन्दर्भ में प्रारूप लेखन/कंटेंट राइटिंग, सार्वजनिक लेखन, व्यावसायिक लेखन इत्यादि का ज्ञान एवं अभ्यास

Suggested Readings

Soorya prasad Dixit (2012), Sanchar Bhasha –Hindi, Lokbharti Prakashan

Hindi-B- Rachna Sagar(2019), Rachna Sagar publication

Omkar N.Koul (2008), Modern Hindi Grammar, Donwoody Press

Richard Delacy, Sudha Joshi (2009), Elementary Hindi: Learn to Communicate in Everyday Situations - Tuttle Publishing (a work book -e-book with MP4 video)

Sunita Narain Mathur, Madhumita Mehrotra (2017), Hindi for Beginners: A Guide to Conversational Hindi (Audio Disc Included), Tuttle Publishing

Surendra Kumar Gambhir (2003), Communicative Hindi for Beginners: Cultural Appropriateness, Vocabulary, Grammatical Accuracy Google book
 DRISHTI IAS BLOG (2023), Hindi Language: Its Journey So Far,
<https://www.drishtiiias.com/blog/hindi-language-its-journey-so-far>
 Britannica blog (nd), Hindi language- history, variety, grammar and vocabulary,
<https://www.britannica.com/topic/Hindilanguage>

Mapping of Course Outcomes with Modules:

Course Out-comes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	L	M	H			
CO 2	L	M	H			
CO 3				H	L	
CO 4			M		H	H

AECA101T/AECA201T: COMMUNICATIVE ASSAMESE II
(2 credits – 30 hours) (L-T-P: 2-0-0)

Course Objectives

The objective of this course is to provide Advance Writing Skill in Assamese Language, knowledge of Assamese grammar, Conversational practice, Cultural and Social Communication, Advance Grammar Concepts and finally to provide professional communication in Assamese.

Course Outcomes

CO 1: Understand the Advanced vocabulary buildings.

CO 2: Explain the Advance sentence formation in Assamese language.

CO 3: Evaluate the importance of Assamese culture professional communication.

Module I: Advanced vocabulary building (6 Hours)

- a. Review of basic Assamese pronunciation and sentence formation
- b. Review of intermediate level vocabulary and grammar
- c. Vocabulary building for advanced topics: politics, economics, technology. etc.
- d. Use of synonyms, antonyms, and homonyms

Module II: Advanced grammar concepts (8 hours)

- a. Advanced sentence formation: passive voice, direct and indirect speech, etc.
- b. Use of conjunctions, interjections, and transitional words

Module III: Conversational practice and Writing practice (8 Hours)

- a. Role-play exercises for advanced situations: negotiating, debating, expressing opinions, etc.
- b. Group discussion and conversation practice
- c. Writing practice for advanced topics: newspaper articles, reports, etc.
- d. Use of rhetorical devices in writing

Module IV: Cultural and social communication (8 hours)

- a. Cultural and social aspects of communication in Assam
- b. Differences in communication styles across generations and regions

- c. Professional communication and specialized communication
- d. Communication in professional contexts
- e. Vocabulary building for professional use
- f. Writing emails and memos in Assamese
- g. Communication for specific purposes: tourism, healthcare, education, etc.
- h. Vocabulary building and sentence formation for specialized communication Role-play exercises for specialized communication scenarios

Suggested Readings

- ১) নতুন আৰ্জু-অসমীয়া বাক্যৰ আৰ্হি বচন। ৫ ম, ৬ ঠ আৰু ৭ ম শ্ৰেণী, - দীনেশ্বৰ নাথ, ক্ৰিয়েটিভ পাব্লিকেশন
- ২) পাঠশালাৰ- বাক্যৰ আৰ্হি বচন। তৃতীয় আৰু চতুৰ্থ শ্ৰেণীৰ বাবে অসম বুক- দিপেন

AEFR101T: FRENCH BEGINNER LEVEL II

(2 credits – 30 hours) (L-T-P: 2-0-0)

Course objective

French Beginner level II is a course of 30 learning hours designed to help learners having completed French Beginner Level 1 to acquire more advanced language skills in French language. These skills prepare students to effectively communicate in French on topics related to various daily situations. Students enhance listening and speaking abilities in real-life situations, learn to read and write practical texts in French, and gain deeper understanding of francophone cultures. By the end of the session, learners are expected to be able to engage in a variety of simple daily conversations, read and write short paragraphs in French.

Course Outcomes

On completion of this course, students will be able to:

- CO1: Recall, name and identify the vocabulary and phrases related to who, when, where and other key question words, explain and interpret their meanings and select appropriate response. (Remembering, analyzing, evaluating)
- CO2: Use the vocabulary and sentence structures learned to converse and discuss on a range of topics related to everyday situations. (Understanding, applying)
- CO3: Demonstrate a deeper understanding of francophone countries' cultures, describe and summarize basic cultural values. (Applying, understanding, evaluating)
- CO4: Analyse cultural differences and choose appropriate ways to interact with speakers from Francophone countries. (Analysing, evaluating)
- CO5: Design and compose meaningful situational dialogues and perform them; invent skits by using the language skills learned. (Creating)

Module I: Pronunciation drills (8 hours)

Liaison and enchainment; Sound discrimination; Distinction of grammatical gender; Elision

Module II: Daily conversation and grammatical structures (16 hours)

a) Shopping

Expressing wishes and needs

Asking and giving direction

Telling time

Describing intention in near-future tense

Making an appointment

Module III: Introduction to Francophone cultures (6 hours)

Tourism, Arts and literature, Lifestyles

Suggested Readings1. *Amical A1*, CLE International, Paris, 2011**Mapping of COs to Syllabus**

Course Outcome	Module 1	Module 2	Module 3
CO1	M	H	
CO2	M	H	
CO3			H
CO4			H
CO5	M	H	

AEGR101T/AEGR201T: INTRODUCTION TO GERMAN LANGUAGE II**(2 credits – 30 hours) (L-T-P: 2-0-0)****Course Objectives**

The course aims at covering the basics of German language. It also covers a few basic grammar topics and an application of grammar in day-to-day life that is in reading, writing, listening, and speaking. On the completion of the first semester, one can understand and use familiar, everyday expressions and very simple sentences, can introduce him/her and others as well as ask others about themselves – e.g., where they live, who they know and what they own – and can respond to questions of this nature.

Course Outcomes

Students will be able to acquire a working knowledge in basic German

Course Contents

	Topic	Grammar
1	Daily schedule and arranging appointments	Dative sentences, verbs, prepositions
2	In the office, different jobs, and leisure activity	Sentence connectives: conjunctions (und, oder, aber)
3	On the computer and emails	The group of nouns
4	Living and the home furnishings	Pronouns
5	Clothes and the shopping	Adjectives
6	Health and body parts	Modal Verbs
7	Holiday, travel, and city tour	Past Tense

Suggested Reading

Netzwerk Deutsch als Fremdsprache A1, Textbook + Workbook by Stephanie Dengler

DEPARTMENT OF MANAGEMENT
PROGRAMME: FIVE-YEAR BBA-MBA INTEGRATED PROGRAMME
DEGREE: INTEGRATED MASTER OF BUSINESS ADMINISTRATION (iMBA)

Vision:

The five year BBA-MBA Integrated curriculum strives to grow into a significant position in Management education to create graduates in the field of business and management to become future business leaders, entrepreneurs who are socially responsible professionals capable of adapting into the dynamic corporate world having a globally acceptable vision.

Mission:

To focus on imparting the highest quality education at par with international standards with a strong foundation of management concepts and its applications, for students to excel and enhance their skills in order to make them accepted worldwide as managers.

To develop a strong industry-academia interface for project based learning, internships and placements. The pedagogy designed focus on practical learning through case studies, flipped classrooms, experiential projects, presentations, group discussions, etc enabling students to apply their knowledge in real world scenarios. This hands-on approach prepares the students to understand and interpret the challenges of the business world and enhances their critical thinking, analytical and communication skills.

Programme Outcomes (PO)

On successfully completing the program the student will be able to:

PO 1. Critical Thinking, Business Analysis and Problem Solving:

Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.

PO 2. Effective Communication:

Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.

PO 3. Social Responsiveness and Interaction:

Developing responsiveness to contextual social issues / problems and exploring solutions. Elicit views of others, mediate disagreements and help reach conclusions in group settings.

PO 4. Ethical and responsible citizen:

Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them. : Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.

PO 5. Environment and Sustainability:

Understand the issues of environmental contexts and sustainable development.

PO 6. Leadership and Team work,

Understanding leadership roles at various levels of the organization and leading teams. Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Program Specific Outcomes (PSO)

On the successful completion of B.B.A., the students will be able to:

PSO 1: Acquisition of Knowledge, skills and experiential learning in functional areas of management:

Comprehend the various concepts, processes and significance; to develop an insight and analytical abilities and also to develop the ability to provide solutions for effective decision making in practical business problems

PSO 2: Development of managerial skills:

Ability to visualize managerial problems and identify various alternatives to solve them To provide an opportunity for gaining practical understanding of the workplace and develop various leadership and interpersonal skills through internship training and also to make the students industry ready and to enhance critical thinking skills in understanding business challenges related to global business.

PSO 3: Entrepreneurship development skills:

To promote entrepreneurial skills by understanding the fundamentals of new business ventures. Ability to apply contemporary tools and techniques

COURSE STRUCTURE

Year	Semester	Category	Course Code	Name of the Course	Credit	Page No
I	1	Major Course 1	MTMP100T	Management Process, Principles and Practices	4	1344
		Minor Course 1	MTBO102T	Business Organisation	4	
		Skill Enhancement Course	MTED104L	Entrepreneurship Development	3	1382
		Multi-disciplinary Course	Course to be chosen from stream not studied in Class 12		3	
		Ability Enhancement Compulsory Course	AECE100T/ AECH100T/ AECA100T AEFR100T/ AEGR100T	Communicative English -I / Communicative Hindi-I / Communicative Assamese-I/ French Beginner Level I/ Introduction to German Language – I	2	249 222 223 224 225
		Common Value Based Course-I	CBES101T	Environmental Studies	1	227
		Common Value Based Course-II	CBHY102T	Health and Wellness, Yoga Education, and Sports and Fitness	1	228
		Community Engagement Course		Service-Learning Theory	2	
		Total Credits			20	
	2	Major Course 2	MTMF107T	Accounting for Managers and Financial Management	4	1345
		Minor Course 2	MTMF103T	Management Fundamentals	4	
		Skill Enhancement Course	MTOM105L	Office Organization and Management	3	1383
		Multi-disciplinary Course	Course to be chosen from stream not studied in Class 12		3	
		Ability Enhancement Compulsory Course	AECE101T/ AECH101T/ AECA101T/ AEFR101T/ AEGR101T	Communicative English -II / Communicative Hindi-II / Communicative Assamese-II/ French Beginner Level-II/ Introduction to German Language–II	2	255 235 237 237 238
		Common Value Based Course-III	CBDT103T	Digital and Technological Solutions	1	240

		Common Value Based Course-IV	CBUI104T	Understanding India	1	241
		Community Engagement Course		Service-Learning Practice	2	
		Total Credits			20	
BBA Certificate						
II	3	Major Course 3	MTMM200T	Marketing Management	4	1346
		Major Course 4	MTOV201T	Organizational Behaviour	4	1347
		Minor Course 3	MTBI205T	Banking and Insurance	4	
		Skill Enhancement Course	MTRM210L	Retail Management	3	1385
		Multi-disciplinary Course	Course to be chosen from stream not studied in Class 12		3	
		Ability Enhancement Compulsory Course	AECE200T/ AECH200T/ AECA200T AEFR200T/ AEGR200T	Communicative English -I / Communicative Hindi-I / Communicative Assamese-I/ French Beginner Level I/ Introduction to German Language – I	2	249
						222
						223
	224					
	225					
	Total Credits				20	
	4	Major Course 5	CMHR202T	Human Resource Management	5	1348
		Major Course 6	MTCB203T	Consumer Behaviour	5	1349
		Major Course 7	MTMD204T	Business Mathematics and Statistics for Decision Making	4	1350
		Minor Course 4	MTFT206T/ MTCM207T/ - -	Fundamentals of Investment / Compensation Management / Customer Relationship Management	4	186
						187
		Ability Enhancement Compulsory Course	AECE201T/ AECH201T/ AECA201T/	Communicative English -II / Communicative Hindi-II / Communicative Assamese-II/	2	255
						235
						237
			AEFR201T/ AEGR201T	French Beginner Level-II/ Introduction to German Language–II		237 238
Total Credits				20		
BBA Diploma						
III	5	Major Course 8	MTME300T	Managerial Economics	5	1352
		Major Course 9	MTEG301T	Business Ethics and Corporate Governance	5	1353
		Major Course 10	MTPO302T	Production and Operations Management	4	1354
		Minor Course 5	MTSH307T/ MTPF308T/ MTMR309T	Strategic HRM/ Personal Financial Planning/ Marketing Research	4	193
		Total Credits				20
	6	Major Course 11	MTPM303T	Business Policy and Strategic Management	4	1355
		Major Course 12	MTFI304T	Financial Markets and Institutions	4	1356
		Major Course 13	MTCL305T	Corporate and Business Law	4	1358

		Minor Course 6	MTIR311T/ MTIP312T/ MTDM313T	Management of Industrial Relations/ Investment Analysis and Portfolio Man- agement / Digital Marketing	4	195 196 197
		Major Course 14		Minor project	4	1359
		Total Credits			20	
BBA						
IV	7	Major Course 15	MTCF400T	Corporate Finance	5	1360
		Major Course 16	MTSC401T	Supply Chain Management	5	1361
		Minor Course 7		Analysis of Business Environment: In- dian and Global	3	
		Minor Course 8	MTRM406T	Research Methodology	2	
		Major Project 1	MTDI408P	Research Project/Dissertation - I	5	1389
		TOTAL CREDITS			20	
	8	Major Course 17	MTSM402T	Services Marketing	5	1363
		Major Course 18	MTCR403T	Corporate Restructuring	5	1364
		Minor Course 9	MTIB407T	International Business	3	
		Skill Enhancement Course		Virality in Digital Media	2	1386
		Major Project 2	MTDI409P	Research Project / Dissertation - II	6	
		Total Credits			20	
BBA (Honours)/ BBA (Honours) with Research						
V	9	Major Course 19		Strategic Management	4	
		Minor Course 10		Quantitative Techniques for Business	4	
		Skill Enhancement Course		Business Case Design and Presenta- tion	3	
		Specialization I: Finance Specialisation				
		Discipline Specific Elec- tive-I		Corporate Financial Decision	3	
		Discipline Specific Elec- tive-II		Financial Reporting	3	
		Discipline Specific Elec- tive-III		International Finance	3	
		Specialization II: Marketing Specialisation				
		Discipline Specific Elec- tive-I		International Marketing	3	188
		Discipline Specific Elec- tive-II		Integrated Marketing Communications	3	
		Discipline Specific Elec- tive-III		Hospitality & Tourism Marketing	3	
		Specialization III: Marketing Specialisation				
		Discipline Specific Elec- tive-I		Cross Cultural Management	3	
		Discipline Specific Elec- tive-II		Training & Management Development	3	
		Discipline Specific Elec- tive-III		Strategic HRM	3	190
		TOTAL CREDITS			20	
	10	Major Course 20		Dissertation III	4	

		Minor Course 11		Data Analytics and AI in Business	4	
		Skill Enhancement Course		Business Case Design and Presentation	3	
			Finance Specialisation			
		Discipline Specific Elective-I		Project Appraisal & Finance	3	
		Discipline Specific Elective-II		Management of Financial Institutions	3	
		Discipline Specific Elective-III		Personal Finance & Planning	3	192
			Marketing Specialisation			
		Discipline Specific Elective-I		Service Marketing	3	
		Discipline Specific Elective-II		Sales and Distribution Management	3	
		Discipline Specific Elective-III		Product & Brand Management	3	
			HR Specialisation			
		Discipline Specific Elective-I		HR Analytics	3	
		Discipline Specific Elective-II		Team Dynamic and Leadership	3	
		Discipline Specific Elective-III		Organisational Development & Change Management	3	
			Total Credits			20
			Integrated MBA			

DETAILED SYLLABUS MAJOR COURSES

Semester	Category	Course Code	Course Name	Credits
1	Major Course 1	MTMP100T	Management Process, Principles and Practices	4
2	Major Course 2	MTHB101T	Fundamentals of Human Resources Management & Organisation Behaviour	4
3	Major Course 3	MTMM200T	Marketing Management	4
3	Major Course 4	MTAI201T	Introduction to Aviation Industry	4
4	Major Course 5	MTFM202T	Fundamentals of Financial Management	5

4	Major Course 6	MTCB203T	Consumer Behaviour	5
4	Major Course 7	MTMD204T	Business Mathematics and Statistics for Decision Making	4
5	Major Course 8	MTME300T	Managerial Economics	5
5	Major Course 9	MTEG301T	Business Ethics and Corporate Governance	5
5	Major Course 10	MTPO302T	Production and Operations Management	4
6	Major Course 11	MTPM303T	Business Policy and Strategic Management	4
6	Major Course 12	MTFI304T	Financial Markets and Institutions	4
6	Major Course 13	MTCL305T	Corporate and Business Law	4
6	Major Course 14	MTMP306P	Minor Project – 1	4
7	Major Course 15	MTCF400T	Corporate Finance	5
7	Major Course 16	MTSC401T	Supply Chain Management	5
8	Major Course 17	MTSM402T	Services Marketing	5
8	Major Course 18	MTCR403T	Corporate Restructuring	5

MTMP100T: MANAGEMENT PROCESS, PRINCIPLES AND PRACTICES

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s): The objective of this course is to develop an understanding of the Principles and processes of management covering the basic management functions and challenges in the emerging perspective.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: define the meaning of MPP. (Remembering)

CO2: explain the theory of planning and control. (Understanding)

CO3: determine the organisational process. (Applying)

Module I: Introduction to MPP (15 Hours)

Introduction: Concept, Nature, Process and Significance of Management; Managerial Roles (Mintzberg); Development of Management Thought- Classical, Neo -classical, Behavioural and Management Science Approach, System and Contingency Approaches.

Module II: Planning & Control (15 Hours)

Planning and Control: Concept, Process and Types; Planning Tools- Forecasting and Scheduling; Decision -making concept and process; Bounded rationality; Management by objectives; Corporate Planning- Environment analysis and Diagnosis

Module III: Organising (15 Hours)

Organising: Concept, nature, process and significance; Authority and Responsibility relationships Delegation, Decentralisation; Departmentation basis and formats (Project and Matrix); Formal and Informal Organisation; Changing patterns in Organisation structures in the Knowledge economy. Directing- Motivating and Leading People at work.

Module IV: Communication and Decision Making (15 Hours)

Role of communication; Communication media and technology, communication networks - formal vs. informal; barriers to effective communication; communication skills; persuasion in communication; active listening; participative decision making techniques; group vs. the individual; the decision making process

Suggested Readings

Joseph L. Massie :Essentials of Management .PHI, New Delhi; 2015

James F.Stoner :Management. Pearsons Education, Delhi ; 2020

Harold Koontz, Heinz Weihrich: Management. Tata McGraw Hill Pub. Co., Delhi; 2015
 Amitai Etzioni :Modern Organizations. PHI, New Delhi; 2021
 Jones, Gareth R. and Jennifer M. George: Contemporary Management. Tata McGraw Hill
 Charles Hill, W.L. and Steven L.McShane: Principles of Management. Tata McGraw Hill

E Resources

<https://www.youtube.com/watch?v=q6LMjurECZM>
<https://www.youtube.com/watch?v=GZ2dmbDmB5I>

Mapping of COs with Syllabus

Cos	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M

MTMF107T: ACCOUNTING FOR MANAGERS AND FINANCIAL MANAGEMENT

(Credits: 4- 60 hours) (L-T-P: 4-0-0)

Objective(s): To equip students with a comprehensive understanding of accounting and financial management principles, enabling them to apply financial analysis and decision-making tools for effective managerial control and strategic planning.

Course/Learning Outcomes

After learning this course, the students will be able to:

CO1: define the Fundamental accounting principles and financial management concepts. (Understanding)

CO2: identify the financial statements and interpret financial information for decision-making (Applying)

CO3: analyse the budgeting and financial control systems for effective resource management. (Analyzing)

CO4: evaluate the financial performance of a business and recommend strategies for improvement (Evaluating)

Module I: Financial Accounting

Introduction to accounting: Basic concepts, accounting principles, and the accounting cycle. Financial statements: Balance sheet, income statement, cash flow statement, and their analysis. Ratio analysis: Liquidity, profitability, solvency, and activity ratios. Inventory valuation and management: Inventory systems, valuation methods, and inventory control.

Module II: Cost Accounting

Introduction to cost accounting: Cost concepts, classification, and behavior. Cost-volume-profit analysis: Break-even point, margin of safety, and contribution margin. Job order costing and process costing: Costing systems and procedures. Activitybased costing: Concept, benefits, and implementation.

Module III: Financial Management

Financial management concepts: Goals, scope, and functions. Time value of money: Concepts, calculations, and applications. Capital budgeting: Techniques for evaluating investment proposals. Working capital management: Cash, receivables, and inventory management.

Module IV: Financial Markets and Institutions

Financial markets: Types, functions, and participants. Financial institutions: Commercial banks, investment banks, and financial intermediaries. Risk management: Types of risk, risk assessment, and risk mitigation. Financial instruments: Shares, debentures, and derivatives.

Module V: Budgeting and Financial Control

Budgeting process: Types of budgets, budgeting techniques, and zero-based budgeting. Performance evaluation: Responsibility accounting, variance analysis, and performance measurement. Financial forecasting and planning: Techniques and tools. Cash flow management: Cash budgeting and cash forecasting.

Suggested Readings

Horngren, C. T., Datar, S., & Rajan, M. V. (2012). Cost accounting: A managerial emphasis. Pearson.
 Ross, S. A., Westerfield, R. W., & Jordan, B. D. (2019). Fundamentals of corporate finance. McGraw-Hill Education.
 Weygandt, J. J., Kimmel, P. D., & Kieso, D. E. (2019). Financial accounting. Wiley.
 Gitman, L. J., & Joehnk, M. D. (2018). Principles of managerial finance. Pearson.

Mapping of COs with Syllabus

Cos	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M
CO4				M	
CO5					M

MTMM200T: MARKETING MANAGEMENT

(Credits: 4 - 60 hours) (L-T-P: 4-0-0)

Objective(s): *The Objective of the course is to introduce the students to the domain of marketing and to its practical applications.*

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: enumerate the fundamentals of marketing management. (Understanding)

CO2: assess the marketing environment. (Analyse)

CO3: analysing market segmentation. (Analysis)

CO4: examine pricing strategy and distribution channels. (Analysis)

CO5: importance of communication in marketing (Creating)

Module I: Fundamentals of Marketing (8 Hours)

Conceptual Framework of Marketing, Core Concepts of Marketing, Marketing Philosophies, Marketing Myopia, Marketing Practices developed over 21st Century; Different Contexts of Marketing Applications.

Module II: Marketing Environment (10 Hours)

Analysis of marketing environment: Macro and Micro components and their impact on marketing decisions, Macro & Micro environment of Marketing – Industry & Competitor analysis, Developing strategies.

Module III: Market Segmentation and Product Overview (13 Hours)

Consumer buying Model, Market segmentation, Targeting and Positioning, Market and Marketing research and Marketing Information System, Marketing Mix, Product mix strategies, : Product and service concept, Product Lines- Length, Breadth & depth, Product life cycle, New product Development, Brand concept, Brand Equity.

Module IV: Pricing and Distribution Strategies (14 Hours)

Pricing strategies, Price setting, Price determination. Channels of distribution: Types, Designing Distribution Channels, Managing Conflicts and Controls in Channels, Retailing, and Wholesaling, E-Retailing.

Module V: Marketing Communication Mix (15 Hours)

Marketing Communication, Integrated Marketing Communication, Promotional Mix Components- Advertising Vs Promotion, Advertising Vs Publicity, Sales Promotion, Public Relations, Personal Selling and Direct Marketing, Digital Marketing. Emerging issues in marketing, Ethical issues, Green marketing, Consumerism, CSR in marketing, Payment related issues in the cashless era.

Suggested Readings

Kotler, P., Keller, K., Koshy, L., & Jha, M: Marketing Management: A South Asian Perspective. Pearson Education, New Delhi; 2019.
 Saxena, R: Marketing Management. Tata McGraw Hill, New Delhi; 2015.
 Stanton: Fundamentals of Marketing, McGraw Hill; 2020.
 S. Jayachandran: Marketing Management, Tata McGraw Hill; 2015.
 Ramaswamy, V. S., & Namakumari, S: Marketing Management: Global Perspective Indian Context. Laxmi Narayan Publication, New Delhi; 2014.

Mapping of COs to syllabus

Cos	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3			H		
CO4				H	
CO5					M

MTOV201T: ORGANISATIONAL BEHAVIOUR

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s): The Objective of the course is to equip students with a comprehensive understanding of individual, group, and organizational behavior, enabling them to analyze organizational dynamics, develop effective interpersonal and leadership skills, and contribute to organizational success.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: demonstration of fundamental concepts and theories of organizational behavior. (Understanding)
 CO2: assessing the individual and group behavior within organizational contexts (Evaluating)
 CO3: assessing the organizational behavior concepts to address real-world organizational challenges (Evaluating)
 CO4: categorise the effective interpersonal and leadership skills. (Analysis)
 CO5: evaluating the impact of organizational behavior on organizational performance (Evaluating)

Module I: Introduction (10 Hours)

Airline Industry – Scope, Types. Scheduled and Non-Scheduled Flights; Air Cargo Transport – Economic and Social impact; Regulatory Bodies; Key Performance indicators.

Module II: Fundamentals of Aviation Industry (12 Hours)

Airline Profitability, Main Industry, Characteristics of Passenger airlines, Service Industry – Characteristics.

Module III: Organisational Structure (12 Hours)

Airline Alliances, Development of commercial airlines, Deregulation – Impact of Deregulated Airline industry, Organizational Structure, Types of Airline Personnel, Flight crew and Cabin Crew Training, Organizational Culture.

Module IV: Airport and services (12 Hours)

Airports – Personnel, Processing Passengers and Freight, Airport Security, Air Navigation Services, Air Traffic Control, Airplanes – Manufacturers – Types of Aircraft.

Module V: Safety and Security (14 Hours)

Air Safety and Security, Role of Regulatory Agencies, Airside Safety, Culture of Safety, Issues in Air safety, Accident and Incident Investigation, Future of Airline Industry

Suggested Readings

Andreas Wald, Sven Grossand Hanns Christian Wirtz, Introduction to Aviation Management, published by Routledge

Dr Richard Shevell, Fundamentals of Aviation and Aerospace, published by CRC Press in 2018

National Research Council, Aviation and the Role of Government, published by National Academies Press in 1998

Bijan Vasign, Ken Flemming and Thomas Tacker, Introduction to Airport Economics I From Theory to Applications, published by Routledge in 2015

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L	M		L	
CO 2	L	L			
CO 3			M	M	M
CO 4			H		
CO 5					H

Major 5: HUMAN RESOURCES MANAGEMENT

(5 credits- 75 hours) (L-T-P: 5-0-0)

Objective(s): The objective of this paper is to provide the students with a comprehensive understanding of human resource management principles and practices, enabling them to effectively manage human capital, contribute to organizational success, and foster a positive work environment.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: define the nature and strategic role of human resource management in organizations (Remembering)

CO2: describe the human resource issues and challenges faced by organizations (Understanding)

CO3: explain the human resource management concepts and practices to solve organizational problems (Applying)

CO4: analyse the effective human resource policies and strategies (Analyzing)

CO5: evaluate the impact of human resource management on organizational performance. (Evaluating)

Module I: Human Resource Management: An Overview

Evolution of human resource management. Strategic human resource management. Human resource planning and job analysis. Recruitment and selection processes. Legal framework of human resource management

Module II: Human Resource Development

Training and development needs assessment. Training methods and techniques. Performance management and appraisal.

Career planning and development. Employee compensation and benefits

Module III: Organizational Behavior

Individual behavior in organizations: Personality, perception, attitudes, and motivation. Group dynamics and team building.

Leadership and organizational culture. Organizational change and development. Conflict management and negotiation

Module IV: Employee Relations

Employee communication and engagement. Employee welfare and safety. Industrial relations and collective bargaining. Labor laws and regulations. Grievance handling and disciplinary actions

Module V: Contemporary Issues in HRM

Global human resource management. Diversity and inclusion. Work-life balance. Organizational ethics and social responsibility. Human resource information systems (HRIS).

Suggested Readings

Dessler, G. (2017). Human resource management. Pearson.

Noe, R. A., Hollenbeck, J. R., Gerhart, B., & Wright, P. M. (2017). Human resource management: Gaining a competitive advantage. McGraw-Hill Education.

Robbins, S. P., & Judge, T. A. (2017). Organizational behavior. Pearson.

Mondy, R. W., Premeaux, S. R., & Noe, R. A. (2016). Human resource management. Wiley.

Mapping of COs with Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M
CO4				M	
CO5					M

MTCB203T: CONSUMER BEHAVIOUR

(5 credits- 75 hours) (L-T-P: 4-0-0)

Objective(s): The objective of the course is to make the *students understand the different concepts of consumer behavior, role of social and cultural settings on consumer behavior and consumer buying process.*

Course/ Learning Outcomes:

At the end of this course students will be able to:

CO1: define the consumer behaviour. (Remembering)

CO2: explain the models of consumer decision process. (Understanding)

CO3: apply the factors influencing consumer behavior in developing marketing strategies, identify purchase decision and post purchase behaviour in varied marketing situations (Applying)

CO4: analyse market segmentation and segmentation of consumer markets, (Analysing)

CO5: assess the positioning strategies on buying behaviour. (Evaluating)

Module I: Contemporary Dimensions of Consumer Behaviour (15 Hours)

Consumer Behaviour, Consumer Decision-Making, Models of Consumer Decision –Making, Types of Consumer Buying Behaviour, Factors influencing Consumer Behaviour, Market Segmentation, Segmentation

of Consumer markets, Positioning, Differentiation and Marketing Mix, Marketing Research; Consumer Research Process, Types of Research Methods.

Module II: Implications Social and Cultural Settings on Consumer Behaviour (15 Hours)

Influence of culture and Subculture on Consumer Behaviour, Influence of Social Class on Consumer Behaviour, Social

Stratification and Marketing Strategy, Group Influence on Consumer Behaviour, Household and Family Influence on Consumer Behaviour, Socialisation of family Members, Family Purchasing Decision-Making and Consumption Related Roles, family Life Cycle.

Module III: Consumer Buying Process (15 Hours)

Stages of Consumer Buying Process, Purchase Decision and Post Purchase Behaviour, Traditional and Contemporary Models of Consumer Behaviour; Case study

Module IV: Advertising as a communication process (20 Hours)

Advertising as a tool of communication; Meaning, nature and importance of advertising; Types of advertising; Advertising objectives. Audience analysis; Setting of advertising budget: Determinants and major methods.

Major media types-their characteristics, internet as an advertising media, merits and demerits; Factors influencing media choice; media selection, media scheduling, Advertising through the Internet-media devices

Module V: Evaluating communication and sales effects (10 Hours)

Evaluating communication and sales effects; Pre- and Post-testing techniques

Suggested Readings

Blackwell, Roger D, Paul W Miniard and James F Engel, Consumer Behaviour, Thomson Learning Inc., 2002.

Duhan S.N., Garima Sahni N.K. , Consumer Behaviour, 1st edition, 2016, Kalyani Publishers
 Loudon, David I., and Albert J. Della Bitta, Consumer Behaviour, Tata McGraw Hill, New Delhi
 Schiffman, Leon G., and Leslie Kanuk, Consumer Behaviour, Prentice Hall, New Delhi
 Schiffman, Kanuk L L., S Ramesh Kumar, Consumer Behaviour, 10th edition, Pearson
 Dheeraj Sinha, Consumer India Inside the Indian Mind and Wallet, 2011, Jain Book Depot

Mapping of COs to Syllabus

Cos	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H		M	L	
CO 2		M			
CO 3			L	H	
CO 4		H			M

MTMD204T: BUSINESS MATHEMATICS & STATISTICS FOR DECISION MAKING

(4 Credits – 60 Hours) (L-T-P: 3-0-0)

Objective(s): The objective of this course is to familiarize students with the applications of mathematics and statistical techniques in business decision-making

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: apply matrices in business and economic models (Applying)

CO2: illustrate the use of differentiation in business and economic models. (Applying)

CO3: identify the methods of calculating interest rates (Applying)
CO4: summarize data sets using descriptive statistics (Understanding)
CO5: analyse the relationship between two variables (Analysing)
CO6: determine the trend and seasonality in time series data (Evaluating)

Part – A: Business Mathematics

Module I: Matrices (7 Hours)

Definition of a matrix. Types of matrices; Algebra of matrices. Calculation of values of determinants up to third order; Adjoint of a matrix; Finding inverse of a matrix through adjoint; Applications of matrices to solution of simple business and economic problems

Module II: Differential Calculus (13 Hours)

Mathematical functions and their types – linear, quadratic, polynomial; Concepts of limit and continuity of a function; Concept of differentiation; Rules of differentiation – simple standard forms. Applications of differentiation – elasticity of demand and supply; Maxima and Minima of functions (involving second or third order derivatives) relating to cost, revenue and profit.

Module III: Basic Mathematics of Finance (5 Hours)

Simple and compound interest Rates of interest – nominal, effective and continuous – their interrelationships; Compounding and discounting of a sum using different types of rates

Part – B: Business Statistics Module IV: Uni-variate Analysis (15 Hours)

Measures of Central Tendency including arithmetic mean, geometric mean and harmonic mean: properties and applications; mode and median. Partition values - quartiles, deciles, and percentiles. Measures of Variation: absolute and relative. Range, quartile deviation and mean deviation; Variance and Standard deviation: calculation and properties.

Module V: Bi-variate Analysis (10 Hours)

Simple Linear Correlation Analysis: Meaning, and measurement. Karl Pearson's co-efficient and Spearman's rank correlation
Simple Linear Regression Analysis: Regression equations and estimation. Relationship between correlation and regression coefficients

Module VI: Time-based Data: Index Numbers and Time-Series Analysis (10 Hours)

Meaning and uses of index numbers; Construction of index numbers: Aggregative and average of relatives – simple and weighted, Tests of adequacy of index numbers, Construction of consumer price indices. Components of time series; additive and multiplicative models; Trend analysis: Finding trend by moving average method and Fitting of linear trend line using principle of least squares.

Suggested Readings

Mizrahi and John Sullivan. Mathematics for Business and Social Sciences. Wiley and Sons.
Budnick, P. Applied Mathematics. McGraw Hill Publishing Co.
N. D. Vohra, Business Mathematics and Statistics, McGraw Hill Education (India) Pvt Ltd 4.
J.K. Thukral, Mathematics for Business Studies, Mayur Publications
J. K. Singh, Business Mathematics, Himalaya Publishing House.
J. K. Sharma, Business Statistics, Pearson Education.
S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.
S.P. Gupta and Archana Gupta, Elementary Statistics, Sultan Chand and Sons, New Delhi.

Richard Levin and David S. Rubin, Statistics for Management, Prentice Hall of India, New Delhi.
M.R. Spiegel, Theory and Problems of Statistics, Schaum's Outlines Series, McGraw Hill Publishing Co.

Mapping of COs to Syllabus

Cos	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H				
CO 3			H			
CO 4				H		
CO 5					H	
CO 6						H

Major 8: MANAGERIAL ECONOMICS : (5 credits-75 Hours) (L-T-P: 5-0-0)

Objective(s): *The purpose of this course is to apply micro economic concepts and techniques in evaluating business decisions taken by firms. The emphasis is on explaining how tools of standard price theory can be employed to formulate a decision problem, evaluate alternative courses of action and finally choose among alternatives. Simple geometry and basic concepts of mathematics will be used in the course of teaching.*

Course/Learning Outcome

At the end of this course students will be able to:

CO1: explain the mechanics of supply and demand in allocating goods and services and resources (Remembering)

CO2: illustrate how changes in demand and supply affect markets (Understanding)

CO3: apply the choices made by a rational consumer (Applying)

CO4: interpret the relationships between production and costs (Evaluating)

CO5: discuss key characteristics and consequences of different forms of markets (Creating)

Module I: (20 Hours)

Demand, Supply and Market equilibrium: individual demand, market demand, individual supply, market supply, market equilibrium; Elasticity of demand and supply : Price elasticity of demand, income elasticity of demand, cross price elasticity of demand, elasticity of supply;

Theory of consumer behavior : cardinal utility theory, ordinal utility theory(indifference curves, budget line, consumer choice, price effect, substitution effect, income effect for normal, inferior and giffen goods), revealed preference theory.

Module II: (15 Hours)

Producer and optimal production choice: optimizing behavior in short run(geometry of product curves, law of diminishing marginal productivity, three stages of production), optimizing behavior in long run (isoquants, iso-cost line, optimal combination of resources) Costs and scale : traditional theory of cost (short run and long run, geometry of cost curves, envelope curves), modern theory of cost (short run and long run), economies of scale, economies of scope.

Module III: (20 Hours)

Theory of firm and market organization : perfect competition (basic features, short run equilibrium of firm/industry, long run equilibrium of firm/industry, effect of changes in demand, cost and imposition of taxes) ; monopoly (basic features, short run equilibrium, long run equilibrium, effect of changes in demand, cost and imposition of taxes, comparison with perfect competition, welfare cost of monopoly), price discrimination; monopolistic competition (basic features, demand and cost, short run equilibrium,

long run equilibrium, excess capacity) ; oligopoly (Cournot's model, kinked demand curve model, dominant price leadership model, prisoner's dilemma

Module IV :(20 Hours)

Factor Market: demand for a factor by a firm under marginal productivity theory (perfect competition in the product market, monopoly in the product market), market demand for a factor, supply of labour, market supply of labour, factor market equilibrium.

Suggested Readings

Dominick Salvatore (2009). Principles of Microeconomics (5th ed.) Oxford University Press
 Lipsey and Chrystal. (2008). Economics. (11th ed.) Oxford University Press
 Koutosyannis (1979). Modern Micro Economics. Palgrave Macmillan
 Pindyck, Rubinfeld and Mehta. (2009). Micro Economics. (7th ed.). Pearson.

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		H		
CO 3			H	
CO 4				H
CO 5	H			M

MTEG301T: BUSINESS ETHICS AND CORPORATE GOVERNANCE

(Credits: 5-75 hours) (L-T-P: 5-0-0)

Objective(s): The objective of this paper is to make the students aware about the importance of ethics in the business, practices of good governance to encourage moral imagination and heightening sensitivity towards the ethical dimension of managerial problems.

Course/Learning Outcomes

At the end of this course the students will be able to:

CO1: define Business Ethics and best practices of business ethics (Remembering)

CO2: explain the various Corporate Social Responsibilities (Understanding)

CO3: plan the need and importance of corporate and professional responsibility (Applying)

CO4: analyse the corporate governance frameworks (Analyzing)

Module I: (15 Hours)

Business ethics: Introduction, Meaning of ethics, Types of business, ethical issues, why ethical problems occur in business, Ethical dilemmas and principles in business,

Case Study: Personal companies like Tata related to Ethics in Business in Indian context

Module II: (20 Hours)

Corporate governance: concept, need to improve corporate governance standards, Features of good governance, Corporate governance abuses, Role played by regulators to improve corporate governance. Different Approaches to Corporate Governance, Leadership and Corporate Governance, Rights and Privileges of shareholders; Investor's Problem and protection; Board of Directors; Role, Duties and Responsibilities of Auditors, Bank and Corporate Governance.

Case Study: International experience- UK scenario (Cadbury committee; US scenario (Tread way commission, Blue ribbon committee); Indian experience- imperatives, CII code of best practices, Kumar Mangalam Birla, Narayan Murthy committee report.

Module III: (20 Hours)

Moral issues in business: Importance of moral issues and reasoning, Principles of moral reasoning, Quality of work life, implications of moral issues in different functional areas of business like finance, HR and marketing.

Whistle blowing: Kinds of Whistle blowing, Marketing truth and advertising: Marketing, Advertising, Truth and advertising, Allocation of moral responsibility in advertising Trade secrets, corporate disclosure, insider trading: Trade secrets, corporate disclosure, insider trading Accounting, finance Affirmative action, Ethics and Environment

Module IV : (20 Hours)

Corporate Social Responsibility: Meaning, Evolution of Corporate Social Responsibility, Limits of Corporate Social Responsibility, Voluntary Responsibility Vs. Legal requirements, Profit maximization vs. social Responsibility, Socially Responsive Management: Strategies of response, formulating socially responsive strategies, Implementing social responsiveness, Financial incentives for social responsibility, Role of self regulation in discharge of social responsibility.

Case studies on Indian companies like Tata, Godrej etc related to Corporate Social Responsibility

Suggested Readings

Crane. A., Business Ethics: Managing Corporate Citizenship and Sustainability in the Age of Globalisation, Taxmann Publishing House.

Manuel G Velasquez. Business Ethics: Concept and Cases

William H. Shaw, Business Ethics: A Textbook with Cases

Tom L. Beauchamp and Norman E. Bowie, Ethical Theory and Business

Jill Solomon, Corporate Governance and Accountability

R. I. Tricker, Corporate Governance: Principles, Policies, and Practices

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H		M	L
CO 2		M		H
CO 3		M	L	H
CO 4		H		L

MTPO302T: PRODUCTION AND OPERATIONS MANAGEMENT

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective(s): This course aims at acquainting the students with the functions of production and operations management and basic issues and tools of managing production and operation functions of an organization. The course also intends to provide the students a system theoretic view on project management and helps develop an understanding on why today's organizations are cultivating a formal project management process to gain competitive advantage.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define a production system. (Remembering)

CO2: explain the tools and techniques to measure work study, motion study. (Understanding)

CO3: demonstrate the procedure for product development and design. (Applying)

CO4: compute project completion time and Analyse and evaluate project risk management techniques. (Evaluating)

Module I: Introduction and Work Study (15 Hours)

Introduction to Production and operations management- Meaning and scope, subdivisions of work study

Method/Motion study and Work Measurement

Module II: Plant Location and layout (15 Hours)

Objectives, Locational factors, Economics of plant location

Meaning, objectives and types of plant layout and their relevance to mass, batch and job- order production systems. Systematic Layout Planning (SLP) procedure

Module III: Product design and Development and PPC (15 Hours)

Meaning of product, Product life cycle (PLC) and Product mix

Decisions to be taken during product development and design

Procedure for product development and design

Value of a product – its meaning, Value Analysis (VA) – its objectives, procedure and example, Simplification and Standardization.

Meaning and Objectives of PPC, Effects of types of production

Module IV: Project Management (15 Hours)

Project management framework, Project management processes, Cost and Time management, Project integration management, Project risk management, Project Quality management, Project communication management.

Suggested Readings

Adam, Ebert, Production and Operations Management, PHI.

R. Panneerselvam, Production and Operations Management, PHI.

K. Aswathappa & K. Shridhara Bhat, Production and Operations Management, Himalaya Publishing

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV
CO 1	H		M	L
CO 2		M		H
CO 3		M	L	H
CO 4		H		L

MTPM303T: BUSINESS POLICY & STRATEGIC MANAGEMENT

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Objective(s): This course is designed to enhance knowledge on business policy and strategy adopted for managing the business. It will help a student to get broad exposure to understand the business policy and strategic management adopted by different business for their smooth running and facing the competition.

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: develop an understanding of underlying concepts, tools, frameworks, issues and challenges involved in the area of Business Policy & Strategic Management for Under-graduates.

CO2: achieve development of an understanding of the increasing competition as well as not for profit business policies, strategies and the practice in organizations

CO3: explain the different circumstances & situations arising from ever changing strategic situation.

Module I: Introduction to Business Strategy and Formulation (15 Hours)

Introduction & Concept of Strategy, Corporate Policy as a field of study, Nature. Importance, purpose and objective of business policy, Chief Executive job, roles and responsibilities of board of Directors, An overview of strategic management, its nature and process, Formulation of strategy, Environment, environment scanning, environment appraisal, Identifying corporate competence & resource.

Module II: Introduction to Strategic Management (15 Hours)

Corporate Strategy, Persona1 and Ethical Values, Business ethics, Industry structure, Reconciling divergent values, Modification of values, moral components of corporate strategy, community considerations and corporate social responsibility (CSR) .

Module III: Strategic Management Process (15 Hours)

Corporate portfolio analysis, competitor & SWOT analysis, strategic audit & choice, strategic plan, routes to sustainable competitive advantage (SCA)

Module IV: Strategic Planning and Implementation (15 Hours)

Strategy Implementation, Structural implementation, organisational design and change, behavioural implementation, leadership, corporate culture. corporate politics and use of power, functional implementation - financial, marketing. Operation personnel (HR) policies and their integration, strategic evaluation and control

Suggested Readings

Wheelen, Thomas L , Hunger, J David & Rangarajan, Krish (2001) Concepts in Strategic Management & Business Policy, Pearson Education.

David, Fred R (2005), Strategic Management Concepts & Cases, PHI.

Kazmi, A. (2000); Business Policy, McGraw Hill.

Pearce, John A , Robinson, Richard B , Mital, Amita (2005) , 10th Edition., Strategic Management – Formulation, Implementation & Control, McGraw Hill.

Mapping of COs with Modules

Cos	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2		H		
CO 3			H	H

MTFI304T: FINANCIAL MARKETS AND INSTITUTIONS

(4 credits – 60 Hours) (L-T-P: 4-0-0)

Objective(s): The objective of this paper is to introduce students to the different aspects and components of financial Institutions and financial markets and also to introduce them with the emerging application of technologies in the system. The study of the course will enable them to take rational decisions in the growing financial environment.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: describe the Indian banking system (Understanding)

CO2: explain the role of regulatory bodies in regulating the system (Understanding)

CO3: analyze the operative system of financial markets in India (Analyzing)

CO4: evaluate the types of debt instruments and their characteristics. (Evaluating)

CO5: elaborate the links between the theories of financial markets (Creating)

Module I: Structure of Indian Financial System (12 Hours)

An overview of the Indian financial system, financial sector reforms: context, need and objectives; major reforms in the last decade; competition; deregulation; capital requirements; issues in financial reforms and restructuring; future agenda of reforms; Regulation of Banks, NBFCs & FIs, Salient provisions of banking regulation act and RBI Act; Role of RBI as a central banker; Products offered by Banks and FIs: Retail banking and corporate banking products. Universal Banking: need, importance, trends and RBI guidelines.

Module II: Emerging Technologies in Indian Financial System (12 Hours)

Core banking solution (CBS); RTGS, IMPS and internet banking, mobile banking, NBFCs and its types; comparison between Banks and NBFCs; payment bankers such as PayTM, Google Pay etc

Module III: Introduction to Financial Markets in India (12 Hours)

Role and Importance of Financial Markets, Financial Markets: Money Market; Capital Market; Factors affecting Financial Markets, Linkages Between Economy and Financial Markets, Debt Market- role and functions of these markets, Issue of Corporate Securities: Public Issue through Prospectus, Rights Issue, On-Line IPO, Book Building of Shares, Disinvestment of PSU, Employees Stock Options, Preferential Issue of Shares,

Module IV: Secondary Market in India (12 Hours)

Introduction to Stock Markets, Regional and Modern Stock Exchanges, International Stock Exchanges, Comparison between NSE and BSE, Raising of funds in International Markets; Indian Stock Indices and their construction, Factors influencing the movement of stock markets, indicators of maturity of stock markets, Major Instruments traded in stock markets, Myths attached to Investing in Stock Markets. Trading of securities on a stock exchange; Selection of broker, capital and margin requirements of a broker, DEMAT System

Module V: Money Markets & Debt Markets in India (12 Hours)

Money Market: Meaning, role and participants in money markets, Segments of money markets, money market instruments.

Role of STCI and DFHI in money market, Debt Market: Introduction and meaning, Market for Government/Debt Securities in

India, Secondary market for government/debt securities, over subscription and devolvement of Government Securities,

Government securities issued by State Governments, Municipal Bonds, Corporate Bonds vs. Government Bonds

Suggested Readings

Khan, MY.(2010).Financial Services(5th ed.).Mc Graw Hill Higher Education.

Bharati V. Pathak, Indian Financial System, Pearson

Shahani, Rakesh(2011). Financial Markets in India : A Research Initiative. Anamica Publications

Goel, Sandeep.(2012).Financial services. PHI.

Gurusamy, S.(2010).Financial Services. TMH.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M			L	
CO 3		H	H		
CO 4			H	M	M
CO 5				H	

MTCL305T: CORPORATE AND BUSINESS LAW

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective(s): *The objective of this paper is to introduce students to the different aspects of Corporate and Business Law. To introduce them with the relevance and applications of the different laws*

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: define what a company is and how it is formed. (Remembering)

CO 2: explain the concepts related to the essential documents of companies (Understanding)

CO 3: explain the knowledge regarding administration of a company (Applying)

CO 4: Identify the legal provisions in the partnership business and its Act. (Analysing)

Module I: Introduction (12 Hours)

Introduction of Companies Act, 2013, meaning and characteristics of a company; types of companies including one person company, small company, and dormant company; association not for profit; illegal association; lifting of corporate veil; Registration and Incorporation of company, on-line filing of documents, promoters, their legal position, pre-incorporation contract; on-line registration of a company, Tribunal courts like NCLT, NCLAT etc

Module II: Documents of Companies (12 Hours)

Memorandum of association, Doctrine of ultra vires, Articles of association, Doctrine of constructive notice and indoor management, prospectus-shelf and red herring prospectus, misstatement in prospectus, book-building; issue, allotment and forfeiture of share, transmission of shares, buyback and provisions regarding buyback; issue of bonus shares.

Module III: Administration and Management of Company (12 Hours)

Classification of directors, women directors, independent director, small shareholder's director; disqualifications, director identity number (DIN); appointment; Legal positions, powers and duties; removal of directors; Key managerial personnel, managing director, manager;

Meetings: Meetings of shareholders and board of directors; Types of meetings, Convening and conduct of meetings, Requisites of a valid meeting, postal ballot, meeting through video conferencing, e-voting.

Committees of Board of Directors- Audit Committee, Nomination and Remuneration Committee, Stakeholders Relationship Committee, Corporate Social Responsibility Committee

Module IV: The Indian Contract Act, 1872 (12 Hours)

Proposal- its communication, acceptance and revocation; Agreement vis-à-vis contract, void agreement & voidable contract

Consideration – essential elements, exception to rule- No consideration no contract; privity of contract and consideration

Capacity to contract; Free consent – coercion, undue influence, misrepresentation, fraud; Mistake – of fact and of law

Legality of object – agreements opposed to public policy and in restraint of marriage, trade & legal proceedings;

Contingent contracts

Performance of contract–liability of joint promisor; Consequences of breach of contract–liquidated damages and penalty, Quasi contract; Indemnity guarantee–surety's liability

Bailment–Duties and liabilities of bailor and bailee, bailment of pledges;

Agency–types of agency, agents duty to principal and vice-versa, ratification and revocation of agent's authority

Module V: The Partnership Act, 1932 (12 Hours)

- a) Nature of Partnership; Relation of partners-inter se; Relation of partners to third parties; Incoming and outgoing partners
- b) Dissolution of Firm; Registration of Firms-effect of non-registration

Suggested Readings

1. Chadha, Reena & Chadha, Sumant; Corporate Laws, Scholar Publishing House, New Delhi
2. Kuchhal, M.C & Kuchhal, Vivek, Business Law, Vikas Publishing House
3. Kapoor, N.D; Business Law; Sultan Chand & Sons, New Delhi.

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2	L	H		
CO 3		L	H	
CO 4				L
CO 5				H

MTMP306P: FIELD BASED LEARNING/MINOR PROJECT**(4 credits-60 Hours) (L-T-P: 0-0-4)**

Objective(s): The objective of the minor project is to acquaint the students with the experiential learning through field work / survey on any related areas from the field of management.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

- CO1: define the different types of research project. (Remembering)
- CO2: explain the various steps of designing research project (Understanding)
- CO3: building questionnaire and schedules (Applying)
- CO4: assessing the data for analysis (Analyzing)
- CO5: appraising the findings in the report (Evaluating)
- CO6: designing a research project report (Creating)

GUIDELINES:**Module I: INTRODUCTION**

Broad introduction to thesis topic and method. Page or two.

Research problem. State broadly, in question form. Give sub-questions. Explain carefully. In one sense, usually the problem is to expand the body of knowledge examined in the literature review.

Need for the research. Who will benefit? Discuss applied and scientific contributions.

Nominal definitions. Define central terms.

Context. Add further info to clarify the research problem.

Module II: THEORY- Literature review

Overview. Theoretical foundations

Literature. Group articles by ideas. For a given idea, first discuss common strands in the literature, then departures

Scope of the study. Theoretical assumptions; discuss limitations they impose.

Module III: METHODS. Outline in a few pages.

Introduction. General description of method and design.

Design. Experiment, quasi-experiment, survey, and so forth. Detailed description

Sample. Universe, population, element, sample design, tolerance, probability.
Measurement. Operational definitions. Include, as applicable, detailed discussion of indexes/ scales.
Specify methods used to assess validity and reliability.
Analysis. Techniques to be used; justification. Nature of relationships expected
(e.g., asymmetrical, symmetrical, reciprocal; linear).
Methodological assumptions. Discuss limitations they impose.

APPENDICES

Schedule. In Gantt Chart form.
Facilities. Faculty and staff expertise, library and computer resources, other special facilities contributing to a successful study. C. Budget.
D. Bibliographic essay. Sources searched (indexes, abstracts, bibliographies, etc.).
Strengths and weaknesses of literature.

Module IV: FININGS

A. Brief overview.
Results of application of method; any unusual situations encountered. Nature of sample.
Descriptive analysis. One-way frequency distributions on central variables.
Validity/reliability analysis.
Tests of hypotheses.

Module V: DISCUSSION

When discussing implications, deal with both the theoretical and the practical. Present only interpretations of the findings, not opinion.
Brief overview.
Discussion of results of application of method. Implications.
Discussion of descriptive analysis. Implications.
Discussion of tests of hypothesis. Implications.
Post-hoc analysis. Implications.

Module VI: CONCLUSION May include writer's opinion. A. Summary of entire thesis in a few pages.

Conclusions. Refer to lit review.
Implications. Speculate about broadest possible consequences, both theoretical and practical.
Label speculation clearly.
Limitations. Theory, method.
Suggestions for future research.

APPENDICES; Bibliographic essay; Questionnaire;Raw data

MTCF400T: CORPORATE FINANCE

(5 Credits - 75 hours) (L-T-P: 5-0-0)

Objective(s): *To acquaint students with the techniques of financial management and their applications for business decision making.*

Course/Learning Outcomes

At the end of this course students will be able to:

- CO 1: define the strategic objectives of the organisation for finance function. (Remembering)
- CO 2: explain the different sources of corporate finance (Understanding)
- CO 3: interpret the impact of risk and cost of capital impact on investment appraisal. (Applying)
- CO 4: analyze the factors impacting the cost of capital (Analyzing)
- CO 5: evaluate a corporation's capital structure (Evaluating)

Module I: Nature of Financial Management (20 Hours)

Nature of Financial Management: Finance and related disciplines; Scope of Financial Management; Profit Maximization, Wealth

Maximization - Traditional and Modern Approach; Functions of finance – Finance Decision, Investment Decision, Dividend Decision; Objectives of Financial Management; Organisation of finance function; Concept of Time Value of Money, present value, future value, and annuity.

Module II: Long -term investment decisions (20 Hours)

Long -term investment decisions: Capital Budgeting - Principles and Techniques; Nature and meaning of capital budgeting; Estimation of relevant cash flows and terminal value; Evaluation techniques - Accounting Rate of Return, Net Present Value, Internal Rate of Return & MIRR.

Concept and Measurement of Cost of Capital: Explicit and Implicit costs; Measurement of cost of capital; Cost of debt; Cost of perpetual debt; Cost of Equity Share; Cost of Preference Share; Cost of Retained Earning; Computation of overall cost of capital based on Historical and Market weights

Module III: Capital Structures (20 Hours)

Capital Structures: Approaches to Capital Structure Theories - Net Income approach, Net Operating Income approach, Modigliani-Miller (MM) approach, Dividend Policy Decision - Dividend and Capital; The irrelevance of dividends: General, MM hypothesis; Relevance of dividends: Walter's model, Gordon's model; Leverage Analysis: Operating and Financial Leverage; EBIT-EPS analysis; Combined leverage.

Module IV: Working Capital Management (15 Hours)

Working Capital Management: Management of Cash - Preparation of Cash Budgets (Receipts and Payment Method only); Cash management technique (Lock box, concentration banking), Receivables Management – Objectives; Credit Policy, Cash Discount, Debtors Outstanding and Ageing Analysis; Costs - Collection Cost, Capital Cost, Default Cost, Delinquency Cost, Inventory Management (Very Briefly) - ABC Analysis; Minimum Level; Maximum Level; Reorder Level; Safety Stock; EOQ (Basic Model), Determination of Working Capital.

Suggested Readings

Berk & DeMarzo, Fundamentals of Corporate Finance, Prentice Hall.

M.Y. Khan & P.K. Jain , Financial Management, Tata McGraw Hill Publishing Co. Ltd.

Rustogi , Financial Management

I.M. Pandey , Financial Management

L.J. Gitman & C.J. Zutter, Managerial Finance

R.A. Brealey, S.C. Myers, F. Allen & P. Mohanty, Principles of Corporate Finance

Mapping of COs to Syllabus

Cos	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		L	M	
CO 3		M	H	
CO 4		M	H	
CO 5				H

MTSC401T: SUPPLY CHAIN MANAGEMENT

(5 credits – 75 Hours) (L-T-P: 5-0-0)

Objective(s): The objective of this paper is to acquaint the students with the concepts and tools of supply chain management and logistics as relevant for an international firm.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define the process of supply chain management. (Remembering)

CO2: demonstrate operational purchasing methods and techniques on supplier management (Understanding)

CO3: explain the strategic importance of logistics elements (Understanding)

CO4: apply sales and operations planning, MRP and lean manufacturing concepts. (Applying) CO5: analyse creation of new value in supply chain for customers & society. (Analysing)

Module I: Basic Framework (15 Hours)

Concept of supply chain management (SCM); SCM and trade Logistics; Business view of SCM; Push and pull of SCM; Decision phases; Impellers and drivers in SCM Process views of SCM, planning and operations; Supply chain modeling; Role of Relationship marketing in SCM; managing relationships with suppliers and customers; Designing strategic distribution network; Factors influencing distribution network.

Module II: Supply Chain and Information Management Systems (15 Hours)

Purchasing Process- Strategic role of purchasing in the supply chain and total customer satisfaction; Types of purchases; Purchasing cycle; Supplier selection and evaluation; Vendor development; Importance of information management; Distribution and sharing of information; Information Technology as a platform for effective and efficient supply chain management

Module III: Logistic System (10 Hours)

Concept, objectives and scope of logistics; System elements; Inbound and Outbound logistics. Reverse inventory, Value added role of logistics, Logistics interface with manufacturer and marketing, Packing, Marking, Just in time concept; Third party logistic outsourcing—challenges and future directions

Module IV: Transportation (20 Hours)

Importance of effective transportation system; Service choices and their characteristics; inter- modal services; Transport cost characteristics and rate fixation; Carrier selection determinants and decision; Structure of Shipping: World seaborne trade; international shipping - characteristics and structure ;Liner and tramp operations; Liner freighting; Chartering-Types, principles and practices; Charter, party agreement; Development in sea transportation-Unitization, containerization, inter and multimodal transport; CFC and ICD; Indian shipping – growth, policy and problems; Ports and port trust; International Air transport: International set up for air transport: Freight rates; India's exports and imports by air – Problems and prospects; Carriage of Goods by sea, sea and combined transport.

Module V: Warehousing and Inventory Management (15 Hours)

Warehousing And Marketing Strategy; Objectives and functions of warehousing; Warehouse Strategies; Material handling equipment and material mobility Warehousing evaluation and requirements Inventory management-inventory categories, EOQ, LT, ICC; Inventory levels; Material planning and sourcing of procurement; Methods of cost reduction.

Suggested Readings

Ballau, R.H., Business Logistics Management, Prentice Hall, Englewood Cliffs.

Bes, J., Chartering Practices.

Bes, J., Dictionary of Shipping and chartering Practices.

Christopher, M., Logistics and Supply Chain Management, Prentice Hall.

ICAO Journal, New York., various issues

Indian Shipping and Transport, Mumbai, Various issues.

Murphy, Paul R. and Donald F. Wood, Contemporary Logistics, Prentice Hall.

Marks, Daniel, Shipping Cartels.

Shapiro, R., Logistics Strategy: Cases and Concepts, West Publishing, St. Paul.

Coughlan, A., Anderson, E. and Louis W. Stern, Marketing Channels, Prentice Hall.

Mapping of Course Outcomes

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L				
CO 2		M			
CO 3			M		
CO 4		M		H	
CO 5	M		H		H

MTSM402T: SERVICES MARKETING**(Credits: 5- 75 Hours) (L-T-P: 5-0-0)**

Objective(s): The objective of this course is to make the students know the service concept, its evolution and growth. To make the students understand Marketing Mix in service marketing and its effective management and to know the service marketing techniques applied in various sectors.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: relate the importance of service economy and Services characteristic.

(Remembering)

CO2: explain the concept of Service Marketing Mix (Understanding)

CO3: identify the various service deliver gap and developing appropriate solutions (Applying)

CO4: analyse the reasons for service failure (Analysing)

Module I: Introduction to Service Economy (15 Hours)

Emergence of the service economy, Concept and nature of Service, Difference between goods and services, Service marketing Mix, Service Management Trinity

Module II: Service Consumer Behaviour (20 Hours)

Understanding the Service Customer as a Decision Maker, service purchase and risk association, Service Evaluation process, The Service Consumer Decision Process, and The Decision-making Process in the Service Sector, Components of Customer Expectations, Service Satisfaction, Service Quality Dimensions

Module III: Service Delivery Process (20 Hours)

Managing Service Encounters, Common Encounter Situations, Managing Service Encounters for Satisfactory Outcomes, Service

Failure, Service Recovery, Process of Service Recovery, Customer Retention and Benefits

Module IV: Delivering Quality Service (20 Hours)

Causes of Service delivery failure – Quality Gaps. The Customer Expectations *versus* Perceived Service gap. Factors and Techniques to Resolve this Gap. Customer Relationship Management. Gaps in Services – quality standards, Factors and Solutions – The Service Performance Gap – Key Factors and Strategies for Closing the Gap. External Communication to the Customers – the Promise *versus* Delivery Gap – Developing Appropriate and Effective Communication about Service Quality

Suggested Readings

Service Marketing, C. Bhattacharjee, Excel Books

Service Marketing, R. Nargundkar, Tata McGraw Hill

Service Marketing the Indian Perspective, R Shakeran R, Excel Books

The Essence of Service Marketing, M.P. Newton, A Payne, PHI

Service Marketing - The Indian Context R. Srinivasan, PHI

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M	M	
CO4				H	H

MTCR403T: CORPORATE RESTRUCTURING**(Credits: 5- 75 Hours) (L-T-P: 5-0-0)**

Objective(s): To familiarize the students with various concept and technique that can help in effective corporate structuring in business. Focus will be on the practical application of the concepts learnt.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define the concept and function of joint venture (Remembering)

CO2: explain the theories of merger and acquisition (Understanding)

CO3: identify takeover and its types (Applying)

CO4: discover the various techniques of valuation of firms during merger (Analyzing)

CO5: assess the impact of merger on shareholders and different stakeholders (Evaluating)

Module I: Joint Ventures: (15 Hours)

Joint Ventures: Concept & Meaning of Joint Ventures, Need & Types of Joint Ventures, Structures & Problems faced in Joint Ventures, some relevant case study of successful and failed joined ventures.

Module II: Mergers and Acquisitions (20 Hours)

Mergers and Acquisitions: Introduction to mergers, types of mergers, theories of mergers & acquisitions, merger strategy - growth, synergy, operating synergy, financial synergy, diversification; Cross-border mergers and acquisitions, issues and challenges in cross border M&A. Handling cross-culture and taxations issues in cross-border M&A. Analysis of Post-Merger Performance. Demerger, types of demergers, reverse merger, buyback of shares, leverage buy-out strategy, Takeover and its types, takeover strategy, takeover bids, legal framework for mergers and acquisitions, leverages and buyouts; Hostile tender offers and various anti-takeover strategies.

Module III: Mergers and Acquisitions (20 Hours)

Deal Valuation and Evaluation: Factors affecting valuation basics, methods of valuation, cash flow approaches, economic value added (EVA), sensitivity analysis, and valuation under takeover regulation, valuation for slump sale, cost-benefit analysis, and swap ratio determination.

Module IV: Post-Merger Evaluation (20 Hours)

Post-Merger Evaluation: Financial Evaluation of Mergers & Acquisitions, Impact on shareholders' Wealth; Methods of payment and financing options in mergers & acquisitions, financing decision, Merger, Acquisition and Competition law 2002, SEBI (Securities & Exchange Board of India) Takeover Code 2011 and criteria for negotiating friendly takeover.

Suggested Readings

Sundarsanam (2006); Creating Value from Mergers and Acquisitions, (1st ed.) Pearson Education
Ramanujan. S. (1999); Mergers: The New Dimensions for Corporate Restructuring, McGraw Hill
Narayankar, Ravi, (2013): Merger and Acquisitions Corporate Restructuring, Strategy and Practices, (2nd ed.). International Book House Pvt. Ltd.

Mapping of COs to Modules

COs	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		L		
CO 3			H	
CO 4			H	
CO5				H

MINOR COURSES

Semes-ter	Category	Course Code	Course Name	Credits	Page No
1	Minor Course 1	MTBO102T	Business Organisation	4	1365
2	Minor Course 2	MTMF103T	Management Fundamentals	4	1366
3	Minor Course 3	MTBI205T	Banking and Insurance	4	1367
4	Minor Course 4	MTFT206T/ MTCM207T/	Fundamentals of Investment / Compensation Management/ Customer Relationship Management/	4	1368 1369 1371
5	Minor Course 5	MTSH307T/ MTPF308T/ MTMR309T/ MTGH310T	Strategic HRM/ Personal Financial Planning / Marketing Research/ Ground Handling Services at Airport	4	1372 1373 1374 1375
6	Minor Course 6	MTIR311T/ MTIP312T/ MTDM313T/ MTAC314T	Management of Industrial Relations/ Investment Analysis and Portfolio Manage- ment/ Digital Marketing / Air Cargo Operations	4	195 1376 1377 198
7	Minor Course 7	MTBE404T/ MTAR405T	Business Environment / Airport Resource Planning and Services Man- agement	3	199 200
7	Minor Course 8	MTRM406T	Research Methodology	2	1380
8	Minor Course 9	MTIB407T	International Business	3	1381

MTBO102T: BUSINESS ORGANIZATION**(4 credits- 60 Hours) (L-T-P: 4-0-0)**

Objective(s): To familiarize students with the basics of business, the different forms of organisations, the process and the basic concepts and functions of management

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: explain the nature, objectives and social responsibilities of business (Remembering)

CO2: describe the different forms of organisations (Understanding)

CO3: understand the process and the basic concepts of management (Understanding)

CO4: describe the different functions of management (Applying)

CO5: explain the different types of business (Evaluating)

Module I: Introduction to Business (10 Hours)

Meaning, Nature, Scope and Social responsibility of Business, Objectives, Essentials of successful business; Functional areas of business; Concept of Business Organisation

Module II: Forms of Business Organization (15 Hours)

Sole proprietorship: Definitions, Features, Merits and Demerits. Partnership: Definitions, partnership deed, Features, Merits and Demerits. Joint Stock Company: Definitions, Features, Merits and Demerits. Co-operatives: Definitions, Features, Merits and Demerits

Module III: Public Enterprises (15 Hours)

Departmental Undertaking: Definitions, Features, Merits and Demerits. Public Corporations: Definitions, Features, Merits and Demerits. Government Companies: Definitions, Features, Merits and Demerits

Module IV: Business Combinations (10 Hours)

Meaning Definitions, Causes, Types, Forms, merits and demerits of Business Combinations, Recent Trends in Business Combinations

Module V: Management of Organizations (10 Hours)

Management- Meaning, Definitions, Difference between Management and Administration, Levels of Management, Objectives of Management, Functions of management- planning, organizing, staffing, directing, coordinating, controlling, Principles of Management.

Suggested Readings

C B. Gupta - Business Organisation and Management, Sultan Chand & Sons.

Dr. S. C. Saxena - Business Administration & Management, Sahitya Bhawan

E Resources

https://www.youtube.com/watch?v=BarcVAOT_fs&list=PL9Cd7H8NFRQxDwIEOu_MBT5AUoysg4NqF

https://www.youtube.com/watch?v=Ewzhw63biOU&list=PL47Z0ywCYIyykGNxHpB6_LN5MvTO8hPGD

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4
CO 1	L	M		
CO 2		H		
CO 3			H	
CO 4				H
CO 5				H

MTMF103T: MANAGEMENT FUNDAMENTALS

(Credits: 4- 60 hours) (L-T-P: 4-0-0)

Objective(s): The objective for this course to provide an understanding of the task and functions of management and to acquaint the participants with the developments in concept. Theories and practices in the overall field of management.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: define the nature and significance of Management (Remembering)

CO2: explain the nature and significance of planning (Understanding)

CO3: describe the staffing functions and explain the significance of communication (Applying)

Module I: Nature and significance of Management (15 Hours)

Nature of management; significance of management; Approaches of management, Contributions of Taylor, Fayol and Barnard, Functions of a Manager, Social responsibility of Managers, Values in management.

Module II: The Nature of significance of Planning (15 Hours)

Nature of Planning, significance of planning, objectives, steps of planning, decision making as key step in planning; process and techniques of decision making; organisation: nature and significance; approaches, departmentation, line and staff relationships; delegation and decentralisation

Module III: Staffing functions (15 Hours)

Nature and significance of staffing functions; selection, interview, training, appraisal and development of managers; directing: Issues in managing human factors, motivation, nature and significance

Module IV: Communication (15 Hours)

Definition and Significance of Communication, Its process, barriers of communication, building effective communication system. Controlling: definition and elements; Control techniques, Coordination, determinants of an effective control system, Managerial Effectiveness.

Suggested Readings

Joseph L. Massie :Essentials of Management .PHI, New Delhi; 2015

James F.Stoner: Management. Pearsons Education, Delhi; 2020

Harold Koontz, Heinz Weihrich: Management. Tata McGraw Hill Pub. Co., Delhi; 2015

Amitai Etzioni: Modern Organizations. PHI, New Delhi; 2021

Jones, Gareth R. and Jennifer M. George: Contemporary Management. Tata McGraw Hill

Charles Hill, W.L. and Steven L.McShane: Principles of Management. Tata McGraw Hill

E Resources

<https://www.youtube.com/watch?v=I6-QB-ElDsE&list=PLJtJvO3aaWe16eg-L7sJ1Ww3021CWIJU9>

<https://www.youtube.com/watch?v=q6LMjurECZM>

Mapping of COs with Syllabus

CO	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H	M	M

MTBI205T: BANKING AND INSURANCE

(3 Credits: 45 Hours) (L-T-P: 3-0-0)

Objective(s): This course is designed to provide students with the necessary skills and knowledge in the context of the functioning of banking and insurance

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: defining the basic principles of banking and insurance. (Remembering)

CO2: relate the various services provided by banks. (Understanding)

CO3: apply the concept of Internet Banking in day-to-day transactions.
(Applying)

CO4: examine the situations to relate the risk and insurance. (Analysing)

Module I: Introduction (10 Hours)

Origin of banking: definition, banker and customer relationship, General and special types of customers, Types of deposits, Origin and growth of commercial banks in India. Financial Services offered by banks, changing role of commercial banks, types of banks.

Module II: Cheque and Paying Banker (10 Hours)

Crossing and endorsement - meaning, definitions, types and rules of crossing. Duties, Statutory protection in due course, collecting bankers: duties, statutory protection for holder in due course, Concept of negligence.

Module III: Banking Lending (6 Hours)

Principles of sound lending, secured vs. unsecured advances, types of advances, Advances against various securities.

Module IV: Internet Banking (10 Hours)

Meaning, Benefits, Home banking, Mobile banking, Virtual banking, E-payments, ATM Card/ iometric card, Debit/Credit card, Smart card, NEFT, RTGS, ECS (credit/debit), E-money, electronic purse, Digital cash.

Module V: Insurance (9 Hours)

Basic concept of risk, Types of business risk, Assessment and transfer, Basic principles of utmost good faith, Indemnity, Economic function, Proximate cause, Subrogation and contribution, Types of insurance: Life and Non-life, Re-insurance, Risk and return relationship, Need for coordination. Power, functions, and Role of IRDA, Online Insurance

Suggested Readings

Agarwal, O.P., Banking and Insurance, Himalaya Publishing House
 Satyadevi, C., Financial Services Banking and Insurance, S. Chand
 Suneja, H.R., Practical and Law of Banking, Himalaya Publishing House
 Chabra, T.N., Elements of Banking Law, Dhanpat Rai and Sons
 Arthur C. And C. William Jr., Risk Management and Insurance, McGraw Hill
 Saxena, G.S. Legal Aspects of Banking Operations, Sultan Chand, and Sons
 Varshney, P.N., Banking Law and Practice, Sultan Chand, and Sons
 Jyotsna Sethi and Nishwan Bhatia, Elements of Banking and Insurance, PHI Learning

Mapping of COs to Syllabus

COs	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			M		
CO4				M	H

MTFT206T: FUNDAMENTALS OF INVESTMENT

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective(s): This course aims to provide students with an understanding of fundamental concepts of business finance and investment.

Course/Learning Outcomes

At the end of this course students will be able to:

Module I: Introduction (10 Hours)

Meaning of investment; Basic areas of investment; Investment functions; Forms of business organizations; Goals of investment management; concept of returns and Interest rates: level of Interest rate, determinants of market interest rates

Module II: Time Value of Money (10 Hours)

Future Value: Single period, multiple period; Present Value: single period and multiple period; Future Value and Present value for multiple cash flows; Present value of an annuity; Future value of an annuity

Module III: Capital Investment Decisions (10 Hours)

Concept of investment decisions; Generating investment project proposal; Process of Capital budgeting decision;; Net present value, payback method, internal rate of return.

Module IV: Basics of Investing (20 Hours)

Basics of Investment & Investment Environment: Risk and Return, Instruments of Investment -Equity shares, Preference shares, Bonds and Debentures. Indian Security Markets - Primary Markets (IPO, FPO, Private placement, Offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE, NSE, MSEI. Security Market Indices: Nifty & Sensex.

Module V: Investing in Mutual Funds (10 Hours)

Concept and background on Mutual Funds: Advantages, Disadvantages of investing in Mutual Funds, Types of Mutual funds: Open ended, close ended, equity, debt, hybrid, money market and entry load vs. exit load funds. Factors affecting choice of mutual funds. CRISIL mutual fund ranking and its usage, calculation and use of Net Asset Value

Suggested Readings

Principles of Financial Management, Levy H. and M. Sarnat, Pearson Education.
 Fundamentals of Financial Management, Brigham and Houston, Cengage Learning.
 Basic Financial Management, Khan and Jain, McGraw Hill Education
 Fundamentals of Financial Management, Prasanna Chandra, McGraw Hill Education
 Financial Management-text and Problems, Singh, J.K, DhanapatiRai and Company, Delhi 6.
 Fundamentals of Financial Management, Rustagi, R.P, Taxmann Publications Pvt.Ltd.
 Singh J K , Singh Amit Kumar, Investing in Stock Markets, A K Publications, Delhi.
 Tripathi, Vanita and Pawar, Neeti (2019), Investing in Stock Market, Taxmann Publications 9.

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M				
CO 2		M			
CO 3			M		
CO 4				H	H

MTCM207T: COMPENSATION MANAGEMENT

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Objectives(s): The course aims to clarify the principles and basic concepts of compensation management in organizations, including the role of human resources management in dealing with employees, and methods used to provide compensation.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define Compensation Management (Remembering)

CO2: explain the principles and importance of compensation management. (understanding)

CO3: develop and design compensation system. (Applying)

CO4: analyze the present trends in calculation of incentives and other pay systems. (Analyzing)

Module I: Introduction to Compensation Management (15 Hours)

Definition of Compensation Management - objectives of compensation – Principles of Compensation Management – Importance of Compensation Management - Types of wages. Exploring and defining the compensation context – Intrinsic compensation - Extrinsic compensation -- Compensation Trends in India. - The 3-P compensation concept

Module II: Compensation Planning & Bases of Compensation (15 Hours)

Compensation Planning: Level, Structure and Systems Decision – Factors influencing compensation level planning: internal factors and external factors.

Traditional Bases for Pay-Seniority and Longevity Pay Merit Pay- Performance Appraisal- Methods- Biases -Strengthening the Pay for Performance Link- Possible Limitations of Merit Pay

Module III: Incentive Pay & Other Pay Systems (15 Hours)

Exploring Incentive Pay- Contrasting Incentive Pay with Traditional Pay.

Individual Incentives- Types of Individual Incentives- Advantages and Disadvantages

Group Incentives- Types of Group Incentives- Advantages and Disadvantages

Companywide Incentives- Types- Designing Incentive Pay Programmes

Person Focused Pay- Competency Based Pay, Pay for Knowledge and Skill Based Pay, Team based pay- Concepts.

Module IV: Designing Compensation System (15 Hours)

Building internally consistent Compensation System - Creating Internal Equity through Job Analysis and Job Valuation

Building Market Competitive Compensation System – compensation surveys - Integrating Internal Job Structures with External Market; Building Pay Structures that Recognise Individual Contribution: Constructing pay structure. Pay structure variations – Broad banding- two tier pay structure.

Suggested Readings

Tapomoy Deb, Compensation Management text & cases, Excel Publication, 2014.

Joseph J. Martocchio, Strategic Compensation- A Human Resource Management Approach- Pearson Education, 2012, 3rd Ed.

Dipak Kumar Bhattacharya, Compensation Management, Oxford University Press, 2014.

Richard.I. Henderson: Compensation Management in A Knowledge Based World - Prentice-Hall, 2012, 9th Ed.

Milkovich & Newman, Compensation, Tata McGraw –Hill, New Delhi, 2015.

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		M		
CO 3			M	
CO4				H

MINOR 4 C: CUSTOMER RELATIONSHIP MANAGEMENT (CRM)

Objectives(s): *To equip students with a comprehensive understanding of customer relationship management principles and strategies, enabling them to build and maintain strong customer relationships, enhance customer satisfaction, and drive business growth.*

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define the concept of customer relationship management and its importance in business (Remembering)

CO2: explain the customer behavior, needs, and preferences to develop effective CRM strategies. (understanding)

CO3: develop and design CRM tools and technologies to manage customer interactions and data. (Applying)

CO4: analyze the effectiveness of CRM initiatives in achieving business objectives (Analyzing)

Module I: Understanding Customer Relationship Management

Concept of CRM: Definition, evolution, and importance. Customer value and satisfaction: Building customer loyalty and retention. Customer lifecycle management: Acquiring, retaining, and growing customers. CRM strategy development: Aligning CRM with business goals.

Module II: Customer Data and Analysis

Customer data management: Collecting, storing, and analyzing customer information. Customer segmentation and targeting: Identifying customer groups and tailoring offerings. Customer lifetime value: Measuring and maximizing customer profitability. Market research and customer insights: Gathering and utilizing customer feedback.

Module III: CRM Technologies and Implementation

CRM software: Features, benefits, and selection criteria. CRM implementation process: Planning, deployment, and integration. Sales force automation: Managing sales processes and customer interactions. Customer service automation: Enhancing customer support and resolution.

Module IV: Customer Experience Management

Customer journey mapping: Understanding customer interactions and touch-points. Customer experience design: Creating exceptional customer experiences. Customer feedback management: Collecting and responding to customer feedback. Service quality management: Delivering consistent and high-quality service.

Module V: Advanced CRM Topics

Digital CRM: Leveraging digital channels for customer engagement. Social CRM: Building relationships through social media. Mobile CRM: Enhancing customer interactions on mobile devices. CRM metrics and evaluation: Measuring CRM performance and ROI.

Suggested Readings

Peppers, D., & Rogers, M. (2005). Customer relationship management: A guide to creating lasting relationships. John Wiley & Sons.

Payne, A., Storbacka, K., & Frow, D. (2008). Managing customer relationships. Financial Times/Prentice Hall.

Rust, R. T., & Reinartz, W. J. (2003). Customer equity: The strategic imperative for growth and profitability. Free Press.

Parvatiyar, A., Sheth, J. N., & Garvin, D. A. (2004). Customer relationship management: A road map for implementation. Tata McGraw-Hill Education.

Mapping of COs to Modules

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		M			
CO 3			H		
CO 4				M	L

MTSH307T: STRATEGIC HUMAN RESOURCE MANAGEMENT**(Credits: 4-60 hours) (L-T-P: 4-0-0)**

Objective(s): The objective of this course is to develop within the students the understanding of the student with relevant concepts, roles and challenges related to strategic human resource management practices in the workplace and design the requisite skills to be competent contributors in the organization's strategic decision-making process and make them competent to for various managerial and administrative positions in different organizations.

Course/ Learning Outcomes:

At the end of this course students will be able to:

CO1: Define the hierarchy of strategy, classify between traditional HR and strategic HR. (Remembering)

CO2: Demonstrate the aims of strategic HRM (Understanding)

CO3: Analyse the concept of HR strategies, explain the approaches of developing HR strategies (Analysing)

CO4: Examine the strategic role of the HR director, determine the strategic role of the HR specialists (Analysing)

CO5: Evaluate the various approaches to motivation (Creating)

Module I: Introduction to Strategic Human Resource Management (12 Hours)

Introduction, Strategy, Hierarchy of Strategy, Corporate Level Strategy, Business Level Strategy, Functional Level Strategy, Strategic HRM, Emergence of Strategic Human Resource Management (SHRM), The Evolutionary Stages of Strategic HRM, Difference Between Traditional HR and Strategic HR, Case study

Module II: Concepts of Strategic Human Resource Management (12 Hours)

Introduction, Trends in Strategic Human Resource Management, HR Practitioners Role, Human Resource as Competitive Advantage, Aims of Strategic HRM, Approaches to Strategic HRM, Formulation of HR Strategies, The Classical Sequential Approach, The Empirical Need-based Approach, Achieving Strategic Fit, Problems in Achieving Strategic Fit, Benefits of Strategic HRM, Barriers to Strategic HRM, Case study

Module III: Human Resource Strategies and its Implementation (12 Hours)

Introduction, HR Strategies, Types of HR Strategies, Overarching Strategies, Specific HR Strategies, Criteria for an Effective HR Strategy, Developing HR Strategies, Methodology for Formulating HR Strategies, Setting Out the Strategy, conducting a Strategic Review, Implementing HR Strategies Barriers to the Implementation of HR Strategies, Overcoming the Barriers, Case study

Module IV: Roles in Strategic Human Resource Management (12 Hours)

The Strategic Role of Top Management, The Strategic Role of Front-line Management, The Strategic Role of the HR Director, The Strategic Role of the HR Specialists, The New Mandate for HR, The Specific Strategic Roles of HR, Business Partner, The Innovation Role, The Change Manager Role, The Implementer Role, Case study

Module V: Challenges in Strategic Human Resource Management (12 Hours)

Introduction, The Challenges of Workplace Diversity, The Management of Workplace Diversity, Managing Diverse Workforce in an Organisation, Planning a Mentoring Program, Organising Talents Strategically, Retention Strategy, Talent Management Strategy and its components, Approaches to Human Resource Planning, Managing Executive Information Systems, Challenges for HR Managers, HRM Strategic Challenges, Case study

Suggested Readings

Deb Tapomoy, Strategic Approach to Human Resource Management Concept, Tools and Application, Atlantic Publishers & Distributors Pvt Ltd.

Nayantara Padhi, Strategic Human Resources Management: Theory and Practice, Atlantic Publishers and Distributors Pvt. Ltd; 1 edition

Mello Jeffrey A., Strategic Management of Human Resources, Cengage Learning, 3rd edition

Sharma A, Khandekar A, Strategic Human Resource Management – An Indian Perspective, SAGE Publications

Schuler, R. S., & Jackson, S. E., 2009, Strategic Human Resource Management. 2nd ed., Wiley-India

Sharma, A and Khandekar, A., 2006, Strategic Human Resource Management: an Indian perspective. 1st ed., Response Books

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV	Module V
CO 1	H		M	L	
CO 2		H			
CO 3					M
CO 4		H		H	
CO 5					H

MTPF308T: PERSONAL FINANCIAL PLANNING

(Credits-4-60 hours) (L-T-P: 4-0-0)

Objective(s): The course aims to familiarize learners with different aspects of personal financial planning like savings, investment, taxation, insurance, and retirement planning and to develop the necessary knowledge and skills for effective financial planning.

Course/ Learning Outcomes:

At the end of this course students will be able to:

CO1: define the meaning and the relevance of financial planning. (Remembering)

CO2: understand the concept of investment planning and its methods. (Understanding)

CO3. examine the scope and ways of personal tax planning. (Applying)

CO4: analyse insurance planning and its relevance. (Analysing)

CO5: develop insight into retirement planning and its relevance. (Evaluating)

Module I: Introduction to Financial Planning (12 Hours)

Financial goals, steps in financial planning, budgeting incomes and payments, time value of money. Introduction to savings, benefits of savings, management of spending & financial discipline, Setting alerts and maintaining sufficient funds for fixed commitments

Module II: Investment Planning (12 Hours)

Process and objectives of investment, concept and measurement of return & risk for various asset classes, measurement of portfolio risk and return, diversification & portfolio formation. Gold bond; Real estate;

Investment in greenfield and brownfield Projects; Investment in fixed income instruments, financial derivatives & commodity market in India. Mutual fund schemes; International investment avenues. Currency derivatives and digital currency

Module III: Personal Tax Planning (12 Hours)

Tax structure in India for personal taxation, Scope of personal tax planning, exemptions and deductions available to individuals under different heads of income and gross total income. Comparison of benefits - Special provision u/s 115 BAC vis-à-vis General provisions of the Income-tax Act, 1961, tax avoidance versus tax evasion

Module IV: Insurance Planning (12 Hours)

Need for insurance. Life insurance, health insurance, property insurance, credit life insurance and professional liability insurance

Module V: Retirement Benefits Planning (12 Hours)

Retirement planning goals, process of retirement planning, Pension plans available in India, Reverse mortgage, Estate planning.

Suggested Readings

Deb Tapomoy, Strategic Approach to Human Resource Management Concept, Tools and Application, Atlantic Publishers & Distributors Pvt Ltd.

Nayantara Padhi, Strategic Human Resources Management: Theory and Practice, Atlantic Publishers and Distributors Pvt. Ltd; 1 edition

Mello Jeffrey A., Strategic Management of Human Resources, Cengage Learning, 3rd edition

Mapping of COs to Modules

	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	L	L	L
CO 2	L	H			
CO 3			H		
CO 4		M		H	
CO 5	M		H		H

MMTMR309T: MARKETING RESEARCH

(Credits: 4- 60 Hours) (L-T-P: 4-0-0)

Objective(s): This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO1: define marketing research (Remembering)

CO2: explain sample and sampling design (Understanding)

CO3: identify various data collecting methods and tools (Applying)

CO4: analyse data hypothesis and testing procedures (Analyzing)

Module I: Introduction of Marketing Research: (15 Hours)

Define Marketing Research, Aims and Objectives of Marketing Research. Applications of Marketing Research, Marketing Information System, Evaluation and Control of Marketing Research, Value of Information in Decision Making, Steps in Marketing Research. Research Design: Formulating the Research Problem, Choice of Research Design, Types of Research Design, Sources of Experimental Errors.

Module II Sample and Sampling Design: (15 Hours)

Some basic terms, Advantages and Limitation of Sampling, Sampling process, Types of Sampling, Types of Sample Designs, Determining the Sample Size, Sampling Distribution of the Mean. Scaling Techniques: The concept of Attitude, Difficulty of Attitude Measurement, Types of Scales, Applications of Scaling in Marketing Research.

Module III: Data Collection: (15 Hours)

Secondary Data, Sources of Secondary Data, Primary Data, Collection of Primary Data, Methods of Data Collection- Observation, Questionnaire, Designing of Questionnaire. Data Processing and Tabulation: Editing, Coding and Tabulation.

Module IV: Data Analysis: (15 Hours)

Testing of Hypothesis, Measurement of Central Tendency, Dispersion, Univariate Analysis, Multiple Regression, Factor Analysis, Cluster Analysis, Multidimensional Scaling, Conjoint Analysis; Interpretation and Report Writing, Types of Research Reports

Suggested Readings

Satyabhushan D., Malhotra NK., (2015) Marketing Research: An Applied Orientation, 7th Edition, Pearson publisher.

Bajpai N., (2011) Business Research Methods: Pearson publisher.

Cooper & Schindler (2015) Business Research Methods, 12th Edition, McGraw-Hill.

Green, Tull & Albaum (2010) Research for Marketing Decisions, 5th Edition, PHI Pvt. Ltd, New Delhi.

Levine, Khrehbiel & Berenson (2013) Business Statistics, 6th Edition, Pearson Education.

Luck D. & Rubin D. (2006) Marketing Research, 7th edition, PHI, New Delhi

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M		M	
CO3			H		
CO4			M	M	H

MTIR311T: MANAGEMENT OF INDUSTRIAL RELATIONS

(4 Credits: 60 Hours)(L-T-P: 4-0-0)

Objective(s): The course focuses on acquainting students with concepts of Industrial Relations and various legislations related to Labour Welfare and Industrial laws.

Course/Learning Outcomes:

At the end of this course students will be able to:

CO1: Define the conceptual knowledge on industrial relations (Remembering)

CO2: Explain the extent to which the workers can participate in management (Understanding)

CO3: Apply the mechanism for resolving industrial disputes (Applying)

CO4: Analyse the provision for payment of wages (Analysing)

CO5: Discuss the legal framework of factories act (Evaluating)

Module I: Concept of Industrial Relations (15 Hours)

Aspects of industrial relations, conflict and cooperation, parties in industrial relations, workers employers and government, trade unions, objectives process, prerequisites of collective bargaining.

Module II: Workers Participation in Management (10 Hours)

Levels & Mode of participation, Works Committee, Joint Management councils, Worker Director, Grievance Procedure, QC.

Module III: Trade Union Act 1926 (15 Hours)

Immunity granted to Registered Trade Unions, Recognition of Trade Unions. The Industrial Employment (Standing Orders) Act 1946, scope, coverage, certification process, modification, interpretation, and enforcement. The Industrial Disputes Act 1947, forum for settlement of disputes.

Module IV: Payment of Wages Act (10 Hours)

Salient features, coverage of employees and employers, rules and benefits relating to The Payment of Wages Act 1936, The Payment of Gratuity Act 1972, The Minimum Wages Act 1948, The Payment of Bonus Act 1965.

Module V: The Factories Act 1948 (10 Hours)

Definition, approval, licensing and registration, health and welfare measures, employment of women and young persons, leave with wages and weekly holidays.

Suggested Readings

C.B.Mamoria, Mamoria & Gankar, Dynamics of Industrial Relations, Himalaya Publishing House Pvt Ltd, 13th Edition, 2014

C.S. Venkat Rathnam, Industrial Relations, Oxford University Press, New Delhi, 2012.

Arun Monappa, Industrial Relations, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T N Chhabra, Industrial Relations and Labour Laws, Dhanpat Rai Publishing House, Edition 5th, 2013 2.

S C Srivastava, Industrial Relations and Labour Laws, Vikas Publishing House.2012

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H	M		
CO3		H	H	L	
CO4				H	
CO5					H

MMTIP312T: INVESTMENT ANALYSIS & PORTFOLIO MANAGEMENT

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Objective(s): To learn the basics of investing and decide where to invest with less risk.

Course/Learning Outcomes

At the end of this course students will be able to:

CO1: define the investment environment, different types of investment vehicles (Remembering)

CO2: explain the logic of investment process (Understanding)

CO3: apply the quantitative methods for investment decision making (Applying)

CO4: analyse the portfolio theory and the process of investment portfolio formation (Analysing)

CO5: analyze relevance of stocks and bonds for the investments (Analysing)

Module I: Basics of risk and return (15 Hours)

Concept of returns, application of standard deviation, coefficient of variation, beta, alpha. Bonds: present value of a bond, yield to maturity, yield to call, yield to put, systematic risk, price risk, interest rate risk, default risk. Yield curve and theories regarding shape of yield curve. Unsystematic risk and non-risk factors that influence yields. Duration and modified duration, immunization of a bond portfolio. Fundamental analysis, Economic analysis, Expected direction of movement of stock prices with macroeconomic variables in the Indian context; Industry analysis: stages of life cycle, Porter's five forces model, SWOT analysis, financial analysis of an industry

Module II: Share valuation (15 Hours)

Dividend discount models- no growth, constant growth, two stage growth model, multiple stages; Relative valuation models using P/E ratio, book value to market value. Technical analysis: meaning, assumptions, difference between technical and fundamental analysis; Price indicators- Dow theory, advances and declines, new highs and lows. Volume indicators- Dow Theory, small investor volumes. Other indicators- futures, institutional activity, Trends analysis: line chart, bar chart, candle chart, point & figure chart. Patterns: head & shoulders, triangle, rectangle, flag, cup & saucer, double topped, double bottomed, Indicators: moving averages. Efficient market hypothesis; Concept of efficiency: Random walk.

Module III: Portfolio analysis (15 Hours)

Portfolio risk and return, Markowitz portfolio model: risk and return for 2 and 3 asset portfolios, concept of efficient frontier & optimum portfolio. Market Model: concept of beta systematic and unsystematic risk. Investor risk and return preferences: Indifference curves and the efficient frontier, Portfolio management services: Passive – Index funds, systematic investment plans. Active – market timing, style investing.

Module IV: Capital Asset Pricing Model (CAPM) (15 Hours)

Efficient frontier with a combination of risky and risk-free assets. Assumptions of single period classical CAPM model. Characteristic line, Capital Market Line, Security market Line. Expected return, required return, overvalued and undervalued assets. Mutual Funds: Introduction, calculation of Net Asset Value (NAV) of a Fund, classification of mutual fund schemes by structure and objective, advantages and disadvantages of investing through mutual funds. Performance Evaluation using Sharpe's Treynor's and Jensen's measures .

Suggested Readings

Security Analysis & Portfolio Management, Fischer, D.E. & Jordan, R.J ; Pearson Education.
Investment Analysis and Portfolio Management, Prasanna Chandra, Tata Mcgraw Hill Education Private Limited

Mapping of COs to Modules

Cos	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3	M	H	H	L
CO4		M	H	H
CO5		L	M	H

MTDM313T: DIGITAL MARKETING

(4 credits- 60 hours) (L-T-P: 4-0-0)

Objective(s): After studying this course, the students will be able to learn about the different knowledge and skills needed for effective digital marketing in the corporate sectors and entrepreneurial ventures.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

- CO 1: define the fundamentals of website marketing. (Remembering)
- CO 2: explain the fundamentals of search engine technology (Understanding)
- CO 3: interpret the various types of social media marketing. (Applying)
- CO 4: analyze the models of digital marketing (Analyzing)
- CO 5: evaluate the web analytics and social media analytics (Evaluating)

Module I: Introduction to Digital Marketing (10 Hours)

Introduction to Digital Marketing, Fundamentals of Website Marketing, Search Engine Marketing, Social Media Marketing, Key

Concepts and Important Terminologies, Fundamentals of Metrics and its importance in digital marketing, Fundamentals of Programmatic Advertisement and Performance Marketing, Traditional marketing vs Digital Marketing

Module II: Search Engine Optimization (15 Hours)

Introduction to SEO, Fundamentals of Search Engine Technology, Overview of Search Engine Upgrades, Fundamentals of Google

Search, Basics of Google Ads, Keyword Research, On-page and Off-page optimization, Core Elements of Optimization,

Understanding Backlinks and Value Network, Organic and Paid Optimization and Techniques of Optimization

Module III: Social Media Marketing (10 Hours)

Introduction Social Media Marketing, Understanding Platforms; types and categories, Relevance in Marketing, Platform Selection, Performance Marketing, Social Media Mentions and Spread, Social Media Sentiment, Lead Generation, Creating a sales funnel.

Module IV: Models of Digital Marketing (10 Hours)

Communication Model (10-C), 7P's of Marketing for content development, AIDA, Framework for targeting and positioning, BOS framework for Channel Development, Integrated Marketing Communication for Efficiencies.

Module V: Web and Social Media Analytics (15 Hours)

Fundamentals of Web Analytics and Social Media Analytics, Understanding Analytical Dimensions, Preparation of Analytical

Plan, Identification of Core Metrics and KPIs, Formulation of Metrics, Interpretation of Platform Inbuilt Dashboards (Facebook, Instagram etc and Google Analytics) Channels and Content Development. Designing a website (non-programming), Designing a

Social Media Page, Merger of Accounts, Understanding Content, Classification of Content, Content Marketing Channels, Post Strategies, Target Identification

Suggested Readings

Ahuja V.: Digital Marketing, Oxford University Press.

Dodson, I. (2016). The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted, and Measurable Online Campaigns (1st ed.). Hoboken, New Jersey Wiley.

Kelsey, T., & Springerlink (Online Service). (2017). Introduction to Social Media Marketing : A Guide for Absolute Beginners. Apress.

Reza Zafarani, Mohammad Ali Abbasi, & Huan Liu. (2014). Social media mining: an introduction. Cambridge University Press.

Mapping of COs to the Course:

COs	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			M	M	H
CO 4				M	
CO 5					M

MTBE404T: ANALYSIS OF BUSINESS ENVIRONMENT: INDIAN AND GLOBAL**(Credits-3 - 45 hours) (L-T-P: 3-0-0)**

Objective(s): To develop students' understanding of the dynamic and complex business environment, both domestically and globally. Equip them with analytical skills to assess environmental factors, identify opportunities and threats, and make informed strategic decisions.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: define the concept of business environment and its components. (Remembering)

CO2: explain the Indian and global business environment, identifying key factors influencing business operations (Understanding)

CO3: identify the impact of environmental changes on business strategies and performance (Applying)

CO4: examine the trade environment in details (Analysing)

Module I: Significance of Business Environment

Analysis for strategic business decisions; Elements of Business Environment; the PEST Framework; Relevant Variables & Crucial Variables in PEST Analysis; Application of PEST framework for identification of Opportunities and Threats and the most viable option; Sources of information and data for PEST Analysis – sources within the nation & global sources – WEB sources International Rating Agencies – Case Studies for illustrating the PEST Framework.

Module II: Economic Environment in India

Economic Environment in India; the Macro Fundamentals; Trends and Sectoral Composition of Growth; Trends, Composition and Direction of India's Foreign Trade; Globalisation and Trade Openness; Regulatory Framework; Liberalisation; Current Monetary & Fiscal Policies; Latest Economic Survey & Union Budget; Savings & Investment Trends.

Module III: FDI & Governance

Foreign Direct and portfolio Investment; FDI to and from India; Mode and Non-equity Mode of Investment (NEM); Constraints of doing business in India; Social landscape – Human development & Urbanization; Cultural specificities; Status of Governance and Corruption.

Module IV: Globalisation of Indian Businesses

Indian MNCs; Decision to go global – Why, when, where & How? Application of PEST Framework in the global context; Process and sources of data for estimation of market-size in a specific country for company's product/service; Global economic growth scenario; Dealing with Volatility, Shocks, Cultural Diversity, Political Risks & Technological obsolescence.

Module V: Ease of Doing Business and Country Studies

Trends of global trade in goods and Services - Modes of investing abroad –FDI, Equity Mode and Non-equity Mode of

Investment (NEM); Mergers and Acquisitions; International Outsourcing & BPO; Rating of Countries in terms Ease of Doing Business, Development Status, HDI, Governance, Corruption & Political Risk; Select Country Studies.

Suggested Readings

Porter, Michael P.: Competitive Strategy: Techniques for Analysing Industries and Competitions; The Free Press 1980.

Steiner, George A. & John F. Steiner: Business, Government and Society: A Managerial Perspective; McGraw-Hill Education; 13th ed 2011

Hill, Charles W.L.: International Business: Competing in the Global Marketplace. Tata McGraw-Hill; 2014.

Govt. of India: Economic Survey (relevant issues).

Reserve Bank of India: Report on Currency and Finance (relevant issues).

World Bank: World Development Report (relevant/ latest issues)

IMF: World Economic Outlook (relevant/ latest issues)

World Trade Organisation: International Trade Statistics (relevant/ latest issues)

UNCTAD: World Investment Reports (relevant/ latest issues)

UNDP: Human Development Report (relevant/ latest issues)

Mapping of COs to Syllabus

Cos	Module I	Module II	Module III	Module IV	Module V
CO 1	L	L	L		
CO 2	M		H		
CO 3		M		H	
CO 4	L				M

MTRM406T: RESEARCH METHODOLOGY

(Credits: 2- 30 Hours) (L-T-P: 2-0-0)

Objective(s): This course is designed to provide students with the necessary skills and knowledge to determine the information necessary to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.

COURSE/LEARNING OUTCOMES:

At the end of this course students will be able to:

CO1: Understand the various kinds of research, objectives of doing research

(Understanding & remembering)

CO2: Applying basic knowledge on qualitative research techniques, and adequate knowledge on measurement & scaling techniques as well as the quantitative data analysis. (Generating inferences)

CO3: Analyzing of data analysis-and hypothesis testing procedures (Analysis)

Module I: Introduction: (6 Hours)

Meaning of Research, Objectives of Research, Types of Research, Research Process, Research Problem formulation; Research

Design: Features of a good research design; Different Research Designs; Measurement in Research; Data types; Sources of Error

Module II: Measurement and Scaling: (8 Hours)

Primary Level of Measurement- Nominal, Ordinal, Interval, Ratio, Comparative and Non-competitive Scaling Techniques, Questionnaire Design, Sampling Process, Sampling Techniques-Probability and Non-Probability Sampling, Sample Size Decision.

Module III: Data Collection: (10 Hours)

Primary & Secondary Data; Survey Method of Data Collection, Classification of Observation Method; Field-work and Data Preparation. Hypothesis: Null Hypothesis & Alternative Hypothesis; Type-I & Type-II Errors; Hypothesis Testing: Z-Test, T-Test, ANOVA, Concepts of Multivariate Techniques.

Module IV: Research Report: (6 Hours)

Meaning, Types and Layout of Research Report; Steps in Report Writing, Tabular & Graphical Presentation of Data, Citations, Bibliography and Annexure in Report, Avoid Plagiarism; Use of Statistical Software to Analysis the Data.

Suggested Readings

Satyabhushan D., Malhotra NK., (2015) Marketing Research: An Applied Orientation, 7th Edition, Pearson publisher.

Bajpai N., (2011) Business Research Methods: Pearson publisher.

Cooper & Schindler (2015) Business Research Methods, 12th Edition, McGraw-Hill.

Green, Tull & Album (2010) Research for Marketing Decisions, 5th Edition, PHI Pvt. Ltd, New Delhi.

Levine, Khrehbiel & Berenson (2013) Business Statistics, 6th Edition, Pearson Education.

Luck D. & Rubin D. (2006) Marketing Research, 7th edition, PHI, New Delhi

Mapping of COs to Modules

COs	Module I	Module II	Module III	Module IV	Module V
CO1	M				
CO2		M			
CO3			H	M	M

MTIB407T: INTERNATIONAL BUSINESS

(Credits-3 - 45 hours) (L-T-P: 3-0-0)

Objective(s): This course provides an overview of the environment, concepts, and basic differences involved in international business

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: describe the foundation of international business. (Remembering)

CO 2: describe international organizations and multinational corporations. (Understanding)

CO 3: define forms of foreign involvement. (Applying)

CO 4: evaluate various international trade theories. (Evaluating)

Module I: Introduction to Global Business (10 Hours)

Global Business: Scope, Global Linkages today; Culture and Global Business: Elements of culture, Training Challenge; Global Trade and Investment Theory: Mercantilism, Classical Trade Theory, Factor Proportion Theory, International Trade and Product cycle theory, Theory of International Investments; Structure of Indian Foreign Trade: Composition & direction; EXIM Bank; Exit Policy of India; Regulation and Promotion of Foreign Trade.

Module II: Global Financial Markets (10 Hours)

Foreign exchange markets; Fixed and Floating Foreign exchange rates; Significant monetary events; Exchange rates, interest rates and economic policy; Economic Integration; Government Trade Policies.

Module III: Global Business Environment (15 Hours)

Private International Law; Public International Law; Risk to Global Business; Doctrine of Sovereign Immunity; Doctrine of

Eminent Domain; Labour Law Differences; Theoretical foundations of International Business; Balance of Payments; International Liquidity; International Economic; Accounting and Tax differences; Multinational Corporations; Foreign Direct Investment.

Module IV: International Finance (10 Hours)

Financing exports and imports; International Capital and Cash Management; Capital Structure: International Dimensions; International Capital Markets; International Banking and Security Markets; IMF; World Bank; IFC; ITA; ADB; WTO.

Suggested Readings

Joshi Rakesh Mohan: International Business, Oxford University Press.

Cherunilam F: International Business: Text and Cases, PHI Learning.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2		H		
CO 3			H	M
CO 4	H			

SKILL ENHANCEMENT COURSES

Semester	Category	Course Code	Course Name	Credits
1	S E Course 1	MTED104L	Entrepreneurship Development	3
2	S E Course 2	MTOM105L	Office Organization and Management	3
3	S E Course 3	MTRM210L	Retail Management	3
8			Virality In Digital Media	2
9 and 10			Business Case Design and Presentation	3

MTED104L: ENTREPRENEURSHIP DEVELOPMENT

(3 Credits-45 Hours) (L-T-P: 4-0-0)

Objective(s): *The purpose of the paper is to orient the learner toward entrepreneurship as a career option and creative thinking and behavior.*

Course/ Learning Outcomes

At the end of the course students will be able to:

CO1: define the concept of entrepreneur. (Remembering)

CO2: classify different types of entrepreneurs and entrepreneurial ventures. (Understanding)

CO3: describe the dimensions of entrepreneurial orientation. (Applying)

CO4: identify strengths, weaknesses of oneself. (Analysing)

Module I: Introduction (8 hours)

Meaning, elements, determinants and importance of entrepreneurship and creative behavior; Entrepreneurship and creative response to the society' problems and at work; Dimensions of entrepreneurship:

intrapreneurship, technopreneurship, cultural entrepreneurship, international entrepreneurship, netpreneurship, ecopreneurship, and social entrepreneurship

Module II: Entrepreneurship and Micro, Small and Medium Enterprises (8 hours)

Concept of business groups and role of business houses and family business in India; The contemporary role models in Indian business: their values, business philosophy & behavioural orientations; Conflict in family business and its resolution

Module III: Sustainability of Entrepreneurship (8 hours)

Public and private system of stimulation, support and sustainability of entrepreneurship. Requirement, availability and access to finance, marketing assistance, technology, and industrial accommodation, Role of Industries/entrepreneur's association and self-help groups, The concept, role and functions of business incubators, angel investors, venture capital and private equity fund

Module IV: Sources of business ideas and tests of feasibility (12 hours)

Significance of writing the business plan/ project proposal; Contents of business plan/ project proposal; Designing business processes, location, layout, operation, planning & control; preparation of project report (various aspects of the project report such as size of investment, nature of product, market potential may be covered); Project submission/ presentation and appraisal thereof by external agencies, such as financial/non-financial institutions

Module V: Mobilising Resources (9 hours)

Mobilising resources for start-up. Accommodation and utilities; Preliminary contracts with the vendors, suppliers, bankers, principal customers; Contract management: Basic start-up problems

Suggested Readings

Kuratko and Rao, Entrepreneurship: A South Asian Perspective, Cengage Learning.
 Hisrich R, Peters M, Dean Shepherd, Entrepreneurship, McGraw Hill Education
 Desai, Vasant. Dynamics of Entrepreneurial Development and Management. Mumbai, Himalaya Publishing House.
 Dollinger, Mare J. Entrepreneurship: Strategies and Resources. Illinois, Irwin.
 David H. Entrepreneurship: New Venture Creation. Prentice-Hall of India, New Delhi.
 Singh, Nagendra P. Emerging Trends in Entrepreneurship Development. New Delhi: ASEED.
 Khanka S S, Entrepreneurial Development, S. Chand & Co, Delhi.

E Resources

<https://www.youtube.com/watch?v=rA4uKly5gO0&list=PLsh2FvSr3n7fQIIdbfKutmSL26TsWitGQ>
<https://www.youtube.com/watch?v=DiKduSs7o34>

Mapping of COs with Syllabus

COs	Module-1	Module-2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	M
CO4			H	L

MTOM105L: OFFICE ORGANIZATION AND MANAGEMENT

(Credits: 3- 45 hours) (L-T-P: 3-0-0)

Objective(s): The course aims to establish the importance of office organisation and management and its role in the workplaces. It also prepares the students to acquire basic knowledge and skills necessary for different tasks and aspects in different industries

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: understand the basic knowledge of office organisation and management (Remembering)

CO2: demonstrate skills in effective office organisation (Understanding)

CO3: organise and to maintain the office records (Applying)

CO4: ability the different types of digital records. (Analysing)

CO5: appraise the different types of organisation structures (Evaluating)

Module I: Fundamentals Of Office Management (10 Hours)

Introduction: Meaning, importance and functions of modern office Modern Office Organisation: Meaning; Steps in office organisation; Principles of Office organisation, Organisation structure types, Nature of office services: Types of services in a modern office, decentralisation and centralisation of office services, Office management: Meaning, Elements and major processes of Office management Office Manager: Functions and qualifications of Office manager

Module II: Administrative Arrangement And Facilities (8 Hours)

Office Accommodation and its Importance: Location of Office, Choice of Location: Urban vs Suburban, Factors to be Considered in Selecting the Site, Securing Office Space, Office Lay-out: Objectives of Office Lay-out, Types of offices: Open Office and Private Office- advantages and disadvantages.

Module III: Office Environment (10 Hours)

Meaning and Components of Office Environment Interior Decoration: Colour Conditioning, Floor Coverings, Furnishings,

Furniture and Fixtures: Types of Furniture, Choice between Wooden and Steel Furniture, Principles Governing Selection of Furniture Lighting and Ventilation, Noise: Internal Noise, External Noise , Cleanliness, Sanitation and Health Safety and Security;

Module IV: Introduction to Records & Filing System (8 Hours)

Importance of Records, types of office records, Records Management: Meaning, Principles of Record Keeping, Functions of Records; Management Filing: Elements of Filing and Filing Functions, Objectives and Importance of Filing, Advantages of Filing, Essentials of a Good Filing System, Classification of Files. Filing Methods: Horizontal and vertical Filing. Office manual: contents, Importance, types of office manuals. Indexing: Meaning, importance, advantages and essentials of good indexing, Retention and disposal of files: Meaning and benefits of record retention, need for disposal of files, life-cycle stages of files.

Module V: Office Mechanisation and Data Processing (9 Hours)

Meaning, Importance and Objectives of Office Mechanisation, Advantages and disadvantages of Office Mechanisation, Factors Determining Office Mechanisation Kinds of Office Machines: Duplicating Machines and Photocopying Machines, Distinction between Data and Information, Importance of Data and Information, Classification of Data, Classification of Information, Data Collection Methods- Primary and secondary data collection methods Data processing using computers: Computer Applications in Office Management, Advantages and Limitations of Computerisation

Suggested Readings

S.P Arora, Office Organisation and Management, Vikas Publishing House Pvt Ltd

M.E Thakuram Rao, Office organisation and Management, Atlantic

Judith Read, Mary Lea Ginn, Record Management, 10th Edition, Cengage Learning.

E Resources

<https://www.youtube.com/watch?v=8iwOCXklmml>

https://www.youtube.com/watch?v=QE6TBuGbScA&list=PL7c2_MFoYT-4Wa-ajZ71x4qZt2aZ_Wrbi

Mapping of COs with Syllabus

COs	Module I	Module II	Module III	Module IV	Module V

CO1	M				
CO2		M			
CO3			M		
CO4			H	H	
CO5				M	M

MTRM210L: RETAIL MANAGEMENT**(Credits: 3- 45 hours) (L-T-P: 3-0-0)**

Objective(s): The course aims to establish the importance of retail management. It also prepares the students to acquire basic knowledge and skills necessary for different tasks and aspects of retail management.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: list the types and forms of Retail business. (Understanding)

CO3: examine Consumer Behavior in various environments. (Applying)

CO3: analyze various Retail operations and evaluate them. (Analysing)

CO4: determine the retail marketing mix. (Knowledge)

CO5: application of IT in retail sector (Applying)

Module I: Introduction to Retail Business (8 Hours)

Definition – functions of retailing - types of retailing – forms of retail business ownership. Retail theories – Wheel of Retailing – Retail life cycle. Retail business in India: Influencing factors – present Indian retail scenario.

Module II: Consumer Behaviour in Retail Business (10 Hours)

Buying decision process and its implication on retailing – Influence of group and individual factors, Customer shopping behaviour, Customer service and customer satisfaction.

Module III: Retail Operations (12 Hours)

Factors influencing location of Store - Market area analysis – Trade area analysis – Rating Plan method - Site evaluation. Retail Operations: Stores Layout and visual merchandising, Stores designing, Space planning, Inventory management, Merchandise Management, Category Management.

Module IV: Retail Marketing Mix (8 Hours)

Introduction -Product: Decisions related to selection of goods (Merchandise Management revisited) – Decisions related to delivery of service. Pricing: Influencing factors – approaches to pricing Place : Supply channel – SCM principles – Retail logistics – Promotion : Setting objectives – communication effects - promotional mix.

Module V: Information Technology in Retailing (7 Hours)

Non store retailing (e-retailing) - The impact of Information Technology in retailing - Integrated systems and networking – EDI – Bar coding – Electronic article surveillance – Electronic shelf labels – customer database management system.

Suggested Readings

Suja Nair; Retail Management, HPH

Karthic – Retail Management, HPH

S.K. Poddar& others – Retail Management, VBH.

R.S Tiwari ; Retail Management, HPH

Mapping of COs with Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2		H			
CO3			H		
CO4				H	
CO5					H

ASE: VIRALITY IN DIGITAL MEDIA**(Credits-2 - 30 hours) (L-T-P: 2-0-0)**

Objective(s): To equip students with a comprehensive understanding of the principles and strategies behind viral content creation and distribution. The course will enable students to analyze digital platforms, identify viral trends, and develop effective strategies to create content that resonates with target audiences.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO 1: describe the concept of virality and its impact on digital marketing. (Remembering)

CO 2: describe digital platforms and audience behavior to identify viral potential. (Understanding)

CO 3: apply engaging and shareable content that aligns with viral trends. (Applying)

CO 4: evaluate the effectiveness of viral campaigns and optimize for future success. (Evaluating)

Module I: Understanding Virality

Definition and characteristics of viral content. The psychology of sharing: social proof, emotions, and triggers. Viral loops and feedback mechanisms. Case studies of successful viral campaigns.

Module II: Digital Platforms and Audience Analysis

Major social media platforms and their viral ecosystems. Understanding target audience demographics and psychographics.

Identifying viral trends and patterns. Influencer marketing and its role in virality

Module III: Content Creation and Curation

Content formats for virality: videos, images, text, and interactive content. Storytelling and narrative structure for maximum impact. Creating shareable content: hooks, headlines, and visual appeal. Content curation and repurposing for sustained engagement

Module IV: Viral Marketing Strategies

Developing a viral marketing plan. Leveraging user-generated content (UGC). Utilizing paid promotion for initial reach. Measuring and optimizing campaign performance. Crisis management for viral content.

Module V: Advanced Topics in Virality

Viral analytics and measurement tools. Ethical considerations in viral marketing. Global virality and cultural nuances. Future trends in viral marketing.

Suggested Readings

Jonah Berger, Contagious: Why Things Catch On

Emily Bell, The Attention Economy: Understanding the New Culture of Now

Kevin Allocca, Why Things Go Viral

Charlene Li, Open Leadership: How Social Technology Can Transform the Way You Lead

Various academic articles and industry reports on viral marketing and social media

INTERNSHIPS

Semester	Category	Course Code	Course Name	Credits
2	Internship	MTIN106I	Internship	4
4	Internship	MTIN211I	Internship	4
5	Internship	MTIN315I	Internship	2

MTIN106I/MTIN211I: INTERNSHIP (Exit of 1st Year or 2nd Year)

(4 Credits- 120 Hours) (L-T-P: 0-0-4)

Objective(s)

The students are required to undergo an internship in work related to Commerce and Management during the semester break at the end of fourth Semester or fifth Semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Identify career alternatives prior to graduation. (Understanding)

CO 2: Translate theory into practice. (Applying)

CO 3: Improve work habits and attitudes towards job success in workplace (Creating)

INTRODUCTION

The field of Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the BBA programme the students are made acquainted with the various facets of General Management, Marketing, HR and Finance functions. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

The internship should be for a minimum duration of **three weeks for 120 hours** which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.

The students have to undergo the internship at the end of 1st Year or 2nd Year if they choose to leave the programme . Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student

The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management.

After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department. e. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise of the following:

- Recommendation Letter from the Department.
- Completion Certificate from the Organisation where the student has worked as intern.
- Internship Diary as per the prescribed format.

d. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.

e. The Contents of the Report must include:

I. Introduction.

II. Objectives of the Internship.

III. About the Organisation (Sector, Activities, Operations).

IV. Description of the work.

The Assessment for the internship must have the following components:

a. Internship Report: 20 marks

b. Internship Diary: 20 marks

c. Seminar Presentation: 30 marks

d. Viva-Voce Examination: 30 marks

MTIN315I: INTERNSHIP (At the end of 4th Semester and evaluated in 5th Semester)

(2 Credits- 60 Hours) (L-T-P: 0-0-2)

Objective(s)

The students are required to undergo an internship in work related to Commerce and Management during the semester break at the end of fourth Semester or fifth Semester. The purpose of this internship is to expose the students to real-life industry work situations. This is an opportunity for the students to learn the application of knowledge that they have acquired from the classes, in an on-the-job situation.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Identify career alternatives prior to graduation. (Understanding)

CO 2: Translate theory into practice. (Applying)

CO 3: Improve work habits and attitudes towards job success in workplace (Creating)

INTRODUCTION

The field of Management is very practical oriented and requires an in-depth knowledge about both the theoretical and practical aspect of business operations. In the BBA programme the students are made acquainted with the various facets of General Management, Marketing, HR and Finance functions. However, the lessons mostly remain with the limits of classroom discussion. The real practices of business are much more complex and subject to judgement of the manager. This internship is an attempt to enable the students to acquire some learning experiences in the practical field and equip themselves with necessary traits to succeed in the corporate environment.

INSTRUCTION AND GUIDELINES FOR STUDENTS

The students should follow the following instruction and guidelines during the course of internship:

1. The internship should be for a minimum duration of **two weeks for 80 hours** which can be extended up to any limit depending upon the convenience and requirement of the student and the organisation respectively.
2. The students have to undergo the internship during the semester break at the end of 3rd semester examination or at the end of 5th semester examination. Any students willing to undergo internship during the semester classes will not be encouraged and would be completely on his/her own cost of attendance and classes. Further, in such a case, the Department holds full right to reject the internship of such student
3. The students can undergo internship at any organisation which is recognised or registered, as applicable, of their choice but the work must be related to commerce and management.
4. After the completion of the internship, the students must submit the Internship Report which should include the Internship Diary as an Annexure to the Report. The format of the Internship Report and Internship Diary should be in accordance with the one prescribed by the Department. e. There would be a Seminar Presentation (PPT) and Viva-Voce Examination towards the end of the 6th Semester based on which the students would be evaluated for the internship. The Internship report would also be a part of evaluation.

STRUCTURE OF INTERNSHIP

The Internship Report must comprise of the following:

- a. Recommendation Letter from the Department.
- b. Completion Certificate from the Organisation where the student has worked as intern. Internship Diary as per the prescribed format.
- c. Organisation details (Address, E-mail, Contact Number) including name, contact number and e-mail of the supervisor is mandatory. This should be included as a part of the Internship Diary according to the prescribed format.
- d. The Contents of the Report must include:
 - I. Introduction.
 - II. Objectives of the Internship.
 - III. About the Organisation (Sector, Activities, Operations).
 - IV. Description of the work.

The Assessment for the internship must have the following components:

- a. Internship Report: 20 marks
- b. Internship Diary: 20 marks
- c. Seminar Presentation: 30 marks
- d. Viva-Voce Examination: 30 marks

RESEARCH PROJECT/DISSERTATION

BBA (Honours)				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	MTDI408P	Dissertation-I	6
8	Research Project/Dissertation	MTDI409P	Dissertation-II	6
BBA (Honours) with Research				
Semester	Category	Course Code	Course Name	Credits
7	Research Project/Dissertation	MTDI410P	Dissertation-I	18
8	Research Project/Dissertation	MTDI411P	Dissertation- II	20

MTDI408P: DISSERTATION - 1

(Credits: 5- 75 Hours) (L-T-P: 0-0-75)

Objective: The basic objective of the project work is to give students an idea of research. In which they need to undertake a field survey for collecting data. Further they need to analyse the data and present a report on the topic in which they have conducted research. The evaluation is done on the basis of the project report, presentation and viva-voce examination.

Guidelines Related To Project:

The entire project will be carried out in one phase. It includes Introduction and Review of Literature part, Research Methodology, Data Analysis and Interpretation and Findings, suggestions and conclusion part.

Course Outcome

- CO1: Define the different types of research project. (Remembering)
- CO2: Explain the various steps of designing research project (Understanding)
- CO3: Building questionnaire and schedules (Applying)
- CO4: Assessing the data for analysis (Analyzing)
- CO5: Appraising the findings in the report (Evaluating)
- CO6: Designing a research project report (Creating)

RESEARCH PROJECT / DISSERTATION-I

(CREDITS: 5- 75 HOURS) (L-T-P: 0-0-75)

Objective: The objective of the course would be to educate the students about the various dimensions of a research-based project work. The students will also be taught about the application of statistical tools through SPSS.

Course Outcomes

At the end of the course students will be able to:

- CO1: Define the different types of research project. (Remembering)
- CO2: Explain the various steps of designing research project (Understanding)
- CO3: Building questionnaire and schedules (Applying)
- CO4: Examining the data for analysis (Analyzing)
- CO5: Appraising the findings in the report (Evaluating)
- CO6: Designing a research project report (Creating)

The Dissertation will comprise of the following:

Synopsis: Submission of a write up on a specific area/topic of study

Review of Literature: Submission of a specified number of reviews to respective guide

Research Methodology: Lecture based on the topic of study

Referencing Style: Lecture on referencing style to be followed while submitting report

Training on application of Statistical software used in research

Submission of Progress Report

Report should comprise of Introduction, Review of Literature, Research Methodology and References.

EVALUATION:

A diary is to be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester.

Evaluation will be done by the respective guide based on timely submission of part-work and quality of work as follows:

Synopsis (30 marks)

Review of Literature (30 marks)

Research Methodology (30 marks)

Publication in Referred Journal: (10 marks)

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REGULATIONS FOR PG PROGRAMMES SCIENCE AND TECHNOLOGY

ASSAM DON BOSCO UNIVERSITY REGULATIONS POST GRADUATE DEGREE PROGRAMMES

SCIENCE AND TECHNOLOGY

The following are the regulations of the Assam Don Bosco University concerning the Post- Graduate Programmes leading to the award of the Master's Degree in the disciplines of Science and Technology made subject to the provisions of its Statutes and Ordinances.

1.0 Academic Calendar

- 1.1 Each academic year is divided into two semesters of approximately 90 working days: an Autumn Semester (July – December) and a Spring Semester (January – June). The Autumn Semester shall ordinarily begin in July for students already on the rolls and the Spring Semester shall ordinarily begin in January. However, the first semester (Autumn, for newly admitted students) may begin later depending on the completion of admission formalities.
- 1.2 The schedule of academic activities approved by the Academic Council for each semester, inclusive of the schedule of continuing evaluation for the semester, dates for the conduct of end-semester examinations, the schedule of publication of results, etc., shall be laid down in the Academic Calendar for the semester.

2.0 Duration of the Programme

- 2.1 The normal duration of the Post Graduate Programme shall be as per the table given below:

Programme	Number of Semesters	Number of Years
Master of Technology (MTECH)	4	2
Master of Science (MSc)	4	2

- 2.2 However, students who do not fulfill some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to 4 more semesters (2 years) to complete all the requirements of the degree.
- 2.3 Under exceptional circumstances and depending on the merit of each case, a period of 2 more semesters (1 year) may be allowed for the completion of the programme

3.0 Course Structure

- 3.1 The University follows Outcome Based Education with Choice Based Credit System (CBCS) for all the Post Graduate Degree Programmes. One credit is equivalent to 15 hours of lecture/tutorial or 30 hours of practical. The courses offered for the Post Graduate Degree Programmes are divided into two baskets – Core Courses and Elective Courses.

3.2 Core Courses: Core courses are those in the curriculum, the knowledge of which is deemed essential for students who are pursuing the said Post Graduate Degree Programme.

- 3.2.1 A student shall be required to take all the core courses offered for a particular programme.
- 3.2.2 The number of credits required from core courses shall be as prescribed by the competent academic authority.

3.3. Elective Courses: These are courses in the curriculum which give the student opportunities for specialization and which cater to his/her interests and career goals. These courses may be selected by the student and/or offered by the department conducting the programme, from those listed in the curriculum according to the norms laid down by the competent academic authority.

- 3.3.1 The number of credits which may be acquired through elective courses shall be prescribed by the competent academic authority.
- 3.3.2 It shall be the prerogative of the department not to offer an elective course which has less than 5 students opting for it.

The schema of categorisation of courses into baskets is as given below:

Core Courses	
Departmental Core (DC)	Core courses which are offered by the department conducting the programme
School Core (SC)	Core courses which are offered by a department other than the department conducting the programme, from within the same School
Institutional Core (IC)	Core courses which are offered by departments of the University from Schools other than the parent School
Elective Courses	
Departmental Elective (DE)	Elective courses which are offered by the department conducting the programme
School Elective (SE)	Elective courses which are offered by a department other than the department conducting the programme, from within the same School
Institutional Elective (IE)	Elective courses which are offered by departments of the University from Schools others than the parent School

***UGC Equivalent Courses-** Core Paper (DC), Ability Enhancement Compulsory Course (IC/SC), Skill Enhancement Course (IE), General Elective (IE/SE), Discipline Specific Elective (DE)

***AICTE Equivalent Courses** - Basic Science Course (IC), Engineering Science Course(IC), Open Elective Course (IC), Humanities and Social Science Courses (IC),Mandatory Course (IC), Professional Core Course (DC), Professional Elective Course (DE)

3.6 In order to qualify for a Post Graduate Degree, a student is required to complete the minimum credit requirements as prescribed by the competent academic authority.

3.7 In addition to the prescribed credit requirement, a student shall have to complete Institutional mandatory courses with Pass grade, as prescribed by the competent academic authority, from time to time, which shall be recorded in the Grade sheet but not taken into account for computing the SGPA and the CGPA.

3.8 **Audit Course:** Students who secure a CGPA of at least 8 at the end of the first may opt to take one audit course per semester from any Department from the second semester onwards, provided the course teacher permits the auditing of the course. This shall be done under the guidance of the Departmental Faculty Advisor/mentor. The student is free to participate in the evaluation process for such courses. However, an attendance of 75% is necessary for obtaining a P grade for such courses. When auditing courses offered by other departments, it shall be the responsibility of the student to attend such courses without missing courses of one's own department and semester.

3.9 In addition, students may also opt for additional elective courses in consultation with their mentors. Students are required to participate in the evaluation process of such courses. The grades obtained for such courses shall be recorded in the grade sheet, but not taken into account for computing SGPA and CGPA.

3.10 It shall be the prerogative of the department to not offer an elective course which has less than 5 students opting for it.

3.11 The medium of instruction shall be English and examinations and project reports shall be in English.

3.12 The course structure and syllabi of the Post Graduate Degree Programmes shall be approved by the Academic Council of the University. Departmental Boards of Studies (DBOS) shall discuss and recommend the syllabi of all the courses offered by the department from time to time before forwarding the same to the School Board of Studies (SBOS). The SBOS shall consider the proposals from the departments and make recommendations to the Academic Council for consideration and approval.

3.13 The curriculum may include industry training and /or fieldwork for a specified time. This is to be satisfactorily completed before a student is declared eligible for the degree. There shall be credit allocation

for such industrial training or fieldwork. Normally these activities shall be arranged during convenient semester breaks as shall be determined by the School Board of Studies.

- 3.14 **Faculty Advisor/Mentor:** A faculty advisor/mentor (and a co-mentor to perform the duties of a mentor during the absence of the mentor) to shall be assigned for groups of students. Faculty advisors/mentors shall help their mentees to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them.

4.0 Admission

- 4.1 All admissions to the Post Graduate Degree Programmes of the University shall be on the basis of merit. There may, however, be provision for direct admission for a limited number of NRI/FN students.

4.2 Eligibility Criteria

4.2.1 To be considered for admission to a Post Graduate Degree Programme a candidate should have passed a Bachelor's Degree (or equivalent) programme of a recognised university securing grades/marks as specified in the table below.

4.2.2 Admission will be on the basis of the performance of the candidate at the graduate level, the Post Graduate Entrance Test conducted by the university and/or a personal interview. Candidates for MTECH who have a valid GATE score may be exempted from the entrance test.

Programme	Grade /Marks requirement from qualifying examinations	Entrance Examinations / Personal Interview
MTECH	Completed a Bachelor's Degree programme in the appropriate stream of technology from a recognised university successfully with a minimum CGPA of 6.5 (or equivalent). The Academic Council may establish other eligibility criteria for M Tech in a particular discipline.	Post Graduate Entrance Test of Assam Don Bosco University
MCA	Completed a Bachelor's Degree programme in any stream of a recognised university successfully with a minimum of 50 % marks in the aggregate. In addition, the candidate must have passed Mathematics or equivalent at the higher secondary level or above.	Post Graduate Entrance Test of Assam Don Bosco University
MSc	Completed a Bachelor's Degree programme in Science of a recognised university successfully with a minimum aggregate, specified by the competent academic body.	Satisfactory performance in the Personal Interview

4.3 Reservation of seats for the programme shall be as per the guidelines laid out in the Statutes of the University.

4.4 Admissions shall ordinarily close after a specified period from the date of commencement of the first semester, through a notification. However, in exceptional cases, admission of a candidate after the last date may be recommended to the University with justification, by the School / Departments concerned. Under such an event, this period shall not exceed four weeks from the date of commencement of the first semester.

4.4.1 The attendance of such students shall be computed from the date of admission.

4.4.2 Such students may be offered the opportunity of taking part in in-semester assessment modules which may have already been completed.

4.5 All candidates shall be required to satisfy the norms prescribed by the University for medical fitness prior to admission.

4.6 Candidates may be required to furnish a certificate of good conduct from the institution last attended.

4.7 Bridge Courses: The Departments shall make provision for Bridge Courses to facilitate admission of students from varied backgrounds to a programme of their choice.

4.8 Value-added Courses: Each department shall offer value-added courses, which are optional. Certificates will be awarded to those who successfully complete the course.

4.9 Anti-Ragging Affidavit: Students and Parents Undertaking Affidavit In compliance of the UGC Regulations, it is compulsory for each student and every parent to submit an online Anti-Ragging undertaking affidavit every academic year. The Link to fill out the online undertaking affidavit by students and parents is:

www.antiragging.in/affidavit_registration_disclaimer.html

www.c4yindia.org/Home/Undertaking

5.0 University Registration

5.1 Candidates shall have to register as bona-fide students with the University as per the University regulations within a period specified by the University, by a formal application routed through the Director of the School concerned.

6.0 Attendance

6.1 To be permitted to appear for the end-semester examination of a particular course, a student is required to have a minimum attendance of 75% for that course.

6.2 Deficiency in attendance up to 10% may be condoned by the Director of the School in the case of leave taken for medical and other grievous reasons, which are supported by valid medical certificates and other requisite documents.

6.3 Some students, due to exceptional situations like their own serious sickness and hospitalization or death of members of inner family circle (restricted to only father, mother, siblings), may have attendance below 65%. Such students may be given bonus attendance percentage for a particular course based on his/her attendance for that course during the remaining days of the current semester, as given in the following table:

Attendance during the remaining days of the current semester	Bonus percentage available in the current semester
95% or more	5
90% or more but less than 95%	4
85% or more but less than 90%	3
80% or more but less than 85%	2
75% or more but less than 80%	1

They shall be permitted to appear for the end-semester examination of the course if, on the strength of this bonus attendance percentage, they obtain 65% attendance for that course.

6.4 If the sum of the credits of the courses for which a student is unable to appear at the end- semester examinations exceeds 50% of the total credits allotted for the semester, he/she shall not be permitted to appear for the entire end-semester examinations in view of clause 9.5 of these Regulations.

6.5 The School may propose to set aside a certain portion of the in-semester assessment marks for attendance. The number of marks and modalities of their allotment shall be made known to the students at the beginning of each semester.

6.6 Leave

6.6.1 Any absence from classes should be with prior sanctioned leave. The application for leave shall be submitted to the office of the Director of the concerned School on prescribed forms, through proper channels, stating fully the reasons for the leave requested along with supporting documents.

6.6.2 In case of emergency such as sickness, bereavement or any other unavoidable reason for which prior application could not be made, the parent or guardian must promptly inform the office of the Director of the concerned School.

6.6.3 If the period of absence is likely to exceed 10 days, a prior application for grant of leave shall have to be submitted through the Director of the concerned School to the Registrar of the University with supporting documents in each case; the decision to grant leave shall be taken by the Registrar on the recommendation of the Director of the concerned School.

6.6.4 The Registrar may, on receipt of an application, also decide whether the student be asked to withdraw from the programme for that particular semester because of long absence.

6.7 It shall be the responsibility of the student to intimate the concerned teachers regarding his/her absence before availing the leave.

7.0 Grading System

7.1 Three types of courses are offered in the Post Graduate programmes:

Graded courses: For the majority of the courses, students shall be assessed and given grades.

Pass/No-Pass courses: There are some courses for which the students are expected to obtain a P grade to be eligible for the degree.

Audit Courses: A third category of courses are audit courses. These are optional.

However, students who opt for these courses must have the required attendance to obtain a P grade in the course.

7.2 Based on the performance of a student, each student is awarded a final letter grade in each graded course at the end of the semester and the letter grade is converted into a grade point. The correspondence between percentage marks, letter grades and grade points is given in the table below:

Marks obtained (x) or (%)	Grade	Description	Grade Points
$90 \geq x \leq 100$	O	Outstanding	10
$80 \geq x < 90$	A+	Excellent	9
$70 \geq x < 80$	A	Very Good	8
$60 \geq x < 70$	B+	Good	7
$50 \geq x < 60$	B	Above Average	6
$41 \geq x < 50$	C	Average	5
$x = 40$	P	Pass	4
$x < 40$ F		Fail	0
	AB	Absent	0
	PS	Pass	0
	NP	Not Passed	0
	X	Not Permitted	0

In addition, a student may be assigned the grades 'PS' and 'NP' for pass marks and non-passing marks respectively, for Pass/Nopass courses, or the grade 'X' (not permitted).

A student shall be assigned the letter grade 'X' for a course if he/she is not permitted to appear for the end semester examination of that course due to lack of requisite attendance.

A letter grade 'F' or 'X' in any course implies failure in that course.

A student is considered to have completed a course successfully and earned the credits if she/he secures a letter grade other than 'F' or 'X'.

7.3 At the end of each semester, the following measures of the performance of a student in the semester and in the programme up to that semester shall be computed and made known to the student together with the grades obtained by the student in each course:

7.3.1 The Semester Grade Point Average (SGPA): From the grades obtained by a student in the courses of a semester, the SGPA shall be calculated using the following formula:

$$SGPA = \frac{\sum_{i=1}^n GP_i \times NC_i}{\sum_{i=1}^n NC_i}$$

Where GP_i = Grade points earned in the i^{th} course

NC_i = Number of credits for the i^{th} course

n = the number of courses in the semester

The Cumulative Grade Point Average (CGPA): From the SGPA's obtained by a student in the completed semesters, the CGPA shall be calculated using the following formula:

$$CGPA = \frac{\sum_{i=1}^n SGPA_i \times NSC_i}{\sum_{i=1}^n NSC_i}$$

Where $SGPA_i$ = Semester Grade point of the i^{th} semester

NSC_i = Number of credits for the i^{th} semester

n = the number of semesters completed

The CGPA may be converted into a percentage by multiplying CGPA by 10.

Both the SGPA and CGPA shall be rounded off to the second place of decimal and recorded as such. Whenever these CGPA are to be used for official purposes, only the rounded off values shall be used.

There are academic and non-academic requirements for the Graduate programmes where a student shall be awarded the 'P' and 'NP' grades. Non-credit courses such as Extra Academic Programmes belong to this category. No grade points are associated with these grades and these courses are not taken into account in the calculation of the SGPA or CGPA. However, the award of the degree is subject to obtaining a 'P' grade in all such courses.

In the case of an audit course, the letters "AU" shall be written alongside the course name in the Grade Sheet. A student is not required to register again for passing failed audit courses.

8.0 Assessment of Performance

8.1 A student's performance is evaluated through a continuous system of evaluation comprising tests, quizzes, assignments, seminars, minor projects, major projects and end-semester examinations.

8.2 Theory Courses: Theory courses shall have two components of evaluation – in- semester assessment of 40% weightage and an end-semester examination having 60% weightage.

8.2.1 The modalities of the conduct of in-semester assessment and weightages attached to its various components shall be as published by the School/Department at the beginning of each semester.

8.3 Lab Courses: Lab courses (Laboratory, Drawing, Workshop, etc.) shall be evaluated on the basis of assessment of tasks assigned and end semester test/viva voce. The weightage assigned for these components of the evaluation is given in the following table:

Component	Weightage
Assessment of Tasks Assigned	40
End-semester test / Viva voce	60

8.3.1 The modalities of the conduct of evaluation under the heading "Assessment of tasks assigned", its components and the weightages attached to its various components shall be published by the department concerned at the beginning of each semester.

8.3.2 The evaluation of the end-semester test for a lab course may be done on the basis of criteria and weightage to be specified in the question paper, among which are included Organisation of the program/experiment Coding, freedom from logical and syntactical errors, and accuracy of the result obtained / conduct of the experiment assigned and accuracy of the result, Extent of completion

A comprehensive viva-voce which examines the overall grasp of the subject

8.4 End-Semester examinations

End-semester examinations for the theory courses, generally of three hours' duration, shall be conducted by the University. The Director of the concerned school shall make the arrangements necessary for holding the examinations.

In the end-semester examinations, a student shall be examined on the entire syllabus of the courses. A student shall not obtain a pass grade for a course without appearing for the end- semester examination in that course.

8.5 Research Seminar

During the course of the Post Graduate programme students may be required to conduct research seminars on a regular basis. The purpose of these research seminars is to encourage the students to conduct literature survey on the recent trends and developments in a chosen area of the discipline.

The literature survey conducted in preparation for these seminars may lead the students to the development of a project model to be executed during the final semesters of the programme. The Research Seminars shall be evaluated on the basis of a presentation, a report and a viva voce examination.

8.6 The Major Project / Research Project / Dissertation

Students of the Post Graduate Programme shall undertake a Major Project / Research Project / Dissertation during the course of their Post Graduate studies. The Major Project / Research Project / Dissertation (to be referred to as Major Project henceforth) is normally conducted in two phases during the last two semesters of the programme.

The Major Project may be a software project, a research oriented project or research work which leads to a dissertation, as may be relevant to the discipline in which the work is undertaken. If it is a research oriented work, it should expose the students to the current state of research in a chosen area of the discipline and lead to new developments in the area.

The Major Project is to be undertaken individually in the campus or outside as may be specified by the department.

Each department shall constitute a Departmental Project Evaluation Committee (DPEC) consisting of the Director of the School (Chairperson), Head of the Department (Vice Chairperson), Project Co-ordinator and two senior teachers from the department, with the Project Co-ordinator as the convenor. The DPEC shall co-ordinate the conduct and assessment of the project.

8.6.4.1 The DPEC will notify the schedule and modalities for the following stages in the implementation of the project.

Submission of the topic of the project.

Notification for assignment of project supervisors.

Submission of the synopsis

Schedule for the seminar presentation of synopsis.

Schedule for Progress Seminars, submission of progress reports and viva voce examination.

Date for the submission of the project report and a brief summary.

Dates for the end semester evaluation of the project.

The DPEC may ask a student to resubmit a synopsis if the same does not get its approval.

The project supervisor may be from outside the department or university. Such a supervisor should be approved by the DPEC and jointly supervise a project with a faculty member of the department.

The minimum qualification of a project supervisor shall be laid down by the DPEC in consultation with the Director of the School and authorities of the University.

The Chairperson of the DPEC will submit to the Controller of Examinations a panel of at least three names of external examiners at least three weeks before the end semester examination. The Controller of Examinations will appoint the external examiner(s) from this panel.

Each student shall submit to the DPEC four bound, printed copies of the project report, prepared according to the prescribed format made available, by the due date. The student will submit also three copies of a brief summary of the project that will be forwarded to the concerned examiners.

The DPEC will make the arrangements necessary to conduct the end semester evaluation in consultation with the examiners appointed by the University, during the dates notified.

The project will be evaluated through in-semester and end-semester assessments of equal weightage. The insemester assessment will be done by the DPEC and the project supervisor. The end-semester assessment will be done by the external examiner(s), the project supervisor and a member of the DPEC appointed by it for the purpose. The weightages attached to their respective evaluations shall be 60:20:20.

The DPEC will forward the in-semester assessment marks to the Controller of Examinations by the date specified by the Examination Department.

Given below are the suggested components of Internal assessment and respective marks assigned:

Synopsis: 15 marks

Seminar presentation of the synopsis: 15 marks

Project implementation: 40 marks

Pre-submission presentation: 15 marks

Pre-submission viva voce: 15 marks

8.6.14 Given below are the suggested components of External assessment and respective marks assigned:

Project implementation: 40 marks

Seminar presentation: 25 marks

Viva voce examination: 20 marks

Project documentation: 15 marks

Publication of papers and registering of patents are encouraged during the Post Graduate programme. Papers published or patents obtained may be awarded extra weightage during the evaluation of the project.

Those who obtain an 'F' grade for the major project will be required to re-enrol for it in the subsequent semester and pay the prescribed fees.

The Director will forward the marks obtained in the in-semester evaluation to the Controller of Examinations within the prescribed time as may be notified.

All evaluated work in a subject except the end semester answer scripts will be returned to the students promptly.

Eligibility for appearing in the end-semester examinations: A student shall be permitted to appear for the end-semester examinations, provided that

A student has not been debarred from appearing in the end semester examinations as disciplinary action for serious breach of conduct.

He/she has satisfactory attendance during the semester according to the norms laid out in section 6 of these regulations.

He/she has paid the prescribed fees or any other dues of the university within the date specified.

8.10 Registration for end-semester Examinations

The University shall, through a notification, invite applications from students to register for the end-semester examinations.

Students who have registered with the University (vide clause 5) and those who have applied for such registration may apply to appear for the end- semester examinations of the university, in response to the notification issued by the University, provided that they fulfil the eligibility norms as laid down in clause 8.9.

All eligible candidates shall be issued an admit card for the relevant examination and for specified courses. A student who does not have a valid admit card may not be permitted to write the end-semester examinations.

A student who secures an 'F' or 'X' grade in any course in a semester may register for the end- semester examination for that course in a subsequent semester when that course is offered again, within the maximum period of time allotted for the completion of the programme. The in-semester assessment marks obtained by him/ her in the last semester in which the said course was attended by him/her shall be retained.

Similarly, in case of an 'NP' grade in Extra Academic Programmes the student shall have to re-register for it in the appropriate semester of the next academic session.

When a student re-registers for the end semester examination of a course, in accordance with clause 8.10.4 above, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

Conduct of Examinations: The University shall conduct the end-semester examinations in accordance with the applicable regulations on such dates as are set down in the Academic Calendar or as notified.

Declaration of Results: The University shall declare the results of a semester and make available to students their grade sheets within the time-frame prescribed by the relevant regulations of the university and specified in the academic calendar.

The University may withhold the results of a student for any or all of the following reasons

he/she has not paid his/her dues

there is a disciplinary action pending against him/her

he/she has not completed the formalities for University Registration according to the requirement of section 5 of these Regulations.

8.14 Re-examining of answer scripts

If a student feels that the grade awarded to him/her in a course is not correct, he/she may apply to the University for the re-examining of his/her answer script.

Re-examining of scripts may be of two different categories – scrutiny and re-evaluation.

Scrutiny: The activities under this category shall ordinarily be confined to checking correctness of the total marks awarded and its conversion into appropriate letter grades whether any part/whole of a question has been left unevaluated inadvertently correctness of transcription of marks on the tabulation sheet and the gradesheet issued in respect of the course under scrutiny.

Re-evaluation: Re-evaluation of the answer script by independent experts in the concerned subject(s).

Application for re-examining of answer scripts

A student may apply for scrutiny or re-evaluation for one or more courses of the just-concluded end-semester examinations within seven calendar days from the date of publication of its results in the application form prescribed for this purpose.

He/she shall pay the prescribed fee to the University as notified.

A student applying for scrutiny/re-evaluation shall expressly state on the application form whether the application made is for Scrutiny or for Re-evaluation. In each case, the student may also request to see his/her answer script.

All applications for scrutiny/re-evaluation must be routed through the Director of the concerned School.

If in the process of re-examining, the grade obtained in a course changes, the better of the two grades shall be assigned to the course. If there is a change, the new grade shall be recorded and a new grade sheet shall be issued to the student.

Without prejudice to any of the clauses of section 8.14, a student who has been found to have used unfair means during an examination shall not be eligible to apply for scrutiny or re-evaluation of answer scripts.

Repeat Examination: The University shall conduct repeat examination for those with F grade at a different time slot, as set down in the Academic Calendar or as notified. Such students should register for these examinations.

Improvement Examination

After the completion of the entire programme of study, a student may be allowed the provision of improvement examinations. These are to be availed of only once each in the Autumn and Spring semesters that immediately follow the completion of the programme, and within the maximum number of years permissible for a programme.

A student who has taken migration from the University shall not be eligible to appear for Improvement Examination.

A student may not choose more than the number of courses specified in the table below for improvement examinations.

Programme	Number of Courses for Improvement Examinations

	Autumn Semester	Spring Semester	Total
MCA	3	3	6
MSc	3	3	6
MTECH	2	2	4

After the improvement examination, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

If the student improves his/her grades through the improvement examination, new grade sheets and comprehensive transcripts shall be issued to the student.

8.17 Special Examination

8.17.1 The University shall conduct Special Examinations to benefit the following categories of students: Students who, on the completion of the final semester, have some 'F' graded courses in the two final semesters, but no 'F' or 'X' graded courses in any of the previous semesters

Students who have only one 'F' graded course in a semester other than the two final semesters and do not have 'F' or 'X' graded courses in the two final semesters.

The Special Examinations shall ordinarily be conducted each year within a month of the declaration of the results of the Spring Semester.

Students who fail to secure 50% of the credits offered in the final semester shall not be eligible to appear for the special examinations. Such students will be governed by the provisions of clause 9.5 of these regulations. However, this restriction shall not apply in the case of students who are unable to appear in the end semester examinations due to exceptional situations like their own serious illness and hospitalisation or death of members of inner family circle (restricted to only father, mother, siblings).

Students who have 'X' graded courses only in the last two semesters may be offered the opportunity for participating in a Tutorial Programme which may be conducted during the semester break immediately following the end- semester examinations of the final semester and students who earn 85% attendance for the programme shall be permitted to appear for the Special Examinations. Separate fees shall be charged for the Tutorial Programme.

Students who do not obtain pass grades in any course at the special examinations shall have to apply in the prescribed format and appear for the end-semester examination of these courses when they are scheduled by the University during subsequent relevant end-semester examinations.

9.0 Enrolment (for semesters other than the first)

9.1 Every student is required to enrol for the relevant courses before the commencement of each semester within the dates fixed for such enrolment and notified by the Registrar.

9.2 Students who do not enrol within the dates announced for the purpose may be permitted late enrolment up to the notified date on payment of a late fee.

9.3 Only those students shall be permitted to enrol who have

- cleared all University, Departmental, Hostel and Library dues and fines (if any) of the previous semester,
- paid all required University, Departmental and Hostel fees for the current semester, and
- not been debarred from enrolling on any specific ground.

9.4 No student may enrol for a semester if he/she has not appeared, for whatever reason, in the end semester examinations of the previous semester.

9.5 A student who fails to obtain 50% of the credits offered in the third and subsequent semesters shall not be permitted to enrol for the next semester and shall have to re-enrol for and attend all the courses of the said semester in the following academic year. Students who due to X grade (lack of due attendance) have been debarred from exams in any semester (including first and second) will have to re-enrol for the same.

10.0 Eligibility for the Award of the Post Graduate Degree

10.1 A student shall be declared to be eligible for the award of the Post Graduate Degree for which he/she has enrolled if he/she has

- 10.1.1 completed all the credit requirements for the degree with grade 'C' or higher grade in each of the mandatory graded courses and grade 'PS' in all mandatory non-graded courses.
- 10.1.2 satisfactorily completed all the non-credit requirements for the degree viz., Extra Academic Activities, Industry Training, field work, internship programme, etc. (if any);
- 10.1.3 obtained a CGPA of 5.00 or more at the end of the semester in which he/she completes all the requirements for the degree;
- 10.1.4 owes no dues to the University, School, Department, Hostels; and
- 10.1.5 has no disciplinary action pending against him/her.
- 10.2 The award of the Post Graduate Degree must be recommended by the Academic Council and approved by the Board of Management of the University.

11.0 Termination from the Programme

- 11.1 If more than the number of years permitted for the completion of a programme have elapsed since the student was admitted, and the student has not become eligible for the award of Degree, the student shall be removed from the programme.
- 11.2 A student may also be required to leave the Programme on disciplinary grounds on the recommendations of the Students' Disciplinary Committee of the concerned School.

ASSAM DON BOSCO UNIVERSITY REGULATIONS POST GRADUATE DEGREE PROGRAMMES

HUMANITIES AND SOCIAL SCIENCES & COMMERCE AND MANAGEMENT

The following are the regulations of the Assam Don Bosco University concerning the Post- Graduate Programmes leading to the award of the Master's Degree in the disciplines of Humanities and Social Sciences & Commerce and Management made subject to the provisions of its Statutes and Ordinances: The Master's Degree Programmes of Assam Don Bosco University consist of theory and practicum components, taught and learned through a combination of lectures, field work/field visit and research projects.

1.0 Academic Calendar

- 1.1 Each academic year is divided into two semesters of approximately 18 weeks duration: an Autumn Semester (July – December) and a Spring Semester (January – June). The Autumn Semester shall ordinarily begin in July for students already on the rolls and the Spring Semester shall ordinarily begin in January. However, the first semester (Autumn, for newly admitted students) may begin later depending on the completion of admission formalities.
- 1.2 The schedule of academic activities approved by the Academic Council for each semester, inclusive of the schedule of continuing evaluation for the semester, dates for end-semester examinations, the schedule of publication of results, etc., shall be laid down in the Academic Calendar for the semester.

2.0 Duration of the Programme

- 2.1 The normal duration of the Post Graduate Programme in the disciplines of Humanities and Social Sciences & Commerce and Management shall be 4 semesters (2 years).
- 2.2 However, students who do not fulfil some of the requirements in their first attempt and have to repeat them in subsequent semesters may be permitted up to 4 more semesters (2 years) to complete all the requirements of the degree.
- 2.3 Under exceptional circumstances and depending on the merit of each case, a period of 2 more semesters (1 year) may be allowed for the completion of the programme

3.0 Course Structure

- 3.1 The choice based credit system shall be followed for the Masters Degree Programmes. Credits are allotted to the various courses depending on the number of hours of lecture/practicum/Field work assigned to them using the following general pattern:

3.1.1 Lecture: One hour per cycle/week is assigned 1 credit.

3.1.2 Practicum/fieldwork: Two hours per cycle/week is assigned 1 credit.

3.2 The courses are divided into two baskets – core courses and elective courses. (Core courses will include “Core Courses” and “Ability Enhancement Courses” mentioned in CBCS guidelines. Elective Courses will include “Discipline Specific Electives”, “Generic Electives”, optional “Dissertation or Project”, and “Skill Enhancement Courses”)

3.3 Core Courses: Core courses are those in the curriculum, the knowledge of which is deemed essential for students who are pursuing the programme.

3.3.1 A student shall be required to take all the core courses offered for a particular programme.

3.3.2 The number of credits required from core courses shall be as prescribed by the competent academic authority.

3.4 Elective Courses: These are courses in the curriculum which give the student opportunities for specialisation and which cater to his/her interests and career goals. These courses may be selected by the student and/or offered by the department conducting the programme, from those listed in the curriculum according to the norms laid down by the competent academic authority.

3.4.1 The number of credits which may be acquired through elective courses shall be prescribed by the Board of studies pertaining to the programme.

3.5 These categories of courses may further be subdivided into departmental, school or institutional, depending on the department which offers the course. The schema of categorisation of courses into baskets is as given below:

*Core Courses	
Departmental Core (DC)	Core courses which are offered by the department which conducts the programme
School Core (SC)	Core courses which are offered by a department other than the department which conducts the programme, from within the same School
Institutional Core (IC)	Core courses which are offered by departments of the University from Schools other than the parent School
*Elective Courses	
Departmental Elective (DE)	Elective courses which are offered by the department which conducts the programme
School Elective (SE)	Elective courses which are offered by a department other than the department which conducts the programme, from within the same School
Institutional Elective (IE)	Elective courses which are offered by departments of the University from Schools others than the parent School

***UGC Equivalent Courses** - Core Paper (DC), Ability Enhancement Compulsory Course (IC/ SC), Skill Enhancement Course (IE), General Elective (IE/SE), Discipline Specific Elective (DE)

- 3.6 In order to qualify for a Master's Degree, a student is required to complete the credit requirement as prescribed in the curriculum.
- 3.7 In addition to the prescribed credit requirement, a student shall have to complete the requirements of Extra Academic Programmes (EAP) as may be prescribed by the Department. Students shall be awarded P/NP grades for the EAP, which shall be recorded in the Gradesheet, but not taken into account for computing the SGPA and the CGPA.
- 3.8 Students who secure a CGPA of at least 7.5 at the end of the 2nd semester may opt to take one audit course per semester from any Department from the 3rd semester onwards, provided the course teacher permits the auditing of the course. This shall be done under the guidance of the Departmental Faculty Advisor/mentor. The student is free to participate in the evaluation process for such courses. However, an attendance of 75% percentage is necessary for obtaining a P grade for such courses. When auditing courses offered by other departments, it shall be the responsibility of the student to attend such courses without missing courses of one's own department and semester.
- 3.9 In addition, students may also opt for additional elective courses in consultation with their mentors. Students are required to participate in the evaluation process of such courses. The grades obtained for such courses shall be recorded in the gradesheet, but not taken into account for computing SGPA and CGPA.
- 3.10 It shall be the prerogative of the department to not offer an elective course which has less than 5 students opting for it.
- 3.11 The medium of instruction shall be English and examinations and project reports shall be in English.
- 3.12 The course structure and syllabi of the Post Graduate Degree Programmes shall be approved by the Academic Council of the University. Departmental Boards of Studies (DBOS) shall discuss and recommend the syllabi of all the courses offered by the department from time to time before forwarding the same to the School Board of Studies (SBOS). The SBOS shall consider the proposals from the departments and make recommendations to the Academic Council for consideration and approval.
- 3.13 The curriculum may include fieldwork / institutional visits / internship for a specified time. These are to be satisfactorily completed before a student is declared eligible for the degree. There shall be credit allocation for such activities. These activities may be arranged during the semester or during convenient semester breaks as shall be determined by the School Board of Studies.
- 3.14 Faculty Advisor/Mentor: A faculty advisor/mentor shall be assigned for groups of students. Faculty advisors/mentors shall help their mentees to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them.

PROGRAMME SPECIFIC CURRICULAR ASPECTS

4.0 MASTER OF SOCIAL WORK (MSW)

- 4.1 Area of Concentration:** The third and fourth semesters shall have courses from a chosen Area of Concentration (AoC) from among those offered by the department. The AoC is to be opted for at the end of the second semester and will be confirmed by the department depending on the availability of seats and the aptitude and ability of the student. An AoC will be offered by the department only if a minimum of ten students opt for it. The fieldwork and research project of the third and fourth semesters will be based on the AoC.

4.2 Concurrent and Continuous Fieldwork

Fieldwork shall be an essential part of the course structure in all the semesters of the programme. The field work practice in the first semester shall consist of orientation visits, sessions for skills training and placement. In the first year, the focus of the field work shall be the community and in the second year the focus shall be based on the specialisation chosen by the students. In the first semester,, students shall be placed in communities, NGOs, service organizations and government agencies working with communities, and in those settings where they can be exposed to the community and community issues. The students get a close feel of the community and community settings, understand the dynamics and issues in the community and become aware of the sensitivities of people while working with them. They also get a firsthand experience of the programmes and

projects implemented in the communities by NGOs and government agencies and the impact that these have on the community. They shall also interact with the personnel from organisations and the community members to understand the tension between tradition and change that the communities in the region are likely to experience, and how it is handled. They shall, with the help of the organisation and the field work supervisor, identify an issue and work on it following the principles of community organization. The students are expected to be creative and innovative in assisting the agency and community in whatever way possible.

The field work practice in the second semester will consist of lab sessions for skills training and placement. The focus will be on the practice of social case work and Group works. The students shall be placed in NGOs, and government service organizations and government agencies working with individuals and families, and in those settings where they can be exposed to issues related to individuals and groups.

4.2.1 Normally a student shall spend fifteen hours over two days per week in field work. However, keeping in mind the peculiar situation of transport and communications in the region and the expenses involved, the field work practice may be arranged in other convenient ways as the institution deems fit.

4.2.2 The student is required to submit the report on the field work and the field work diary to the field work supervisor, before the commencement of classes on the first day of class following the field work days. The supervisor shall conduct regular field work conferences

4.2.3 A student is expected to have 100 percent attendance in field work. Any shortage shall be compensated by him/her.

4.2.4 At the end of the semester the student shall submit a summary report of the field work for the semester and a viva voce examination shall be conducted.

4.2.5 The field work practice in the Third and Fourth Semesters shall focus upon the Area of Concentration chosen by the students. The students shall be placed in the field for twenty five days of consecutive field work. The field work settings shall be communities, NGOs, service organizations, hospitals, clinics and governmental agencies. Those students who are specializing in Community Development will either be placed in an urban or rural community setting that is identified by the Department. Students who are specializing in Medical and Psychiatric Social Work will be exposed to either a Medical or a Psychiatric setting.

4.3 Rural Camp

Students shall organise and participate in a rural camp during the first / second semester. The duration of the rural camp shall generally be ten days excluding days of travel.

4.3.1 The objectives of the rural camp are:

To apply the acquired skills of group work and community organisation in communities.

To understand and assess the problems faced by the rural population.

To involve oneself positively in the communities to help to remove some of these problems.

4.3.2 At the end of the camp each student shall submit a written report to the department in a specified format. Performance at the Rural Camp shall be considered for the evaluation of the Field Work during the second semester.

4.3.3 The Rural Camp shall be credited along with the fieldwork of the semester along with which it can be conveniently coupled.

Study Tour

During the programme the students shall undertake a study tour along with the assigned faculty members to a place approved by the department. The places are to be so chosen as to be of educational benefit to students. During the tour, the focus shall be on visiting and interacting with as many NGOs/ state/national/international organisations involved in developmental work as possible. A report of the learning outcomes shall be submitted to the department at the end of the tour. The Study Tour shall be a Pass/No Pass course.

Block Placement

After the examinations at the end of the fourth semester, the students shall be placed with an NGO or Agency for a period of not less than one month for practical experience and application of their skills. While the Block Fieldwork is not credited, it is mandatory for the completion of the MSW programme. The student shall contact an agency of his/her choice and get the choice of agency approved by the department. Students shall endeavour to choose an agency that is primarily in tune with their AoC and which has credentials in the concerned field. At the end of every week the student shall send a brief report to the supervisor and at the end of the Block Field Work period a summary report shall be submitted. The summary report shall contain a short description of the Agency, the social service skills applied in his/her work and the student's learning outcomes. The report shall be submitted in a format prescribed by the department and shall be submitted together with a certificate from the agency confirming his/her field work, in a prescribed format.

Research Project Work

Every student shall undertake a research project work which has bearing on his/her AoC and present a written thesis on the research work under the supervision and guidance of a faculty member. The preliminary work may begin at the end of the second semester. The students are expected to complete the data collection before the fourth semester. The thesis is to be submitted to the department before the date notified. The student shall write a dissertation of the research thesis and appear for a viva voce examination on the research done. The mode and components of evaluation of the research work and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

5.0 MASTER OF SCIENCE (MSC) PSYCHOLOGY**5.1 Field Work**

Students shall take part in field work during the first three semesters in mental health agencies, medical institutions, educational institutions etc., under the supervision of professional counsellors and psychologists, where the student of psychological counselling can get a first-hand experience of the application of the learning derived from the classroom. The field work shall be credited and shall be evaluated using norms laid down by the department.

5.2 Study Tour

During the programme the students shall undertake a study tour, along with the faculty members, to a place approved by the department. The places are to be so chosen as to be of educational benefit to students. During the tour, the focus shall be to visit and interact with NGOs, hospitals, state/national/international organisations involved in psychological counselling. A report of the learning outcomes shall be submitted to the department at the end of the tour followed by a presentation. The Study Tour shall be a Pass/No Pass course.

5.3 Summer Internship

Students are required to undergo a summer internship of two weeks' during the semester break between the second and third semesters. It is a P/NP course and shall be recorded in the third semester. The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in class room courses to the "real world" of social service agencies, medical institutions, the criminal justice system, business, and industry. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills. The summer internship enriches the students' academic experience while making a valuable contribution to the community and utilizing the vacation optimally.

5.4 Supervised Internship

Each student shall perform a supervised internship for a period of 90 days (spread across semester three and four with 45 days in each semester) in two organizations which offers counselling help to clients. The supervised internship is a credited course and the report for each internship shall be submitted by the students at the end of each semester followed by a presentation on the same. It shall be the prerogative of the department to propose the number of institutions where a student is expected to perform supervised internship. Supervision shall be provided for by the university in collaboration with the organisation where the student performs the internship. Evaluation of the internship shall be based on the documentation, reports from the organisation, report of the supervisor and the presentation and the viva voce examination of the student at the end of the period of Internship.

5.5 Research Project Work

A research project shall be undertaken during the course of the third and the fourth semesters. The topic of the research shall be so chosen that it will be possible for the student to pursue and complete the research work in the institution/hospital where the student is placed for the supervised internship. The preliminary work may begin at the end of the second semester. The students are expected to complete the data collection before the fourth semester. The thesis is to be submitted to the department before the date notified. The student shall write a dissertation of the research thesis and appear for a viva voce examination on the research done. The mode and components of evaluation of the research work and the weightages attached to them shall be published by the Department/ Institute at the beginning of the semester.

5.6 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A Group assignment shall be accompanied by a common presentation.

6.0 MASTER OF ARTS (MA) EDUCATION

6.1 Specialisations

The Master's Degree Programme in Education offers a number of specialisations, of which a student shall be required to choose a specialization after the completion of the first semester. The department shall have the prerogative of not offering a specialisation if a sufficient number of students do not opt for it.

6.2 Educational Seminar

During the course of the programme, students are expected to present a series of seminars which will address fundamental intellectual, conceptual and practical issues in current educational philosophy and application. They may also deal with other relevant topics which may be suggested by the department. Students shall be assisted through guest lectures, discussions, field work in education related institutions and active engagement with faculty members. During these interactions students shall be provided with an opportunity to explore how best to bring new interdisciplinary scholarship, technology and critical thinking into the development of the chosen seminar area. They shall also consider alternative pedagogic strategies, teaching techniques and technologies. Students shall prepare and present a final paper based on these seminars. Students shall be evaluated on the basis of the seminars and the final paper.

6.3 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

6.4 Research Project Work

Every student shall undertake a research project work which has bearing on his/her field of specialisation and present a written thesis on the research work under the supervision and guidance of a faculty member. The Research Project shall be undertaken individually, in two phases during the third

and fourth semesters. Students are expected to make presentations to the department at different stages of the research work. The student shall write a dissertation of the research thesis, submit it to the department and appear for a viva voce examination at times to be notified by the department. The mode and components of evaluation of the research work and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

6.5 School Visits

The students of the Masters Programme in Education shall be engaged in regular school visits with the purpose of understanding and evaluating the process of teaching, learning and evaluation as well as the exigencies of administration of the school.

6.6 Internship

During the final semester of the programme, a student is required to undergo an internship for a period of one month. The internship provides an opportunity for students to experience the ground reality and connect it with the theoretical and methodological perspectives the student has studied and interiorized. During the internship the student will be monitored and guided by his/her supervisor and faculty members. The student will be required to maintain a journal and at the end of the period of internship, submit a written report and to make a presentation of his/her experiences and learnings at the internship. The student will be required also to submit a report from the head of the institution regarding his/her performance there.

The evaluation of the student shall be based on the level of his/her engagement during the internship in addition to his/her ability to communicate this engagement in the journal, the report and the presentation. The journal and the report are to be submitted within a month of the completion of the internship. The department shall specify the criteria for evaluating the journal, the report and the presentation.

6.7 Journaling

During the 1st semester, students shall maintain a reflective journal, to develop within them a reflection that can be described as an inner dialogue, using visible thinking routine (Harvard), as a critical structure for guiding their journal writing. Journaling has to be done six days a week. At the end, the student will be awarded grade/marks after assessing their learning.

7.0 MASTER OF ARTS (MA) MASS COMMUNICATION

7.1 Specialisations

The Master's Degree Programme in Mass Communication offers a number of specialisations, of which a student shall be required to choose a specialisation after the completion of the first semester. The department shall have the prerogative of not offering a specialisation if a sufficient number of students do not opt for it.

7.2 Media House Visits

During the course of the programme, students shall be required to visit a variety of Media Houses in small groups constituted by the department. The purpose of these Media House Visits shall be to gain exposure to the best practices among the day-to-day activities of the media house. A report of the visit is to be submitted in the format specified within two days of the visit. The Media House visit shall be a graded course and grades shall be awarded on the basis of the written reports of the media house visits.

7.3 Research Project Work

Every student shall undertake a research project work which has a bearing on his/her field of specialisation and present a written thesis on the research work under the supervision and guidance of a faculty member. The Research Project shall be undertaken individually, in two phases during the course of two semesters as shall be laid down in the course structure of the programme. Students are expected to make presentations to the department at different stages of the research work. The student shall write a dissertation of the research thesis, submit it to the department and appear for a viva voce examination at times to be notified by the department. The mode and components of evaluation

of the research work and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

7.4 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

7.5 Internship

All students shall undergo an internship involving media related activities of four weeks' duration. The purpose of the internship is to give the students an opportunity to have a hands-on field experience to effectively put into practice the theoretical and practical learning from the programme in an area of interest. Students may undergo their internship in a media house of their choice. The student shall be required to discuss the choice of media house with the department and obtain its consent. Before going for the internship, a Letter of Consent from the concerned media house, in the prescribed format, shall be submitted by the student to the Department. After returning from the internship each student shall have to submit a detailed report in a prescribed format. Each student shall also make a presentation of the internship experience and learning in the Department and submit a certificate of successful completion of the internship from the designated authority of the concerned media house. The schedule of the conduct, report submission and evaluation of the internship shall be as notified by the Department. The components of evaluation of the Internship and their weightages shall be as notified by the department at the beginning of the semester.

7.6 Final Project

As a Final Project the students are required to create a Social Awareness and Community Development oriented multimedia project which shall culminate in a Media Event. The purpose of the final project is to showcase all the skills that the students have acquired during the course of the programme as well as demonstrate their Media and Event Management, and Media Entrepreneurship abilities and at the same time use these skills for the service and upliftment of the community. The Final Project shall essentially be a group project and the number of groups shall be specified by the department. The groups shall perform their activities under the guidance of faculty members who shall be assigned to guide each group. The last dates for the submission of the project proposal and the conduct of the event shall be notified by the Department well in advance. The components of evaluation of the Final Project and their weightages shall be as notified by the department at the beginning of the semester.

8.0 MASTER OF ARTS (MA) ENGLISH

8.1 Specialisations

The Master's Degree Programme in English offers a number of specialisations, of which a student shall be required to choose a specialisation after the completion of the second semester. The department shall have the prerogative of not offering a specialisation if a sufficient number of students do not opt for it.

8.2 Educational Seminar

During the course of the programme, students are expected to present a series of seminars related to English literature. They may also deal with other relevant topics which may be suggested by the department. Students shall prepare and present a final paper based on these seminars. Students shall be evaluated on the basis of the seminars and the final paper.

8.3 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

8.4 Dissertation

Students will be required to write a dissertation in the 4th semester.

9.0 MASTER OF (MA) PUBLIC ADMINISTRATION

9.1 Specialisations

The Master's Degree Programme in Public Administration offers a number of specialisations, of which a student shall be required to choose a specialisation. The department shall have the prerogative of not offering a specialisation if a sufficient number of students do not opt for it.

9.2 Project Work/Dissertation

The Master's Degree Programme in Public Administration will require students to do Project work in the 3rd and 4th semesters. The mode and components of evaluation of the project work and the weightages attached to them shall be published by the department at the beginning of the semester.

9.3 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

9.0 MASTER OF COMMERCE (MCOM)

9.1 Specialisations

The Master's Degree Programme in Commerce offers a number of specialisations, of which a student shall be required to choose a specialisation after the completion of the second semester. The department shall have the prerogative of not offering a specialisation if a sufficient number of students do not opt for it.

9.2 Project Work/Dissertation

The Master's Degree Programme in Commerce will require students to do Project work in the 3rd and 4th semesters. The mode and components of evaluation of the project work and the weightages attached to them shall be published by the department at the beginning of the semester.

9.3 Assignments

Assignments are an essential part of learning. The faculty shall engage students in a minimum of one individual and one group assignment per course, per semester. A group assignment shall be accompanied by a common presentation.

10.0 Admission

10.1 All admissions to the Post Graduate Degree Programmes of the University shall be on the basis of merit. There may, however, be provision for direct admission for a limited number of NRI/FN students.

10.2 Eligibility Criteria

10.2.1. To be considered for admission to a Post Graduate Degree Programme a candidate should have passed a Bachelor's Degree (or equivalent) programme of a recognised university securing 50% of the grades/marks.

10.2.2. Admission will be on the basis of the academic records of the candidate, and taking into consideration his/her performance in any or all of the following:

Written test

Group Discussion

Personal Interview

Candidates whose results for the qualifying examination are not yet declared may be provisionally admitted provided she/he submits proof of fulfilment of the eligibility criteria by 31 October of the year of provisional admission.

Bridge Courses: The Departments shall make provision for Bridge Courses to facilitate admission of students from varied backgrounds to a programme of their choice.

Value-added Courses: Each department shall offer value-added courses, which are optional. Certificates will be awarded to those who successfully complete the course.

Anti-Ragging Affidavit: Students and Parents Undertaking Affidavit In compliance of the UGC Regulations, it is compulsory for each student and every parent to submit an online Anti-Ragging undertaking affidavit every academic year. The Link to fill out the online undertaking affidavit by students and parents is:

www.antiragging.in/affidavit_registration_disclaimer.html

www.c4yindia.org/Home/Undertaking

11.0 University Registration

11.1 Candidates shall have to register as bona-fide students with the University as per the University regulations within a period specified by the University, by a formal application routed through the Director.

12.0 Attendance

12.1 To be permitted to appear for the end-semester examination of a particular course, a student is required to have a minimum attendance of 75% for that course.

12.2 Deficiency in attendance up to 10% may be condoned by the Director in the case of leave taken for medical and other grievous reasons, which are supported by valid medical certificates and other requisite documents.

12.3 Some students, due to exceptional situations like their own serious sickness and hospitalization or death of members of inner family circle, may have attendance below 65%. Such students may be given bonus attendance percentage for a particular course based on his/her attendance for that course during the remaining days of the current semester, as given in the following table:

Attendance during the remaining days of the current semester	Bonus percentage available in the current semester
95% or more	5
90% or more but less than 95%	4
85% or more but less than 90%	3
80% or more but less than 85%	2
75% or more but less than 80%	1

They shall be permitted to appear for the end-semester examination of the course if on the strength of this bonus attendance percentage, they obtain 65% attendance for that course.

12.4 If the sum of the credits of the courses for which a student is unable to appear at the end- semester examinations exceeds 50% of the total credits allotted for the semester, he/she shall not be permitted to appear for the entire endsemester examinations in view of clause 13.5 of these Regulations.

12.5 The School may decide to set aside a certain portion of the in-semester assessment marks for attendance. The number of marks and modalities of their allotment shall be made known to the students at the beginning of each semester.

12.6 Leave

12.6.1 Any absence from classes should be with prior sanctioned leave. The application for leave shall be submitted to the Office of the Director of the School on prescribed forms, through the Head of the Department, stating fully the reasons for the leave requested along with supporting documents.

12.6.2 In case of emergency such as sickness, bereavement or any other unavoidable reason for which prior application could not be made, the parent or guardian must inform the office of the Director promptly.

12.6.3 If the period of absence is likely to exceed 10 days, a prior application for grant of leave shall have to be submitted through the Director to the Registrar with supporting documents in each case; the decision to grant leave shall be taken by the Registrar on the recommendation of the Director.

12.6.4 The Registrar may, on receipt of an application, also decide whether the student be asked to withdraw from the programme for that particular semester because of long absence.

12.6.5 It shall be the responsibility of the student to intimate the concerned teachers regarding his/her absence before availing of the leave.

13.0 Grading System

13.1 Based on the performance of a student, each student is awarded a final letter grade in each graded course at the end of the semester and the letter grade is converted into a grade point. The correspondence between percentage marks, letter grades and grade points is given in the table below:

Marks obtained (x) o	Grade	Description	Grade Points
$90 \geq x \leq 100$	O	Outstanding	10
$80 \geq x < 90$	A+	Excellent	9
$70 \geq x < 80$	A	Very Good	8
$60 \geq x < 70$	B+	Good	7
$50 \geq x < 60$	B	Above Average	6
$41 \geq x < 50$	C	Average	5
$x = 40$	P	Pass	4
$x < 40$ F		Fail	0
	AB	Absent	0
	PS	Pass	0
	NP	Not Passed	0
	X	Not Permitted	0

In addition, a student may be assigned the grades 'PS' and 'F' for pass marks and non-passing marks respectively, for Pass/Nopass courses, or the grade 'X' (not permitted).

13.1.1 A student shall be assigned the letter grade 'X' for a course if he/she is not permitted to appear for the end semester examination of that course due to lack of requisite attendance.

13.1.2 A letter grade 'F' or 'X' in any course implies failure in that course.

13.1.3 A student is considered to have completed a course successfully and earned the credits if she/he secures a letter grade other than 'F' or 'X'.

13.2 At the end of each semester, the following measures of the performance of a student in the semester and in the programme up to that semester shall be computed and made known to the student together with the grades obtained by the student in each course:

13.2.1 The Semester Grade Point Average (SGPA): From the grades obtained by a student in the courses of a semester, the SGPA shall be calculated using the following formula:

$$SGPA = \frac{\sum_{i=1}^n GP_i \times NC_i}{\sum_{i=1}^n NC_i}$$

Where GP_i = Grade points earned in the i^{th} course
 NC_i = Number of credits for the i^{th} course
 n = the number of courses in the semester

13.2.2 The Cumulative Grade Point Average (CGPA): From the SGPA's obtained by a student in the completed semesters, the CGPA shall be calculated using the following formula:

$$CGPA = \frac{\sum_{i=1}^n SGP_i \times NSC_i}{\sum_{i=1}^n NSC_i}$$

Where SGP_i = Semester Grade point of the i^{th} semester
 NSC_i = Number of credits for the i^{th} semester
 n = the number of semesters completed

13.2.3 The CGPA may be converted into a percentage by multiplying CGPA by 10.

13.3 Both the SGPA and CGPA will be rounded off to the second place of decimal and recorded as such. Whenever these CGPA are to be used for official purposes, only the rounded off values will be used.

13.4 There are academic and non-academic requirements for the programme where a student will be awarded the 'P' and 'NP' grades. All non-credit courses (such as Study Tour and Extra Academic Activities) belong to this category. No grade points are associated with these grades and these courses are not taken into account in the calculation of the SGPA or CGPA. However, the award of the degree is subject to obtaining a 'P' grade in all such courses.

14.0 Assessment of Performance

14.1 A student's performance is evaluated through a continuous system of evaluation comprising tests, quizzes, assignments, seminars, projects, research work, concurrent and block field work performance and end-semester examinations.

14.2 Theory Courses: Theory courses will have two components of evaluation – in-semester assessment of 40% weightage and an end-semester examination having 60% weightage.

14.2.1 The modalities of conduct of in-semester evaluation, its components and the weightages attached to its various components shall be published by the department concerned at the beginning of each semester.

14.3 Practicum/Field Work/Lab: These courses shall be evaluated on the basis of attendance, performance of tasks assigned and an end semester test/viva voce examination. The weightage assigned to these components of the evaluation is given in the following table:

Component	Weightage
Attendance	10
Performance of tasks assigned	30
End-semester test / viva voce examination	60

14.4 End-Semester examinations

14.4.1 End-semester examinations, generally of three hours' duration, shall be conducted by the University for the theory courses. However, the Director of the Institute shall make the arrangements necessary for holding the examinations.

14.4.2 In the end-semester examinations, a student shall be examined on the entire syllabus of the courses.

14.4.3 A student shall not obtain a pass grade for a course without appearing for the end- semester examination in that course.

14.5 The evaluation of performance in Co-curricular Activities will be done by the authorities conducting them and they will communicate the grades to the Director who will forward them to the Controller of Examinations of the University. 14.6 The Director will forward the marks obtained in the in-semester evaluation to the Controller of Examinations within the prescribed time as may be notified.

14.7 All evaluated work in a subject except the end semester answer scripts will be returned to the students promptly. They should be collected back after the students have examined them, and preserved for a period of one semester.

14.8 Eligibility for appearing in the end-semester examinations: A student will be permitted to appear for the end-semester examinations, provided that

14.8.1 A student has not been debarred from appearing in the end semester examinations as disciplinary action for serious breach of conduct.

14.8.2 He/she has satisfactory attendance during the semester according to the norms laid out in section 9 of these regulations.

14.8.3 He/she has paid the prescribed fees or any other dues of the university, institute and department within the date specified.

14.9 Registration for end-semester Examinations

14.9.1 The University shall, through a notification, invite applications from students to register for the end-semester examinations.

14.9.2 Students who have registered with the University and those who have applied for such registration may apply to appear for the end-semester examinations of the university, in response to the notification issued by the University, provided that they fulfil the eligibility norms as laid down in clause 14.8.

14.9.3 All eligible candidates shall be issued an admit card for the relevant examination and for the specified courses. A student who does not have a valid admit card may not be permitted to write the end-semester examinations.

14.9.4 A student who secures an 'F' or 'X' grade in any course in a semester may register for the end-semester examination for that course in a subsequent semester when that course is offered again, within the maximum period of time allotted for the completion of the programme. The in-semester assessment marks obtained by him/her in the last semester in which the said course was attended by him/her shall be retained.

14.9.5 Similarly, in case of an 'NP' grade in Extra Academic Programmes the student shall have to re-register for it in the appropriate semester of the next academic session.

14.9.6 When a student re-registers for the end semester examination of a course, in accordance with clause 14.9.4 above, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

14.10 Conduct of Examinations: The University shall conduct the end-semester examinations in accordance with the applicable regulations on such dates as are set down in the Academic Calendar or as notified.

14.11 Declaration of Results: The University shall declare the results of a semester and make available to the students their grade sheets within the time-frame prescribed by the relevant regulations of the university and specified in the academic calendar.

14.11.1 The University may withhold the results of a student for any or all of the following reasons

he/she has not paid his/her dues

there is a disciplinary action pending against him/her

he/she has not completed the formalities for University Registration according to the requirement of section 6 of these Regulations.

14.12 Re-examining of answer scripts

If a student feels that the grade awarded to him/her in a course is not correct, he/she may apply to the University for the re-examining of his/her answer script.

Re-examining of scripts may be of two different categories – scrutiny and re-evaluation.

Scrutiny: The activities under this category shall ordinarily be confined to checking

correctness of the total marks awarded and its conversion into appropriate letter grades whether any part/whole of a question has been left unevaluated inadvertently correctness of transcription of marks on the tabulation sheet and the grade sheet issued in respect of the course under scrutiny.

Re-evaluation: Re-evaluation of the answer script by independent experts in the concerned subject(s).
Application for re-examining of answer scripts

A student may apply for scrutiny or re-evaluation for one or more courses of the just- concluded end semester examinations within seven calendar days from the date of publication of its results in the application form prescribed for this purpose.

He/she shall pay the prescribed fee to the University as notified.

A student applying for scrutiny/re-evaluation shall expressly state on the application form whether the application made is for Scrutiny or for Re- evaluation. In each case, the student may also request to see his/her answer script.

All applications for scrutiny/re-evaluation must be routed through the Director of the Institute.

If in the process of re-examining, the grade obtained in a course changes, the better of the two grades shall be assigned to the course. If there is a change, the new grade shall be recorded and a new grade sheet shall be issued to the student.

Without prejudice to any of the clauses of section 14.12, a student who has been found to have used unfair means during an examination shall not be eligible to apply for scrutiny or re-evaluation of answer scripts.

Repeat Examination: The University shall conduct repeat examination for those with F grade at a different time slot, as set down in the Academic Calendar or as notified. Such students should register for these examinations.

Improvement Examination

After the completion of the entire programme of study, a student may be allowed the provision of improvement examinations. These are to be availed of only once each in the Autumn and Spring semesters that immediately follow the completion of the programme, and within the maximum number of years permissible for the programme.

A student may choose no more than six courses (three in the Autumn semester and three in the Spring semester) for improvement examinations.

After the improvement examination, the better of the two grades obtained (the old and the new) shall be considered for the calculation of SGPA and CGPA.

If the student improves his/her grades through the improvement examination, new grade sheets and comprehensive transcripts shall be issued to the student.

14.15 Special Examination

14.15.1 The University shall conduct Special Examinations to benefit the following categories of students:

Students who, on the completion of the final semester, have some 'F' graded courses in the two final semesters, but no 'F' or 'X' graded courses in any of the previous semesters

Students who have only one 'F' graded course in a semester other than the two final semesters and do not have 'F' or 'X' graded courses in the two final semesters.

The Special Examinations shall ordinarily be conducted each year within a month of the declaration of the results of the Spring Semester.

Students who fail to secure 50% of the credits offered in the final semester shall not be eligible to appear for the special examinations. Such students will be governed by the provisions of clause 15.5 of these regulations. However, this restriction shall not apply in the case of students who are unable to appear in the end semester examinations due to exceptional situations like their own serious illness and hospitalisation or death of members of inner family circle (restricted to only father, mother, siblings).

Students who have 'X' graded courses only in the last two semesters may be offered the opportunity for participating in a Tutorial Programme which may be conducted during the semester break immediately following the end- semester examinations of the final semester and students who earn 85% attendance for the programme shall be permitted to appear for the Special Examinations. Separate fees shall be charged for the Tutorial Programme.

Students who do not obtain pass grades in any course at the special examinations shall have to apply in the prescribed format and appear for the end-semester examination of these courses when they are scheduled by the University during subsequent relevant end-semester examinations.

15.0 Enrolment (for semesters other than the first)

- 15.1 Every student is required to enrol for the programme through the designated officer at the commencement of each semester on the days fixed for such enrolment and notified in the Academic Calendar.
- 15.2 Students who do not enrol on the days announced for the purpose may be permitted late enrolment up to the notified day in the Academic Calendar on payment of a late fee.
- 15.3 Only those students will be permitted to enrol who have
 - 15.3.1 cleared all University, Institute, Department, Hostel and Library dues and fines (if any) of the previous semester,
 - 15.3.2 paid all required University, Institute, Department and Hostel fees for the current semester, and
 - 15.3.3 not been debarred from enrolling on any specific ground.
- 15.4 No student may enrol for a semester if he/she has not appeared, for whatever reason, in the end semester examinations of the previous semester.
- 15.5 A student who fails to obtain 50% of the credits offered in the third and subsequent semesters shall not be permitted to enrol for the next semester and shall have to re-enrol for and attend all the courses of the said semester in the following academic year. Students who due to X grade (lack of due attendance) have been debarred from exams in any semester (including first and second) will have to re-enrol for the same.

16.0 Eligibility for the Award of Degree

- 16.1 A student shall be declared to be eligible for the award of the degree if he/she has
 - 16.1.1 completed all the credit requirements for the degree with grade 'C' or higher grade in each of the graded courses and grade 'P' in all the non-graded courses.
 - 16.1.2 satisfactorily completed all the non-credit requirements for the degree (if any);
 - 16.1.3 obtained a CGPA of 5.00 or more at the end of the semester in which he/she completes all the requirements for the degree;
 - 16.1.4 owes no dues to the University, Institute, Department, Hostels; and
 - 16.1.5 has no disciplinary action pending against him/her.
- 16.2 The award of the degree must be recommended by the Academic Council and approved by the Board of Management of the University.

17.0 Termination from the Programme

- 17.1 If more than the number of years permitted for the completion of a programme have elapsed since the student was admitted, and the student has not become eligible for the award of Degree, the student shall be removed from the programme.
- 17.2 A student may also be required to leave the Programme on disciplinary grounds on the recommendations of the Students' Disciplinary Committee of the concerned School.

SCHEME OF IN-SEMESTER EVALUATION
POST GRADUATE DEGREE PROGRAMMES
M.TECH, MCA, MSW, MSC, MA and MCOM

THEORY COURSES

The different components of the scheme of in-semester for the theory courses are given in the table below:

Component	Weightage
Class Test (Two class tests of equal weightage)	20
Assignments, Group Presentations/Seminar	10
Non-formal evaluation	5
Attendance	5
Total	40

Non-formal Evaluation

Non-formal evaluation may be done using a combination of quizzes, unannounced tests, open book tests, library work reports, class room interaction and participation, etc. The scheme of non-formal evaluation shall be announced by every teacher in the beginning of the semester.

Attendance

Marks for attendance will be given according to the following scheme:

Attendance Percent (x)	Marks Allotted
$75 \leq x < 80$	2
$80 \leq x < 90$	3
$90 \leq x < 95$	4
$95 \leq x \leq 100$	5

NB: There shall be no re-test for in-semester Assessment under any circumstance. The original marks of all the in-semester Assessment components shall be retained for all further repeat examinations.

MCA Minor Project

The guidelines for the conduct and evaluation of the MCA Minor Project shall be laid down by the Department. The components of evaluation and allotment of marks will be as follows:

In Semester Evaluation	Marks	End Semester Evaluation (Weightage 40)	Marks
Synopsis	10	Project Implementation	16
Seminar presentation of synopsis (Analysis and Design)	15	Seminar Presentation	8
Progress Seminar (Implementation)	15	Viva Voce Examination	16
Project Documentation	10		
Attendance	10		
Total	60		40

In-Semester Evaluation of MCA Major Project

The in-semester evaluation of the MCA Major Project shall have 60% weightage. The Internal Evaluation of the Major project will be done through two seminar sessions:

Synopsis	:	20
Seminar Presentation of Synopsis (Analysis and Design)	:	30
Progress Seminar (Implementation)	:	30
Project Documentation	:	20

External Evaluation of all Major projects will follow the guidelines laid down in the Regulations.

MSW, MSc Psychology Field Work

The components of evaluation and their weightages for the concurrent/continuous fieldwork are as follows:

Component	Weightage
Field Work Diary	10
Agency Evaluation	15
Faculty Evaluation	20
Attendance	5
Viva Voce Examination	50
Total	100

Practicum

Field Report	:	15
Presentation	:	15
Administration of tests	:	10
Faculty Evaluation	:	10
Viva Voce Examination	:	50

MSW, MSc Psychology Research Project

Phase I

Literature Survey Presentation	:	40
Synopsis Presentation	:	60

Phase II

Examination of Thesis	:	50
Presentation and Viva Voce Exam	:	50

MTECH, MSC (Physics, Chemistry, Mathematics, Biochemistry, Biotechnology, Microbiology, Botany, Zoology) THEORY COURSES

For theory courses, in-semester assessment carries 40% weightage. Different components along with the weightage of each are given in the table below:

Component	Weightage	Remarks
Class Test (Two Class tests of one and a half hour duration)	20	Average of the two marks shall be considered
Assignments	15	Written Assignments/Seminar on course Topics/ Technical Paper Review
Non-formal evaluation	5	Based on response and interaction in class, quizzes, open book tests, etc.
Total	40	

There shall be no re-test for In-semester assessment under any circumstance. The original marks of all the In-semester assessment components shall be retained for all further repeat examinations.

In-Semester Evaluation of Project (Phase I) / Research Project (Phase I) / Dissertation (Phase I)

The in-semester evaluation of Project Phase I / Research Project (Phase I) / Dissertation (Phase I) shall have 60% weightage. It shall be evaluated in the following seminar sessions having equal weightage:

Seminar 1: Presentation of the synopsis

Synopsis	:	30%
Seminar presentation of the synopsis	:	50%
Viva voce examination	:	20%

Seminar 2: Progress Seminar

Progress report	:	30%
Progress seminar	:	50%
Viva voce Examination	:	20%

In-Semester Evaluation of Project (Phase II) / Research Project (Phase II) / Dissertation (Phase II)

The in-semester evaluation of Project Phase II / Research Project (Phase II) / Dissertation (Phase II) shall have 60% weightage. The in-semester evaluation will be done through two seminar sessions having equal weightage. Each seminar will be evaluated using the following components.

Progress Report	:	30
Progress Seminar	:	50
Viva Voce Examination	:	20

External Evaluation of the project / Research Project / Dissertation shall follow the guidelines laid down in the Regulations.

RULES, PROCEDURES AND BEHAVIOURAL GUIDELINES***1. Dress Code and Identity Card***

- 1.1 The dress code of the University consists of shirt / top (of the prescribed colour and material), trousers (of the prescribed colour and material), shoes (black) and socks (dark grey), a belt (black/dark brown, if required) and a tie (blue, with diagonal stripes). Students are required to come to the University following this dress code. The tie will be required to be worn only on formal occasions. An apron (of the prescribed colour) is to be worn in the Chemistry Lab and during Workshop Practice. During winter, students may wear only a blazer and/or a sweater (full sleeve or sleeveless) of the prescribed colour and material.
- 1.2 The Student Identity Card is to be brought to the University every day and is to be produced whenever asked for. Entry to the University campus shall be only on production of the Identity Card. The Identity Card is also the Library Card.
- 1.3 All students should wear the ID card around the neck from entry in the morning to exit in the evening.

2. Morning Assembly

- 2.1 The morning assembly is a daily programme in the university on all class days during which all members, i.e., students, faculty, staff and management meet together. The assembly starts at the prescribed time. During the assembly, important announcements are made and a thought or insight is shared. The assembly is concluded with an invocation to God to bless the activities of the day. Note that any announcement made at the morning assembly is considered as being equivalent to notifying the same in the notice boards. All students should reach the assembly venue before prescribed time. Immediately after assembly all should proceed to the classroom to start class. Any change in procedures will be notified by the concerned School at the beginning of the Semester.
- 2.2 One of the following prayers may be used to conclude the Morning Assembly:

The Our Father

*Our Father, who art in heaven,
Hallowed be thy name, Thy kingdom come, Thy will be done on earth as it is in heaven.
Give us this day, our daily bread
And forgive us our trespasses
As we forgive those who trespass against us. And lead us not into
temptation, But deliver us from all evil, Amen.*

Or

*Prayer for Peace
Lord, make me an instrument of
your peace, where there is hatred,
let me sow love; where there is
injury, pardon; where there is
doubt, faith; where there is despair,
hope; where there is darkness,
light; where there is sadness, joy;
O Divine Master, grant that I may not so much seek to be con-
soled as to console; to be understood as to understand; to be
loved as to love.
For it is in giving that we re-
ceive; it is in pardoning that we
are pardoned;
and it is in dying that we are born to eternal life. Amen*

3. Punctuality in Attending Classes

- 3.1 All are expected to be at their respective assembly venues five minutes before assembly time.
- 3.2 Normally no student shall leave the University before all the classes are over. In case of an emergency, a student may leave with proper written permission from the HOD of the concerned department.

4. Make-up Classes, Leave of Absence and Earned Attendance

- 4.1 If any student misses any laboratory class due to illness or other grievous problems, he/she is required to meet the concerned teacher for completing the experiments as soon as possible. Such make-up attendance will be taken into consideration at the end of the semester if attendance is less than 75%. At most two make-up attendances may thus be earned by any student.
- 4.2 Any student who is required to be engaged in a University activity or a pre-planned training and placement activity during class hours, may apply for the grant of an 'earned attendance' from the concerned HODs in the prescribed form available at the Reception. Such applications must be forwarded by the Activity In-Charge. For club related activities, Faculty Advisor of the concerned club will be the Activity In-Charge. In all other cases, Faculty In-Charge or Assistant Faculty In-Charge of Student Affairs will be the Activity In-Charge. Filled up forms shall be submitted preferably before or in case of emergency, immediately after the activity for which earned attendance is to be granted.
- 4.3 Any student going to participate in any activity or competition outside the University must apply to the Faculty In-Charge of student Affairs using the prescribed form which must be forwarded by the Assistant Faculty In-Charge of Student Affairs in consultation with respective Club Advisers. On return, these students must report back to the Assistant Faculty In-Charge of Student Affairs for recording the outcome.
- 4.4 Any student who is not able to attend classes due to medical or other grievous reasons are required to apply for leave in the prescribed form along with valid medical certificates and other requisite documents, to the Faculty In-charge, students' affairs within seven days of joining back. Such applications must be signed by a parent of the student and forwarded by the mentor of the concerned student and the HOD of the concerned department. Only these students will be considered for condonement of deficiency in attendance.

5. Discipline

- 5.1 Personal, academic and professional integrity, honesty and discipline, a sense of responsibility and a high degree of maturity is expected of all students inside and outside the campus. Integrity calls for being honest in examinations and assignments, avoiding plagiarism and misrepresentation of facts.
- 5.2 Indulging in acts of violence, riotous or disorderly behaviour directed towards fellow students, faculty members or other employees of the institution/hostel in the campus or outside is considered to be a serious breach of discipline and will attract penalty.
- 5.3 Respect for Common Facilities: Care and respect for common facilities and utilities are an essential component of social responsibility. Any willful damage to University property must be made good by the persons concerned. Further, maintaining cleanliness of the classrooms and the entire campus is everyone's responsibility.
- 5.4 Substance Abuse: Chewing of tobacco, betel nut and the likes, smoking and the use of other addictive substances and alcoholic drinks are strictly prohibited. These should not be brought into or used within the campus of the University. Violation of this norm will lead to stern action.
- 5.5 Use of Cell Phones: Cell phones may be used in the University lawns, canteens and other open areas. However, the use of cell phones in classrooms and labs are strictly prohibited except when used for teaching/learning purposes with the explicit permission of the teacher concerned. The cell phone of anyone found violating this rule shall be confiscated and his/ her SIM card shall be taken away and retained in the University office for 7 days. If a person violates the norm for a second time, his/her mobile will be confiscated and retained in the University office till the end of the semester.
- 5.6 Use of Internet: The entire campus is wi-fi enabled and the students may use the Internet freely for educational purposes. Students may also use the Computing Centre for browsing the Net. However, the use of Internet to access unauthorized and objectionable websites is strictly prohibited.
- 5.7 All cases of indiscipline will be brought before the Students' Disciplinary Committee and the decisions made by the Committee for dealing with such cases shall be final.

6. Class Tests and Examinations

- 6.1 The conduct of examinations will be governed by the norms of the University.
- 6.2 The Student Identity Card shall be the Admit Card for the class tests
- 6.3 During class tests, all students are expected to enter the venue of the class test 15 minutes before the scheduled time of commencement. However, no one will be permitted into the examination hall after 15 minutes of the commencement of the class test and No one will be allowed to leave the examination hall until an hour has elapsed from the commencement of the class test.
- 6.4 No one is to leave the hall during examination for any purpose, except in case of an emergency.
- 6.5 Malpractices during class tests and examinations will not be tolerated and will attract stern action.

7. Ragging

Ragging and eve-teasing are activities which violate the dignity of a person and they will be met with zero tolerance. Antiragging norms have been given to each student at the time of admission and all students and parents have signed the antiragging affidavit. Any case of ragging and eve-teasing must be reported to the anti-ragging squad. All cases of violation of antiragging norms will be taken up by the anti-ragging Committee and punished according to the norms.

8. Grievance Redressal

The University has constituted a Grievance Redressal Cell to redress any genuine grievance students may have. Any student having a genuine grievance may make a representation to the Grievance Redressal Cell through his/her mentor. The representation should be accompanied by all relevant documents in support of the genuineness of the grievance.

9. School Association

- 9.1 The School Association is an association of the representatives of the various stake holders of the School – students, staff, faculty and management. It is the responsibility of the School Association to

take charge of organizing most of the co-curricular activities such as the annual festivals, quizzes, debates, competitions and social events.

- 9.2 A male and a female student are elected by the students of each class as “class representatives” to represent them in the School Association. Class representatives are expected to be outstanding students who are academically competent and having qualities of leadership.

10. Participation in University Activities

- 10.1 In order to provide opportunities for the holistic development of the human person, a large number of co-curricular and extra-curricular activities are designed and implemented under the banner of the University Association and student clubs. Some of the most important activities are D'ERVE & BOS-COSIADE (intra- University sports and cultural festival during University Week), PRAJYUKTTAM (the inter-University technical festival). All students are expected to take part actively in such activities to showcase their talents, to develop leadership qualities and to gain the experience of working in groups.
- 10.2 **Training and Placement Activities:** The training and Placement Cell of DBCET has been incorporated with the objective of minimizing the gap between industry and academia and giving the students training and exposure so that they can capitalize on every opportunity for placement. It is the prime responsibility of the cell to look after all matters concerning ‘Training to enhance employability’ and ‘guiding students for placement’. In the first two semesters, students are trained for communication skills development under the department of Humanities and Social Sciences, and personal development programmes under the department of campus ministry. From the third semester onwards, in every semester, students are given systematic training in aptitude tests, communication skills, group discussion, etc. They are also made to undergo mock HR and Technical Interviews. These activities of the training and placement cell find a place in the curriculum as Extra Academic Programmes (EAP) and all students are required to get a P grade for these activities by taking an active part in these activities regularly.

Other departments of the University offer customised services in training and placement of their students.

11. Free Time

Some hours without class may be available for some students during the day. Students are expected to use such ‘free time’ for visiting the library, meeting teachers and mentors, self-study, carrying out lab or project related activities, etc.

12. Faculty Performance Feedback

In order to improve the teaching and learning process in the University, students will be required to give feedback about the performance of their teachers from time-to-time. All students are expected to participate in the online feedback sessions concerning their teachers with sincerity and responsibility.

13. Mentoring

All students are assigned mentors from among the faculty members for their guidance. Directors of Schools in collaboration with the Heads of Departments will take care of assigning mentors. Mentors shall help the students to plan their courses of study, advise them on matters relating to academic performance and personality development, and help them to overcome various problems and difficulties faced by them. Although students should meet their mentors on a regular basis to get timely help, specific days have been set aside in the calendar for meeting mentors to ensure proper documentation of achievements, activities, shortcomings and problems faced by the students. Every student must meet the mentor during these days.

14. Interaction Meet with Parents

The University organises interaction meetings with parents once a year in which the parents are invited to interact with teachers and management to appraise themselves about the performance of their ward and also to offer their suggestions for the betterment of the institution. It is the responsibility of the students too to invite their parents to come and participate in the event and make the event meaningful.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING**PROGRAMME: MASTER OF TECHNOLOGY (MTECH) COMPUTER SCIENCE AND ENGINEERING**

SEMESTER I						
Type	Category	Course Code	Course Name	L-T-P	Credits	Page No
	Specialization: Data Science					
Theory	Core 1	CSMF0086	Mathematical foundations of Computer Science	3-0-0	3	1433
	Core 2	CSDT0087	Advanced Data Structures	3-0-0	3	1434
	Core 3	ECRM0042	Research Methodology and IPR	2-0-0	2	1435
	Prog. Specific Elective I	CSSC0088	Data Science	3-0-0	3	1435
		CSDI0089	Distributed Systems	3-0-0	3	1436
		CSDP0090	Data Preparation and Analysis	3-0-0	3	1437
	Prog. Specific Elective II	CSRS0091	Recommender System	3-0-0	3	1438
		CSML0092	Machine Learning	3-0-0	3	1439
		CSTN0093	Data Storage Technologies and Networks	3-0-0	3	1440
Lab	Lab1	CSDT6076	Advanced Data Structures Lab	0-0-4	2	1476
	Lab2	CSML6077	Machine Learning Lab	0-0-4	2	
	Specialization: Internet of Things					
Theory	Core 1	CSMF0086	Mathematical foundations of Computer Science	3-0-0	3	1433
	Core 2	CSDT0087	Advanced Data Structures	3-0-0	3	1434
	Core 3	ECRM0042	Research Methodology and IPR	2-0-0	2	1435
	Prog. Specific Elective I	CSSC0088	Data Science	3-0-0	3	1456
		CSWA0094	Wireless Access Technologies	3-0-0	3	1457
		CSMS0095	Mobile Applications and Services	3-0-0	3	1458
	Prog. Specific Elective II	CSML0092	Machine Learning	3-0-0	3	
		CSSI0096	Smart Sensors and Internet of Things	3-0-0	3	1459
		CSLF0097	Logic and Functional programming	3-0-0	3	1460
Lab	Lab1	CSDT6076	Advanced Data Structures Lab	0-0-4	2	1476
	Lab 2	CSML6077	Machine Learning Lab	0-0-4	2	
	Specialization: Information Security					
Theory	Core 1	CSMF0086	Mathematical foundations of Computer Science	3-0-0	3	1433
	Core 2	CSDT0087	Advanced Data Structures	3-0-0	3	1471
	Core 3	ECRM0042	Research Methodology and IPR	2-0-0	2	1435
	Prog. Specific Elective I	CSDF0098	Digital Forensics	3-0-0	3	1472
		CSEH0099	Ethical Hacking	3-0-0	3	1472
		CSID0100	Intrusion Detection	3-0-0	3	1473
		CSMR0101	Malware Analysis & Reverse Engineering	3-0-0	3	1474

	Prog. Specific Elective II	CSSC0102	Secure Software Design and Enterprise Computing	3-0-0	3	1475
		CSML0092	Machine Learning	3-0-0	3	1439
Lab	Lab1	CSDT6076	Advanced Data Structures Lab	0-0-4	2	1476
	Lab2	CSML6077	Machine Learning Lab	0-0-4	2	
Audit	Audit 1	EGRW0015	English for Research Paper Writing	2-0-0	0	
Total Credits					18	
SEMESTER II						
	Specialization: Data Science					
	Core 3	CSAA0103	Advance Algorithms	3-0-0	3	1441
	Core 4	CSSP0104	Soft Computing	3-0-0	3	1442
Theory	Prog. Specific Elective III	CSDV0105	Data Visualization	3-0-0	3	1443
		CSBD0106	Big Data Analytics	3-0-0	3	1444
		CSDD0107	Data Warehouse and Data Mining	3-0-0	3	1446
	Prog. Specific Elective IV	CSDS0108	Data Security and Access Control	3-0-0	3	1447
		CSWD0109	Web Analytics and Development	3-0-0	3	1448
		CSKD0110	Knowledge Discovery	3-0-0	3	1448
		CSNL0111	Natural Language Processing	3-0-0	3	1450
Lab	Lab3	CSAA6078	Advanced Algorithm Lab	0-0-2	2	1451
	Lab4	CSDV6079	Data Visualisation Lab	0-0-2	2	1451
	Specialization: Internet of Things					
	Core 3	CSAA0103	Advance Algorithms	3-0-0	3	1441
	Core 4	CSSP0104	Soft Computing	3-0-0	3	
Theory	Prog. Specific Elective III	CSNI0112	Sensor Networks and Internet of Things	3-0-0	3	1461
		CSDV0105	Data Visualization			1462
		CSAC0113	IoT Application and Communication Protocols			1463
	Prog. Specific Elective IV	CSBD0106	Big Data Analytics	3-0-0	3	1464
		CSNY0114	Network Security			1465
		CSAM0115	Advanced Machine Learning			1466
Lab	Lab3	CSAA6078	Advanced Algorithm Lab	0-0-2	2	1451
	Lab4	CSDV6079	Data Visualisation Lab	0-0-2	2	1467
	Specialization: Information Security					
	Core 3	CSAA0103	Advance Algorithms	3-0-0	3	1441
	Core 4	CSSP0104	Soft Computing	3-0-0	3	
Theory	Prog. Specific Elective III	CSEC0116	Data Encryption & Compression	3-0-0	3	1478
		CSSW0117	Steganography & Digital Watermarking			1479
		CSIT0118	Information Theory & Coding			1480
	Prog. Specific Elective IV	CSRA0119	Security Assessment and Risk Analysis	3-0-0	3	1481
		CSCD0120	Secure Coding			1482
		CSBI0121	Biometrics			1483
Lab	Lab3	CSAA6078	Advanced Algorithm Lab	0-0-2	2	1484

	Lab4	CSEN6080	Data Encryption & Compression Lab	0-0-2	2	1484
Pro- ject		CSMI6081	Mini Project with Seminar	0-0-2	2	1452
Audit	Audit 2 (MOOCs)	EDCI0100	Constitution of India	0-0-0	0	
Total Credits					18	
SEMESTER III						
	Specialization: Data Science					
The- ory	Prog. SpecificElec- tive V	CSCG0134	GPU Computing	3-0-0	3	1452
		CSCL0135	Cloud Computing			1453
		CSDD0136	Distributed Databases			1455
	Specialization: Internet of Things					
	Prog. Specific					
		CSIS0137	IOT and Smart Cities			1469
		CSCL0135	Cloud Computing	3-0-0	3	
	Elective V					1470
	Specialization: Information Security					
	Prog. SpecificElec- tive V	CSDM0139	Data Warehousing & Mining	3-0-0	3	1486
		CSWI0140	Web Search & Information Retrieval			1487
		CSDY0141	Database Security and Access Control			1488
	Open Elec- tive	CSBA0142	Business Analytics	3-0-0	3	1485
Pro- ject	Dissertation	CSDI6092	Dissertation Phase – I	0-0-20	10	1488
Total Credits				6-0-20	16	
SEMESTER IV						
	Specialization: Data Science					
Pro- ject	Dissertation	CSDI6093	Dissertation Phase – II	0-0-32	16	1489
	Specialization: Internet of Things					
	Dissertation	CSDI6093	Dissertation Phase – II	0-0-32	16	
	Specialization: Information Security					
	Dissertation	CSDI6093	Dissertation Phase – II	0-0-32	16	
Total Credits				0-0-32	16	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

LIST OF GENERIC ELECTIVE COURSES/ OPEN ELECTIVES

SEM I

FOR SPECIALISATION DATA SCIENCE

Data Science

Distributed Systems

Data Preparation and Analysis

Recommender System

Machine Learning

Data Storage Technologies and Networks

FOR SPECIALISATION INTERNET OF THINGS

Data Science

Wireless Access Technologies

Mobile Applications and Services

Machine Learning

Smart Sensors and Internet of Things

Logic and Functional programming

FOR SPECIALISATION INFORMATION SECURITY

Digital Forensics

Ethical Hacking

Intrusion Detection

Malware Analysis & Reverse Engineering

Secure Software Design and Enterprise Computing

Machine Learning

SEM II

FOR SPECIALISATION DATA SCIENCE

Data Visualization

Big Data Analytics

Data Warehouse and Data Mining

Data Security and Access Control

Web Analytics and Development

Knowledge Discovery

Natural Language Processing

FOR SPECIALISATION INTERNET OF THINGS

Sensor Networks and Internet of Things

Data Visualization

IoT Application and Communication Protocol

Big Data Analytics

Network Security

Advanced Machine Learning

FOR SPECIALISATION INFORMATION SECURITY

Data Encryption & Compression

Steganography & Digital Watermarking

Information Theory & Coding

Security Assessment and Risk Analysis

Secure Coding

Biometrics

SEM III

FOR SPECIALISATION DATA SCIENCE

GPU Computing

Cloud Computing

Distributed Databases

FOR SPECIALISATION INTERNET OF THINGS

Cloud Computing

IOT and Smart Cities

Emulation and Simulation Methodologies

FOR SPECIALISATION INFORMATION SECURITY

Data Warehousing & Mining

Web Search & Information Retrieval

Database Security and Access Control

OPEN ELECTIVE

Business Analytics

Course from Swayam

Program Outcomes

PO1:An understanding of the theoretical foundations and the limits of computing

PO2: An ability to adapt existing models, techniques, algorithms, data structures, etc. for efficiently solving problems

PO3:An ability to design, develop and evaluate new computer based systems for novel applications which meet the desired needs of industry and society

PO4:Understanding and ability to use advanced computing techniques and tools

PO5:An ability to undertake original research at the cutting edge of computer science & its related areas

PO6:An ability to function effectively individually or as a part of a team to accomplish a stated goal

PO7:An understanding of professional and ethical responsibility

PO8:An ability to communicate effectively with a wide range of audience

PO9:An ability to learn independently and engage in life long learning

PO10:An understanding of the impact of IT related solutions in an economic, social and environment context.

Program specific outcome(PSO)

Specialisation: Data science

PSO1:Apply the concept of theoretical knowledge of computer science, data structures, algorithms, mathematical computation and statistical formulae with respect to research methodology.

PSO2:Develop programs that use data mining techniques on bigdata for clustering, classification and ranking using cloud infrastructure for research.

Specialisation: Internet of Things

PSO1: Apply the concept of theoretical knowledge of computer science, data structures, algorithms, mathematical computation and statistical formulae with respect to research methodology.

PSO2:Design and develop code for various sensor-based applications for different sectors that use data collected through IoT deployment.

Specialisation: Information Security

PSO1: Apply the concept of theoretical knowledge of computer science, data structures, algorithms, mathematical computation and statistical formulae with respect to research methodology.

PSO2: Design operational and strategic cyber-security strategies, policies, and solutions that use cyber security techniques, information assurance, digital forensics software/tools, encryption, machine learning, and secure coding for securing data.

Semester I												
Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
Advanced Data structure	M	H									H	M
Advanced Data structure Lab	M	M									H	M
Mathematical foundations of Computer Science	H										M	L
Research Methodology and IPR					M				L		H	
Specialisation: Data Science												
Machine Learning			M	H							M	H
Machine Learning Lab				H							M	H
Recommender System										M		
Data Storage Technologies and Networks					M						M	
Data Science		M		H								M
Distributed Systems			M									
Data Preparation and Analysis	M	M		M							H	M
Specialisation: Internet of Things												
Wireless Access Technology(CSMS0095)	M										M	H

Mobile application and services			H									H
Smart sensor and Internet of Things			M								H	H
Logical and functional programming				H								
English for Research Paper Writing								H			M	

Semester II												
Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO 2
Advance Algorithms	M	H									M	H
Advance Algorithms Lab	M	M									M	
Soft Computing	M										M	
Mini Project	M	M	M	M	M	H	L	L	L		M	M
Constitution of India						M		M				L
Specialisation: Data Science												
Data Visualization			M								M	M
Data Visualisation Lab			M								M	M
Big Data Analytics				H						M		H
Data Warehouse and Data Mining	M			M								H
Data Security and Access Control				M			L			L	M	M
Web Analytics and Development				H							M	H
Knowledge Discovery	M	M									M	M
Natural Language Processing		M								L	M	L
Specialisation: Internet of Things												
Advanced machine learning			H	M							M	L
Network Security(CSNY0114)	M	H									M	M
Big Data Analytics				H						M	M	H
Sensor Network and Internet of Things	M	M	M									H
Data Visualization			M									M
Data Visualisation Lab			M									M
IoT Application and Communication Protocol					M						M	H
Specialisation: Information Security												
Data Encryption & Compression	M	H									H	M

Data Encryption & Compression Lab	M	H									M	
Steganography & Digital Watermarking	M		H								M	M
Information Theory & Coding	H	M									H	
Security Assessment and Risk Analysis					H					M	M	M
Secure Coding				M							M	
Biometrics				M							M	

Semester III												
Specialisation: Data Science												
Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2
GPU Computing	M										M	M
Cloud Computing	M		H									M
Distributed Data-bases	M										M	H
Business Analytics				H								H
Dissertation Phase – I		M	M	M		H					M	M
Specialisation: Internet of Things												
IoT and Smart City			H	M							H	M
Emulation and simulation methodology			M	M							M	M
Cloud Computing	M		H									
Business Analytics				H							M	H
Dissertation Phase – I		M	M	M		H					M	M
Specialisation: Information Security												
Data Warehousing & Mining	H										H	L
Web Search & Information Retrieval				M							M	M
Database Security and Access Control	M			H								L
Business Analytics				H							H	M
Dissertation Phase – I		M	M	M		H					M	

Semester IV												
Specialisation: Data Science												
Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PSO1	PSO 2
Project Phase II		M	M	M		H					M	H
Specialisation: Internet of Things												
Project Phase II		M	M	M		H					M	H

Detailed Syllabus

CSMF0086: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

(3 credits)

Objectives

To understand the mathematical fundamentals that are prerequisites for a variety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.

To study various sampling and classification problems.

Course Outcomes

Define and Recall the basic notions of discrete and continuous probability (Remembering)
Explain the methods of statistical inference, and the role that sampling distributions play in those methods (Understanding).
Apply discrete mathematics in formal representation of various computing constructs. (Applying)
Analyse the recent trends in distribution functions in various interdisciplinary fields (Analysing)
Evaluating the basic notions of Mathematics in the application areas of Computer Science & Engineering (Evaluating).
Elaborate the importance of analytical problem solving approach in engineering problems (Creating).

Module I (7 hours)

Probability mass, density, and cumulative distribution functions, parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markov chains

Module II (7 hours)

Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood

Module III (8 hours)

Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.

Module IV (9 hours)

Graph Theory: Isomorphism, Planar graphs, graph colorings, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.

Module V (10 hours)

Computer science and engineering applications: Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

Module VI (4 hours)

Recent Trends in various distribution functions in the mathematical field of computer science for varying fields like bioinformatics, soft computing, and computer vision.

Suggested Readings

John Vince, Foundation Mathematics for Computer Science, Springer.
K. Trivedi. Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
M. Mitzenmacher and E. Upfal. Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
Alan Tucker, Applied Combinatorics, Wiley

CSDT0087: ADVANCED DATA STRUCTURES

(3 credits)

Objectives:

The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
Students should be able to understand the necessary mathematical abstraction to solve problems.
To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
Students should be able to come up with analysis of efficiency and proof of correctness.

Course Outcomes

Recall the mathematical background and abstractions for analysis of algorithms. (Remembering)
 Explain the implementation of symbol tables using hashing techniques. (Understanding)
 Apply amortized analysis on data structures, including binary search trees, mergeable heaps, and disjoint sets. (Applying)
 Develop and Analyse algorithms for red-black trees, B-trees and Splay trees. (Analysing)
 Develop and evaluate algorithms for text processing applications. (Evaluating)
 Choose suitable data structures and develop algorithms for computational geometry problems. (Creating)

Module I (7 Hours)

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.
 Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Module II (5 Hours)

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

Module III (7 Hours)

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

Module IV (11 Hours)

Text Processing: String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

Module V (10 Hours)

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadrees, k-D Trees.

Module VI (5 Hours)

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

Suggested Readings

Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
 M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M				
CO 2	M	H	H			
CO 3	M	M	M	H		
CO 4				H	M	
CO 5				M	H	

CO 6					M	H

ECRM0042: RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHT**(2 credits)**

Objective: This course is designed to help students to identify research problems in various fields. It aims at giving potential researchers the knowledge of effectively analysing and interpreting results and presenting the findings to the scientific and technological community of the world. This course also aims at motivating students to bring about their creative ideas for innovation and establishing research impact in the global arena through intellectual ownership.

Course Outcomes

- To be able to identify research problems in various fields
- To be able to approach investigations scientifically in order to find solutions for research problems of interest
- To know how to undertake literature review for knowing the state of the art in the areas of interest
- To know how to put forward the research problems, findings, analyses and interpretations effectively
- To know how to take ownership of new findings through intellectual property right laws

Module I: Research problem formulation and solution (12 Hours)

Meaning, sources, scope and objective of a research problem; Good research problem criteria and characteristics, errors in selecting a research problem; Research problem solutions— approaches for investigation; Approaches to effective literature studies; Data collection, analysis, interpretation and instrumentation; Plagiarism and ethical practices.

Module II: Technical writing (10 Hours)

Effective writing; Research proposal development and its format; Different report types.

Module III: Intellectual Property Rights (8 Hours)

Nature of intellectual property: Patent, design, trade and copyright; Patenting and development process; Patent grant under PCT and procedure; Geographical indications.

Patent rights: Administration of patents systems, scope, information and databases, technology licensing, New developments and case studies.

Suggested Readings

Goddard Wayne, Melville Stuart, Research Methodology: An Introduction For Science And Technology Students, Juta & Co.Ltd.
 Kumar Ranjit, Research Methodology A Step By Step Guide For Beginners, SAGE publications Inc.
 Halbert J. Debora, Resisting Intellectual Property, CRCpress.
 Menell S. Peter, Lemley A. Mark, Merges P. Robert, Intellectual Property In New Technological Age, Clause 8 Publishing.
 C.R. Kothari, Research Methodology Methods and Techniques, New Age International

CSSC0088: DATA SCIENCE**(3 credits)****Objectives:**

- Provide you with the knowledge and expertise to become a proficient data scientist.*
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science*
- Produce Python code to statistically analyse a dataset*
- Critically evaluate data visualisations based on their design and use for communicating stories from data*

Course Outcomes

- Define the basics of the knowledge and expertise required to become a proficient data scientist. (Remembering)
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science. (Understanding)
- Develop Python code to statistically Analyse a dataset. (Applying)
- Analyse data visualizations based on their design (Analysing)

Evaluate the use of communicating stories from data (Evaluating)
Design and develop analytical report (Creating)

Module I (5 Hours)

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Module II (7 Hours)

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources

Module III (10 Hours)

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Module IV (10 Hours)

Data visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Module V (6 Hours)

Applications of Data Science, Technologies for visualisation, Bokeh (Python)

Module VI (7 Hours)

Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods used in data science.

Suggested Readings

Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.
Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M				
CO 2	H	M	H			
CO 3			M	H		
CO 4				H	M	
CO 5				M	H	
CO 6					M	H

CSDI0089: DISTRIBUTED SYSTEMS

(3 Credits)

Objectives: To introduce the fundamental concepts and issues of managing a large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.

Course Outcomes

Recall the fundamental concepts and issues of managing a large volume of shared data in a parallel and distributed environment. (Remembering)

Explain the distributed system architecture and its application in various fields. (Understanding)

Apply network virtualization and analyse pros and cons. (Applying)

Analyse design trends in distributed systems. (Analysing)

Formulate and evaluate remote method invocation and objects. (Evaluating, Creating)

Module I (8 Hours)

Introduction: Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts Distributed database management system architecture: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues

Module II (10 Hours)

Distributed database design: Alternative design strategies; Distributed design issues; Fragmentation; Data allocation Semantics data control:View management; Data security; Semantic Integrity Control Query processing issues: Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.

Module III (10 Hours)

Distributed query optimization: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms
Transaction management:The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transactionmodels
Concurrency control: Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management

Module IV (7 Hours)

Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols

Module V (6 Hours)

Parallel database systems:Parallel architectures; parallel query processing and optimization; load balancing

Module VI (4 Hours)

Advanced topics:Mobile Databases, Distributed Object Management, Multi-databases

Suggested Readings

Principles of Distributed Database Systems, M.T. Ozsú and P. Valduriez, Prentice-Hall, 1991.
Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	H	H	M			
CO 3		M	H	M		
CO 4				H	M	M
CO 5				M	H	

CSDP0090: DATA PREPARATION AND ANALYSIS

(3 Credits)

Objective: To prepare the data for analysis and develop meaningful Data Visualizations

Course Outcomes

List the data gathering and preparation techniques. (Remembering)
Explain the techniques as per utilisation. (Understanding)
Apply explorative analysis techniques. (Applying)
Analyse results after application of explorative analysis techniques. (Analysing)
Evaluate the data visualisation outcomes (Evaluating)
Formulate efficient techniques for data preparation and analysis. (Creating)

Module I (9 Hours)

Data Gathering and Preparation: Data formats, parsing and transformation, Scalability and real- time issues

Module II (10 Hours)

Data Cleaning: Consistency checking, Heterogeneous and missing data, Data Transformation And segmentation

Module III (12 Hours)

Exploratory Analysis: Descriptive and comparative statistics, Clustering and association, Hypothesis generation

Module IV (14 Hours)

Visualization: Designing visualizations, Timeseries, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity

Suggested Readings

Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H	H	M	
CO 3		M	H	
CO 4			M	H
CO 5				M
CO6				H

CSRS0091: RECOMMENDER SYSTEM

(3 Credits)

Objectives:

To learn techniques for making recommendations, including non-personalized, content-based, and collaborative filtering

To automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations

Course Outcomes

Relate techniques for making recommendations, including non-personalized, content-based, and collaborative filtering (Remembering)

Illustrate automation of a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations. (Understanding)

Apply techniques for making recommendations, including non-personalized, content-based, and collaborative filtering (Applying)

Analyse the choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations. (Analysing)

Evaluate recommender systems on the basis of metrics such as accuracy, rank accuracy, diversity, product coverage, and serendipity. (Evaluating)

Design recommendation system for a particular application domain. (Creating)

Module I (8 Hours)

Introduction: Overview of Information Retrieval, Retrieval Models, Search and Filtering, Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

Module II (8 Hours)

Content-based Filtering: High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Module III (8 Hours)

Collaborative Filtering: User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

Module IV (8 Hours)

Hybrid approaches: Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade, Meta-level, Limitations of hybridization strategies

Module V (5 Hours)

Evaluating Recommender System: Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations.

Module VI (8 Hours)

Types of Recommender Systems: Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems.

Suggested Readings

Jannach D., Zanker M. and Felfering A., Recommender Systems: An Introduction, Cambridge University Press (2011), 1st ed.

Charu C. Aggarwal, Recommender Systems: The Textbook, Springer (2016), 1st ed.

Ricci F., Rokach L., Shapira D., Kantor B. P., Recommender Systems Handbook, Springer (2011), 1st ed.

Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, Springer (2013), 1st ed.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M				
CO 2	H	M	H			
CO 3			M	L		
CO 4				M	M	
CO 5				H	H	
CO 6				H		H

CSML0092: MACHINE LEARNING

(3 Credits)

Objectives:

To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.

To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.

Explores supervised and unsupervised learning paradigms of machine learning.

To explore Deep learning techniques and various feature extraction strategies.

Course Outcomes

Relate how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes. (Remembering)

Illustrate supervised and unsupervised learning paradigms of machine learning. (Understanding)

Design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances. (Applying, Analysing)

Examine the Deep learning techniques and various feature extraction strategies. (Analysing)

Evaluate the results and compare in a different environment to have best results. (Evaluating)

Create applications as per the requirements in a suitable environment. (Creating)

Module I (10Hours) Supervised Learning (Regression/Classification)

Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes, Linear models: LinearRegression, LogisticRegression, GeneralizedLinearModels, SupportVectorMachines, Non-linearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking

Module II (7 Hours) Unsupervised Learning

Clustering: K-means/Kernel K-means, Dimensionality Reduction: PCA and kernel PCA, Matrix Factorization and Matrix Completion, Generative Models (mixture models and latent factor models)

Module III (6 Hours)

Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical, Learning Theory, Ensemble Methods (Boosting, Bagging, RandomForests)

Module IV (8 Hours)

Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, DeepLearning and Feature Representation Learning

Module V (8 Hours)

Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference

Module VI (6 Hours)

Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.

Suggested Readings

Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012

TrevorHastie, RobertTibshirani, JeromeFriedman, TheElementsofStatisticalLearning, Springer 2009 (freely available online)

Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	H	H	M			
CO 3			H			
CO 4				H	M	
CO 5			M	M	H	M
CO 6						H

CSTN0093: DATA STORAGE TECHNOLOGIES AND NETWORKS

(3 Credits)

Objective: To provide learners with a basic understanding of Enterprise Data Storage and Management Technologies

Course Outcomes

Recall the various data storage techniques (Remembering)

Explain the basic understanding of Enterprise Data Storage and Management Technologies (Understanding)

Experiment with Storage System Architecture (Applying)

Analyse the Virtualization Technologies and Storage Area Network (Analysing)

Evaluate and deploy an efficient technique for data storage. (Evaluating & Creating)

Module I (7 Hours)

Storage Media and Technologies – Magnetic, Optical and Semiconductor Media, Techniques for read/write Operations, Issues and Limitations.

Module II (8Hours)

Usage and Access – Positioning in the Memory Hierarchy, Hardware and Software, Design for Access, Performance issues.

Module III (7 Hours)

Large Storages – Hard Disks, Networked Attached Storage, Scalability issues, networking issues.

Module IV (8 Hours)

Storage Architecture- Storage Partitioning, Storage System Design, Caching, Legacy Systems.

Module V (10 Hours)

Storage Area Networks – Hardware and Software Components, Storage Clusters/Grids. Storage QoS– Performance, Reliability, and Security issues.

Module VI (5 Hours)

Recent Trends related to Copy data management, Erasure coding, and Software Defined Storage appliances.

Suggested Readings

The Complete Guide to Data Storage Technologies for Network- centric Computing Paperback– Import, Mar 1998 by Computer Technology Research Corporation

Data Storage Networking: Real World Skills for the CompTIA Storage by Nigel Poulton

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	H	H	M			
CO 3			H			
CO 4				H	M	
CO 5			M	M	H	M

CSAA0103: ADVANCED ALGORITHMS

(3 Credits)

Objectives:

Introduce students to the advanced methods of designing and Analysing algorithms. The student should be able to choose appropriate algorithms and use it for a specific problem.

To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.

Students should be able to understand different classes of problems concerning their computation difficulties.

To introduce the students to recent developments in the area of algorithmic design.

Course Outcomes

Recall different algorithms (Remembering)

Explain the applications of various algorithms (Understanding)

Applying computer algorithms for different purposes. (Applying)

Analyse the complexity/ performance of different algorithms. Categorize the different problems in various classes according to their complexity. (Analysing)

Evaluate the different problems in various classes according to their complexity. (Evaluation)

Elaborate the recent activities in the field of the advanced data structure. (Creating)

Module I (6 Hours)

Sorting: Review of various sorting algorithms, topological sorting

Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge weighted case (Dijkstra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Module II (7 Hours)

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting paths.

Module III (8 Hours)

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute, maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

Module IV (9 Hours)

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.

Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm

Module V (10 Hours)

Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness.

One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm

Module VI (5 Hours)

Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Suggested Readings

"Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.

"The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.

"Algorithm Design" by Kleinberg and Tardos.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2	H	H				
CO 3		H	H			
CO 4		M	M	H	M	
CO 5			M	M	H	
CO 6						H

CSSP0104: SOFT COMPUTING

(3 Credits)

Objectives:

To introduce soft computing concepts and techniques and foster their abilities in designing appropriate techniques for a given scenario.

To implement soft computing based solutions for real-world problems.

To give students knowledge of non-traditional technologies and fundamentals of artificial neural

networks, fuzzy sets, fuzzy logic, geneticalgorithms.

To provide student hand-on experience on MATLAB to implement variousstrategies.

Course Outcomes

Identify and describe soft computing techniques and their roles in building intelligent machines. (Remembering & understanding)

Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems. (Applying)

Analyse genetic algorithms to combinatorial optimization problems. (Analysing)

Evaluate and discuss solutions by various soft computing approaches for a given problem. (Evaluating and Creating).

Module I (7 Hours)

Introduction to soft computing and neural networks: Evolution of Computing: Soft Computing Constituents, FromConventional AI to Computational Intelligence: Machine Learning Basics

Module II (8 Hours)

Fuzzy logic: Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations,Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy InferenceSystems, Fuzzy Expert Systems, Fuzzy Decision Making.

Module III (8 Hours)

Neural networks: Machine Learning Using Neural Network, AdaptiveNetworks, Feed forward Networks, Supervised Learning Neural Networks,Radial Basis Function Networks : Reinforcement Learning, Un-supervisedLearning Neural Networks, Adaptive Resonance architectures, Advances inNeural networks

Module IV (5 Hours)

Genetic algorithms: Introduction to Genetic Algorithms (GA),Applications of GA in Machine Learning : Machine Learning Approach toKnowledge Acquisition.

Module V (12 Hours)

Matlab/Python Lib: Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic

Module VI (5 Hours)

Recent Trends in deep learning, various classifiers, neural networks and genetic algorithms. Implementation of recently proposed soft computing techniques.

Suggested Readings

Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing, Prentice:Hall of India,2003.

GeorgeJ.KlirandBoYuan, FuzzySetsandFuzzyLogic:TheoryandApplications,PrenticeHall,1995.

MATLAB ToolkitManual.

Mapping of Cos to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					L
CO 2	H	H			M	
CO 3		M		H		
CO 4			M		M	M

CSDV0105: DATA VISUALISATION

(3 Credits)

Objectives:

To familiarize students with the basic and advanced techniques of information visualization and scientific visualization,

To learn key techniques of the visualization process, a detailed view of visual perception, the visualized data and the actual visualization interaction and distorting techniques

Course Outcomes

- Recall the basic and advanced techniques of information and scientific visualization. (Remembering)
- Explain the key techniques of the visualization process. (Understanding)
- Apply detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques. (Applying)
- Analyse different visualization techniques and their applicability to different types of data. (Analysing)
- Compare techniques for visual mapping, geographic data and collaborative visualization. (Evaluating)
- Create a process to have an understanding of large-scale abstract data. (Creating)

Module I (8 Hours)

Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

Module II (8 Hours)

Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

Module III (8 Hours)

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

Module IV (10 Hours)

Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

Module V (7 Hours)

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations

Module VI (4 Hours)

Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.

Suggested Readings

- WARD, GRINSTEIN, KEIM, .Interactive Data Visualization: Foundations, Techniques, and Applications.
- Natick : A K Peters, Ltd.
- E. Tufte, The Visual Display of Quantitative Information, Graphics Press

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	L	H	H			
CO 3						
CO 4			M	H	H	
CO 5					H	
CO 6			H	H	H	M

CSBD0106: BIG DATA ANALYTICS

(3 Credits)

Objectives:

- Understand big data for business intelligence. Learn business case studies for big data analytics.
- Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools

Course Outcomes

- Describe big data and use cases from selected business domains. (Remembering & Understanding)
- Applying NoSQL big data management. (Applying)
- Install, configure, and run Hadoop and HDFS and analyse the data. (Analysing)
- Perform map-reduce analytics using Hadoop (Evaluating)

Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for creating big data analytics.
(Creating)

Module I (8 Hours)

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.

Module II (8 Hours)

Introduction to NoSQL, aggregated data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-to-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.

Module III (8 Hours)

Data format, Analysing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java Interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures

Module IV (8 Hours)

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats

Module V (7 Hours)

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.

Module VI (6 Hours)

Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

Suggested Readings

Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilly, 2012.
Eric Sammer, "Hadoop Operations", O'Reilly, 2012.
E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilly, 2012.
Lars George, "HBase: The Definitive Guide", O'Reilly, 2011.
Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilly, 2010.
Alan Gates, "Programming Pig", O'Reilly, 2011.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	L	H	M			
CO 3			H			
CO 4			M	H	H	
CO 5					H	M

CSDD0107: DATA WAREHOUSING AND DATA MINING

(3 Credits)

Objectives:

The objective of this course is to introduce data warehousing and mining techniques.

Application of data mining in web mining, pattern matching and cluster analysis is included to aware students of broad data mining areas.

Course Outcomes

List the various data warehousing and data mining techniques. (Remembering)

Explain the principles, concepts, functions and various applications of data warehouse. (Understanding)

Apply data mining techniques for classification and prediction. (Applying)

Perform cluster, periodicity and social network analysis. (Analysing)

Evaluate and compare various data mining solutions for a given problem. (Evaluating)

Choose appropriate data warehousing and data mining techniques to build real-world systems. (Creating)

Module I (7 Hours)

Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;

Module II (7 Hours)

Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,

Module III (8 Hours)

Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis;

Module IV (9 Hours)

Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis;

Module V (9 Hours)

Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.

Module VI (5 Hours)

Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis

Suggested Readings

Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.

Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006.

G Dong and J Pei, Sequence Data Mining, Springer, 2007.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H				
CO 3		H	M			
CO 4		M	H	M		
CO 5				H	M	M

CO 6						H

CSDS0108: DATA SECURITY AND ACCESS CONTROL**(3 Credits)**

Objective: The objective of the course is to provide fundamentals of database security. Various access control techniques mechanisms were introduced along with application areas of access control techniques.

Course Outcomes

Define access control in the database. (Remembering)

Explain the purpose and fundamentals of access control. (Understanding)

Identify the capabilities and limitations of various access control mechanisms. (Applying)

Analyse the data, identify the problems, and choose the relevant models and algorithms to apply. (Analysing)

Assess the strengths and weaknesses of various access control models and to Analyse their behaviour. (Evaluating)

Design and develop access control mechanisms for enterprise IT infrastructures. (Creating)

Module I (7 Hours)

Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non-Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations.

Module II (8 Hours)

Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy.

Module III (9 Hours)

Biba Integrity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system Temporal Constraints in RBAC, MAC AND DAC. Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi line Insurance Company

Module IV (10 Hours)

Smart Card based Information Security, Smart card operating system fundamentals, design and implantation principles, memory organization, smart card files, file management, atomic operation, smart card data transmission ATR, PPS Security techniques- user identification, smart card security, quality assurance and testing, smart card life cycle-5 phases, smart card terminals.

Module V (7 Hours)

Recent trends in Database security and access control mechanisms. Case study of Role-Based Access Control (RBAC) systems.

Module VI (4 Hours)

Recent Trends related to data security management, vulnerabilities in different DBMS.

Suggested Readings

Role Based Access Control: David F. Ferraiolo, D. Richard Kuhn, Ramaswamy Chandramouli.
<http://www.smartcard.co.uk/tutorials/sct-itsc.pdf> : Smart Card Tutorial.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H				
CO 3		M	M			
CO 4		M	H	H		
CO 5				M	M	L
CO 6					H	M

CSWD0109: WEB ANALYTICS AND DEVELOPMENT
(3 Credits)

Objective: The course explores use of social network analysis to understand growing connectivity and complexity in the world ranging from small groups to WWW.

Course Outcomes

Relate with core research communities, publications, focused on web and social media analytics and research questions engaged. (Remembering)
Discuss clickstream data collection techniques, their impact on metrics, and their inherent limitations. (Understanding)
Identify and interpret commonly used web metrics (Applying)
Analyse and evaluate tasks and techniques used in web analytics. (Analysis/Evaluation)
Elaborate the resulting insights to support website design decisions, campaign optimisation, search analytics, etc. (Creating)

Module I (8 Hours)

Introduction – Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization

Module II (8 Hours)

Web Analytics tools: Click Stream Analysis, A/B testing, Online Surveys

Module III (8 Hours)

Web Search and Retrieval: Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models

Module IV (12 Hours)

Making Connection: Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity

Module V (9 Hours)

Connection: Connection Search, Collapse, Robustness Social involvements and diffusion of innovation

Suggested Readings

Hansen, Derek, Ben Shneiderman, Marc Smith. 2011. Analysing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304.

Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.

Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press.

<http://www.cs.cornell.edu/home/kleinber/networks-book/>

Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press.
Monge, P. R. & Contractor, N. S. (2003). Theories of communication networks. New York: Oxford University Press.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	H			
CO 3		M	H		
CO 4		M	M	H	
CO 5				M	H

CSKD0110: KNOWLEDGE DISCOVERY
(3 Credits)

Objective: To conduct case studies on real data mining examples

Course Outcomes

Recall the basic terminologies like learning goals, concept representation, decision tree, computational learning, artificial neural network, classification. (Remembering)

Explain different categories of machine learning and machine learning methodologies and illustrate the theory behind designing a learning model. (Understanding)

Compare efficiency of different learning algorithms, classify supervised and unsupervised learning goals. (Understanding)

Apply different learning algorithms for real life classification problem, sketch the structure of different learning model such as neural network, support vector machine, naive bayes etc. (Applying)

Analyse decision tree learning, computational learning, artificial neural network and instance based learning and how one learning overcomes the drawback in the other. (Analysing)

Judge in terms of different complexity which algorithms better in what situation. (Evaluating).

Create and design ensemble based learning, propose new learning for optimizing real life problems. (Creating)

Module I (7 Hours)

Introduction KDD and Data Mining - Data Mining and Machine Learning, Machine Learning and Statistics, Generalization as Search, Data Mining and Ethics

Module II (8 Hours)

Knowledge Representation - Decision Tables, Decision Trees, Classification Rules, Association Rules, Rules involving Relations, Trees for Numeric Predictions, Neural Networks, Clusters

Module III (9 Hours)

Decision Trees - Divide and Conquer, Calculating Information, Entropy, Pruning, Estimating Error Rates, The C4.5 Algorithm Evaluation of Learned Results- Training and Testing, Predicting Performance, Cross-Validation

Module IV (8 Hours)

Classification Rules - Inferring Rudimentary Rules, Covering Algorithms for Rule Construction, Probability Measure for Rule Evaluation, Association Rules, Item Sets, Rule Efficiency

Module V (6 Hours)

Numeric Predictions - Linear Models for Classification and Numeric Predictions, Numeric Predictions with Regression Trees, Evaluating Numeric Predictions

Module VI (7 Hours)

Artificial Neural Networks – Perceptrons, Multilayer Networks, The Backpropagation Algorithm Clustering - Iterative Distance-based Clustering, Incremental Clustering, The EM Algorithm

Suggested Readings

Data mining and knowledge discovery handbook by Maimon, Oded (et al.)

Data Cleansing : A Prelude to knowledge Discovery

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	H	M		
CO 3		M	M	H		
CO 4		M	H	H		
CO 5				M	M	L
CO 6					H	M
CO 7				H	L	L

CSNL0111: NATURAL LANGUAGE PROCESSING

(3 Credits)

Objectives: The goals for this course are to study:

algorithms and methods for building computational models of natural language understanding, including syntactic analysis, semantic representations, discourse analysis, and statistical and corpus-based methods for text processing and knowledge acquisition

issues involved in natural language understanding applications that can benefit from natural language processing, such as information extraction, question answering, machine translation, and spoken language understanding. By the end of the course, students will have a good understanding of and appreciation for natural language processing, and have the necessary skills to build natural language processing tools.

Course Outcomes

Recall algorithms and methods for building computational models of natural language processing (Remembering)

Explain syntactic analysis, semantic representations, discourse analysis, and statistical and corpus-based methods for text processing and knowledge acquisition. (Understanding)

Apply the methods of natural language processing. (Applying)

Analyse Issues involved in natural language processing. (Analysing)

Evaluate and generate applications that can benefit from natural language processing, such as information extraction, question answering, machine translation, and spoken language understanding.

(Evaluating & Creating)

Module I (10 hours)

Introduction to NLP, Knowledge in language processing, Representation and Understanding, Organization of NLP systems, Models and algorithms, Linguistic Essentials

Module II (15 hours)

Grammars and Parsing - Syntactic Processing: Collocations; Regular Expression and Automata; Morphology and Finite-State Transducers; N-grams; Word Classes and Part-of-Speech Tagging; Context-Free Grammars for English; Parsing with Context-Free Grammars: Top-down parsing, Bottom-up parsing; Features and Unification; Lexicalized and Probabilistic Parsing

Module III (10 hours)

Semantic processing :Representing Meaning; Semantic Analysis: Integrating semantic analysis to parsers, Semantic Grammars; Lexical Semantics; Word Sense Disambiguation and Information Retrieval: Selection- Restriction based disambiguation, Machine learning approaches; Dictionary based approaches, Information retrieval

Module IV (7 hours)

Pragmatics :Discourse, Dialogue and Conversational Agents: Dialogue acts, Automatic Interpretation of Dialogue acts; Natural Language Generation: Discourse Planning; Machine Translation: Direct Translations, Translation using Statistical techniques

Module V (3 hours)

NLP Applications and Tools :Sentiment Analysis, Text Summarization, Text Entailment, Machine Translation, Question Answering, Cross Lingual Information Retrieval (CLIR), NLTK, WordNet

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	H	M		
CO 3		M	H	L	
CO 4		M	M	H	M
CO 5				M	H

CSAA6078: ADVANCED ALGORITHM LAB

(2 Credits)

Objectives:

The fundamental design, analysis, and implementation of basic data structures.

Basic concepts in the specification and analysis of programs.

Principles for good program design, especially the uses of data abstraction.

Sample Problems on Data structures

Course Outcomes

Recall and explain the fundamentals of design and analysis of basic data structures and experiment with the implementation process. (Remembering, Understanding, Applying)

Examine and evaluate the concepts in the specification and analysis of programs. (Analysing, Evaluating)

Elaborate the principles for good program design, especially the uses of data abstraction. (Creating)

List of Programs

Program to find Breadth First Search of a graph.

Program to find Depth First Search of a graph.

Program to find strongly connected components of a graph.

Implement Prim's algorithm to find a minimal spanning tree of a graph.

Implement Kruskal's algorithm to find a minimal spanning tree of a graph.

Implement Dijkstra's algorithm to find the shortest path in a graph.

Implementation of algorithms to compute a maximum weight maximal independent set.

Implementation of graph matching algorithms.

Implementation of Ford-Fulkerson Method to compute maximum flow.

Implementation of Edmond-Karp maximum-flow algorithm.

Implement Strassen's Algorithm.

Implement Floyd Warshall Algorithm.

CSDV6079: DATA VISUALISATION LAB

(2 Credits)

Course Outcomes

Recall the design process to develop visualization methods and visualization systems, and methods for their evaluation. (Remembering)

Create and process data and visual mapping and the visualization (Creating).

Illustrate an understanding of large-scale abstract data. (Understanding)

Analyse data in various perspectives. (Analysing)

Evaluate the results generated from various applications. (Evaluating)

Create visualization methods for different applications. (Creating)

List of Programs

Program to recursively subdivide a tetrahedron to form a 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.

Program to implement Liang-Barsky line clipping algorithm.

Program to draw a color cube and spin it using OpenGL transformation matrices.

Program to create a house-like figure and rotate it about a given fixed point using OpenGL functions.

Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.

Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively.

Allow the user to specify the circle and the quadrilateral.

Program, using OpenGL functions, to draw a simple shaded scene consisting of a teapot on a table.

Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.

Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.

Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)

Program to display a set of values {fij} as a rectangular mesh. Project: 11. Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL..

Program to recursively subdivide a tetrahedron to form 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.

Program to implement Liang-Barsky line clipping algorithm.

Program to draw a color cube and spin it using OpenGL transformation matrices.

Program to create a house-like figure and rotate it about a given fixed point using OpenGL functions.

Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.

Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral.

Program, using OpenGL functions, to draw a simple shaded scene consisting of a tea pot on a table. Define suitably the position and properties of the light source along with the properties of the surfaces of the solid object used in the scene.

Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.

Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)

Program to display a set of values {fij} as a rectangular mesh.

Project: 1. Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL.

CSMI6081: MINI PROJECT WITH SEMINAR

(2 Credits)

Course Outcomes

Recall the software development life cycle and fundamental phases of system/application/software design and research. (Remembering)

Explain how to carry out a project work and explain the importance of different phase of a system design, workflow and time estimation with research outlook. (Understanding)

Implement a system and plan how to perform research for real time application along with hardware and softwares. (Applying)

Compare the feasibility of a project in terms of time, effort and money. (Analyze)

Evaluate a project based on its efficiency applicability robustness, user friendliness etc., with socio economic factors (Evaluating)

Design applications by critically examining and scientifically designing each phase of the project. (Creating)

CSCG0134: GPU COMPUTING

(3 Credits)

Objectives: The objective of the course is to learn concepts of parallel programming, learn parallel programming with Graphics Processing Units (GPUs), implement programs on GPUs, and learn debugging and profiling of programs written for GPUs.

Course Outcomes

Describe the basic concepts of GPUs and parallel programming (Remembering)

Explain the hardware and software aspects of GPU (Understanding)

Use GPU for applications such as Image Processing, Graph algorithms, Simulations and Deep Learning. (Applying)

Analyze GPU programs to detect errors (Analyzing)

Evaluate the efficiency of GPU programs (Evaluating)

Develop GPU programs including programs for concurrent data structures and programs employing different synchronization techniques (Creating)

Module I (12 Hours)

Introduction: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds,

CPU/GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL/Open-ACC, Hello World ComputationKernels,Launchparameters,Threadhierarchy,Warps/Wavefronts,Thread-blocks/Workgroups, Streaming multiprocessors, 1D/2D/3D thread mapping, Device properties, Simple-Programs

Module II (7 Hours)

Memory:Memoryhierarchy,DRAM/global,local/shared,private/local,textures,ConstantMemory,Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with differentmemo-ries

Module III (9 Hours)

Synchronization: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchroniza-tion across CPU and GPU

Functions:Devicefunctions,Hostfunctions,Kernelsfunctions,Usinglibraries(suchasThrust),anddeveloping libraries.

Module IV (7 Hours)

Support: Debugging GPU Programs. Profiling, Profile tools, Performance aspects

Streams: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based-Synchronization - Overlapping data trans-fer and kernel execution, pitfalls.

Module V (5 Hours)

Case Studies: Image Processing, Graph algorithms, Simulations, Deep Learning

Module VI (5 Hours)

Advanced topics: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Het-erogeneous processing.

Suggested Readings

Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wen-meiHwu; Morgan Kaufman; 2010 (ISBN:978-0123814722)

CUDA Programming: A Developer's Guide to Parallel Computing with GPUs; Shane Cook; Morgan Kaufman; 2012 (ISBN:978-0124159334)

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					M
CO 2	M	H	M			
CO 3		M	H	L		
CO 4		M	M	H	M	
CO 5				M	H	
CO 6			H	H		L

CSCL0135: CLOUD COMPUTING

(3 Credits)

Objectives:

The student will also learn how to apply trust-based security model to real-world security problems.

An overview of the concepts,processes,and bes tpractices needed to successfully secure information

within Cloud infrastructures.

Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Course Outcomes

- Basics of cloud computing (Remembering)
- Understanding cloud computing architecture and cloud computing model (Understanding)
- Identify security aspects of each cloud model (Applying)
- Develop a risk management strategy for moving to the cloud (Analysing)
- Implement a public cloud instance using a public cloud service provider (Evaluating)
- Apply trust based security model to different layer (Creating)

Module I (8 Hours)

Introduction to Cloud Computing

Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

Module II (8 Hours)

Cloud Computing Architecture Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model

Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

Module III (8 hours)

Security Issues in Cloud Computing, Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security

Identity and Access Management, Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

Module IV (8 hours)

Security Management in the Cloud: Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS

Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Change to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications,

U.S. Laws and Regulations, International Laws and Regulations.

Module V (8 hours)

Audit and Compliance: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/ External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud

Module VI (5 hours)

ADVANCED TOPICS: Recent developments in hybrid cloud and cloud security

Suggested Readings

Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication Date: November 2, 2009

Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice), Tim Mather, ISBN-10: 0596802765, O'Reilly Media, September 2009

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H				
CO 3		M	H	L		
CO 4		M	M	H	M	

CO 5			M	H	M	M
CO 6			H	H		L

CSDD0136: DISTRIBUTED DATABASES**(3 Credits)**

Objectives: The objective of course is to provide insight to distributed data base, normalization techniques and integrity rules, and to learn about parallel database systems along with object oriented models.

Course Outcomes

Describe the concepts related to distributed database, normalization techniques and integrity rules, parallel database systems, and distributed object database management systems. (Remembering)
 Explain concepts related to distributed DBMS architecture, query processing, transaction management, distributed concurrency control, distributed object database management systems etc. (Understanding)
 Apply normalization to make efficient retrieval from database and query. (Applying)
 Analyze design issues and efficiency of query statements. (Analyzing)
 Choose appropriate distributed database design for a given application. (Evaluating)
 Create distributed databases, parallel database systems, and object database systems for a given problem. (Creating)

Module I (10 Hours)

Introduction: Distributed Data processing, Distributed database system (DDBMS), Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS.

Module II (7 Hours)

Distributed DBMS Architecture: DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture. Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, Semantic Integrity Control.

Module III (8 Hours)

Overview of Query Processing: Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing.
 Introduction to Transaction Management: Definition of Transaction, Properties of transaction, types of transaction. Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanisms, locking based concurrency control algorithms.

Module IV (7 Hours)

Parallel Database Systems: Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture.

Module V (8 Hours)

Distributed Object Database Management systems: Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing. Transaction management. Database Interoperability: Database Integration, Query processing.

Module VI (5 Hours)

Recent approaches, models and current trends in improving the performance of Distributed Database.

Suggested Readings

Principles of Distributed Database Systems, Second Edition, M. Tamer Ozsu Patrick Valduriez
 Distributed Databases principles and systems, Stefano Ceri, Giuseppe Pelagatti, Tata McGrawHill.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H				
CO 3		M	H	L		
CO 4		M	M	H	M	
CO 5			M	H	M	M
CO 6				M	H	L

CSSC0088: DATA SCIENCE**(3 credits)**

Objectives:

*Provide you with the knowledge and expertise to become a proficient data scientist.**Demonstrate an understanding of statistics and machine learning concepts that are vital for data science**Produce Python code to statistically analyse a dataset**Critically evaluate data visualisations based on their design and use for communicating stories from data***Course Outcomes**

Define the basics of the knowledge and expertise required to become a proficient data scientist.

(Remembering)

Demonstrate an understanding of statistics and machine learning concepts that are vital for data science. (Understanding)

Develop Python code to statistically Analyse a dataset. (Applying)

Analyse data visualizations based on their design (Analysing)

Evaluate the use of communicating stories from data (Evaluating)

Design and develop analytical report (Creating)

Module I (5 Hours)

Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Module II (7 Hours)

Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources

Module III (10 Hours)

Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Module IV (10 Hours)

Data visualisation: Introduction, Types of data visualisation, Data for visualisation: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Module V (6 Hours)

Applications of Data Science, Technologies for visualisation, Bokeh (Python)

Module VI (7 Hours)

Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods used in data science.

Suggested Readings

Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk From The Frontline. O'Reilly.

Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1,

Cambridge University Press.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M	M				

CO 2		M	H			
CO 3			M	H		
CO 4				H	M	
CO 5				M	H	
CO 6					M	H

CSWA0094: WIRELESS ACCESS TECHNOLOGIES**(3 credits)****Objectives:**

Overview of wireless access technologies, Fixed wireless access networks. Terminal mobility issues regarding wireless access to Internet

Introduction to various Network topologies, hotspot networks, Communication links: point-to-point, point-to-multipoint, multipoint-to-multipoint.

To provide an overview of Standards for most frequently used wireless access networks: WPAN, UWB, WLAN, WMAN, WWAN. Network services. Wireless access networks planning, design and installation.

To get an insight of Wireless networking security issues, Wireless access network exploitation and management, software requirements, link quality control.

Course Outcomes

Recall basics of wireless access technologies, Fixed wireless access networks and terminal mobility issues regarding wireless access to the Internet (Remembering)

Explain the various Network topologies, hotspot networks and Communication links. (Understanding)

Explain the standards for most frequently used wireless access networks. (Understanding)

Planning, design and installation of Wireless access networks (Applying)

Analyse and get an insight of Wireless networking security issues, Wireless access network exploitation and management, software requirements and link quality control. (Analysing)

Estimate the requirements of accessories to establish a network (Evaluating)

Establish a network as per requirements. (Creating)

Module I (7 Hours)

Necessity for wireless terminals connectivity and networking. Wireless networking advantages and disadvantages, Overview of wireless access technologies. Narrowband and broadband networks, fixed and nomadic networks. Wireless local loop (WLL), Public Switched Telephone Network (PSTN) interfaces.

Module II (7 Hours)

Fixed wireless access (FWA) networks, frequency bands for different networks. Criteria for frequency bands allocation, Network topologies, hotspot networks. Communication links: point-to-point (PTP), point to multipoint (PMP), multipoint-to-multipoint (MTM).

Module III (9 Hours)

Standards for most frequently used wireless access networks: WPAN (802.15, Bluetooth, DECT, IrDA), UWB (Ultra-Wideband), WLAN (802.11, Wi-Fi, HIPERLAN, IrDA), WMAN (802.16, WiMAX, HIPERMAN, HIPERACCESS),

WWAN (802.20), Other technologies for broadband wireless access, Local Multipoint Distribution Service (LMDS), Multichannel Multipoint Distribution Service (MMDS). Ad Hoc networks, Network services. Services types based on carrier frequency and bandwidth.

Module IV (9 Hours)

Wireless access networks planning, design and installation. Services provision, legislative and technical aspects, Technical and economical factors for network planning: expenses, coverage, link capacity, network complexity and carrier-to-interference ratio (C/I). Base station or access point allocation. Base station and access point equipment. Terminal mobility issues regarding wireless access to the Internet. Wireless networking security issues.

Module V (8 Hours)

Example of laptop or handheld PC wireless connection in real environment. PC wireless interface equipment. Wireless access network exploitation and management, software requirements, link quality control. Business model, wireless network services market, market research and marketing, service

providers, wireless data application service providers (WDASP) and their role on the public telecommunication services market, billing systems.

Module VI (8 Hours)

Recent trends in wireless networking and various access mechanisms, new standards of wireless communication.

Suggested Readings

- M. P. Clark, Wireless Access Networks: Fixed Wireless Access and WLL networks -- Design and Operation, John Wiley & Sons, Chichester
 D. H. Morais, Fixed Broadband Wireless Communications: Principles and Practical Applications, Prentice Hall, Upper Saddle River
 R. Pandya, Introduction to WLLs: Application and Deployment for Fixed and Broadband Services, IEEE Press, Piscataway

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	L	H	M			
CO 3			H	M		
CO 4				H	M	
CO 5				M	H	
CO 6					M	H

CSMS0095 MOBILE APPLICATIONS AND SERVICES

(3 Credits)

Objectives

This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.

It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets.

It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile

Course Outcomes

Relate and explain the emerging technologies and tools used to design and implement feature-rich mobile applications for smartphones and tablets. (Remembering, Understanding)

Building the applications for different platform. (Applying)

Analyze the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile. (Analyzing)

Evaluate the results and compare in different environment to have best outcome. (Evaluating)

Create applications as per requirements in suitable environment. (Creating)

Syllabus

Module I (7 Hours)

Introduction: Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User.

Module II (7 Hours)

More on Uis: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis, . Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.

Module III (9 Hours)

Communications via Network and the Web:State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android

Telephony, Notifications and Alarms: Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics.

Module IV (9 Hours)

Putting It All Together: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android Multimedia: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia.

Module V (8 Hours)

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android.

Module VI (5 Hours)

Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT.

Suggested Readings

Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Sons

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H	M			
CO 3			H	M		
CO 4				H	H	
CO 5					M	H

CSSI0096 SMART SENSORS AND INTERNET OF THINGS

(3 Credits)

Objectives

Able to understand the application areas of IOT.

Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.

Able to understand building blocks of Internet of Things and characteristics.

Course Outcomes

Explain the revolution of Internet in Mobile Devices, Cloud & Sensor Networks. (Understanding)

Identify the application areas of IOT. (Applying)

Examine the building blocks of Internet of Things and their characteristics. (Analyzing)

Evaluate the results and compare the performance in different environment. (Evaluating)

Construct IoT based products as per requirements for a suitable environment. (Creating)

List and explain the different sensors and illustrate their applications in smart devices. (Remembering)

Syllabus

Module I (7 Hours)

Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT.

Module II (7 Hours)

Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc.

Module III (9 Hours)

Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors.

Module IV (10 Hours)

Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel

Module V (7 Hours)

Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor.

Module VI (5 Hours)

Recent trends in smart sensor for day to day life, evolving sensors and their architecture.

Suggested Readings

Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing.

Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H	M			
CO 3			H	M		
CO 4				H	M	
CO 5					H	M
CO 6						H

CSLF0097: LOGIC AND FUNCTIONAL PROGRAMMING

(3 credits)

Objectives:

To further the state of the art on the theoretical and practical aspects of developing declarative programming tools in logic programming for IOT data analysis .

To introduce basics of functional programming and constraint logic programming for nodes in IOT.

Introduction into formal concepts used as a theoretical basis for both paradigms, basic knowledge and practical experience.

Course Outcomes

Define sensors and relate their data collection technique with various criteria set by the users.

(Remembering)

Explain the state of the art on the theoretical and practical aspects of developing declarative programming tools in logic programming for IOT data analysis. (Understanding)

Experiment with the basics of functional programming and constraint logic programming for nodes in IOT. (Applying)

Examine the formal concepts used as a theoretical basis for both paradigms, basic knowledge and practical experience. (Analysing)

Evaluate the results and compare in different environments to have best results. (Evaluating)

Create IoT based products as per requirements in a suitable environment. (Creating)

Module I (5 Hours)

Proposition Logic: Introduction of logic and Functional Paradigm, Propositional Concepts, Semantic Table , Problem Solving with Semantic Table.

Module II (7 Hours)

Natural Deduction and Axiomatic Propositional Logic: Rules of Natural Deduction, Sequent Calculus, Axiomatic Systems, Meta theorems, Important Properties of AL, Resolution, Resolving Arguments

Module III (7 Hours)

Introduction to Predicate Logic Objects, Predicates and Quantifiers, Functions, First Order Language, Quantifiers, Scope and Binding, Substitution, An Axiomatic System for First Order Predicate Logic, Soundness and Completeness, Axiomatic Semantic and Programming

Module IV (12 Hours)

Semantic Tableaux & Resolution in Predicate Logic: Semantic Tableaux, Instantiation Rules, Problem-solving in Predicate Logic, Normal forms, Herbrand Universes and H-interpretation, Resolution, Unification, Resolution as a computing Tool, Nondeterministic Programming, Incomplete Data Structure,

Second Order Programming in Prolog, Logic Grammars: Definite Clause Grammar, A Grammar Interpreter.

Module V (9 Hours)

Lazy and Eager Evaluation strategies: Evaluation Strategies, Lazy Evaluation: Evaluation Order and strictness of function, Programming with lazy evaluation, Interactive functional program, Delay of unnecessary Computation, Infinite Data Structure, Eager Evaluation and Reasoning

Module VI (5 Hours)

Recent trends in logical and functional programming, predicate logics and various evaluation strategies.

Suggested Readings

John Kelly, "The Essence of Logic", Prentice-Hall India.

Saroj Kaushik, "Logic and Prolog Programming", New Age International Ltd

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2	M	H				
CO 3			H	M		
CO 4				H	M	
CO 5				M	H	M
CO 6					M	H

CSNI0112 SENSOR NETWORKS AND INTERNET OF THINGS

(3 credits)

Objectives

The course gives an overview of various topics related to wireless sensor networks, which are expected to be the basis for the emerging internet-of-things.

The course covers topics with relation to various sub disciplines of computer science such as hardware, operating systems, distributed systems, networking, security and databases.

Able to understand wireless sensor network (WSN) specific issues such as localization, time synchronization, and topology control are addressed as well.

Course Outcomes

Define the function of sensors. (Remembering)

Explain how to connect sensors to the environment. (Understanding)

Organize and connect sensors together to have generated output. (Applying)

Examine hardware and software level consideration for IoT sensors. (Analyzing)

Evaluate results from data. (Evaluating)

Creating a real time applications. (Creating)

Syllabus

Module I (7 Hours)

Introduction and Applications: smart transportation, smart cities, smart living, smart energy, smart health, and smart learning. Examples of research areas include for instance: Self-Adaptive Systems, Cyber Physical Systems, Systems of Systems, Software Architectures and Connectors, Software Interoperability, Big Data and Big Data Mining, Privacy and Security.

Module II (8 Hours)

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints hardware, Data representation and visualization, Interaction and remote control.

Module III (8 Hours)

Industrial Automation- Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, Commercial Building Automation- Introduction, Case study: phase one-commercial building automation today, Case study: phase two- commercial building automation in the future.

Module IV (10 Hours)

Hardware Platforms and Energy Consumption, Operating Systems, Time Synchronization, Positioning and Localization, Medium Access Control, Topology and Coverage Control, Routing: Transport Protocols, Network Security, Middleware, Databases.

Module V (7 Hours)

IOT Physical Devices & Endpoints: What is an IOT Device, Exemplary Device Board, Linux on Raspberry, Interface and Programming & IOT Device

Module VI (5 Hours)

Recent trends in sensor network and IOT architecture, Automation in Industrial aspect of IOT.

Suggested Readings

Mandler, B., Barja, J., MitreCampista, M.E., Cagálová, D., Chaouchi, H., Zeadally, S., Badra, M., Giordano, S., Fazio, M., Somov, A., Vieriu, R.-L., Internet of Things. IoT Infrastructures, Springer International Publishing.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H				
CO 3			H	H		
CO 4				H	M	
CO 5					H	
CO 6						H

CSDV0105: DATA VISUALISATION

(3 credits)

Objectives:

*familiarize students with the basic and advanced techniques of information visualization and scientific visualization,
to learn key techniques of the visualization process
a detailed view of visual perception, the visualized data and the actual visualization interaction and
distorting techniques*

Course Outcomes

Recall the basic and advanced techniques of information and scientific visualization. (Remembering)
Explain the key techniques of the visualization process. (Understanding)
Apply detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques. (Applying)
Analyse different visualization techniques and their applicability to different types of data. (Analysing)
Compare techniques for visual mapping, geographic data and collaborative visualization. (Evaluating)
Create a process to have an understanding of large-scale abstract data. (Creating)

Module I (8 Hours)

Introduction of visual perception, visual representation of data, Gestalt principles, information overloads.

Module II (8 Hours)

Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

Module III (8 Hours)

Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

Module IV (10 Hours)

Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

Module V (7 Hours)

Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations

Module VI (4 Hours)

Recent trends in various perception techniques, various visualization techniques, data structures used in

data visualization.

Suggested Readings

WARD, GRINSTEIN, KEIM, .Interactive Data Visualization: Foundations, Techniques, and Applications. Natick : A K Peters, Ltd.
E. Tufte, The Visual Display of Quantitative Information, Graphics Press

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		H			
CO 2	L		H			
CO 3					H	H
CO 4			M	H	H	
CO 5					H	
CO 6			H	H	H	M

CSAC0113: IOT APPLICATIONS AND COMMUNICATION PROTOCOLS (3 credits)

Objectives

Basic introduction of all the elements of IoT-Mechanical, Electronics/sensor platform, Wireless and wire-line protocols, Mobile to Electronics integration, Mobile to enterprise integration.

Open source/commercial electronics platform for IoT-Raspberry Pi, Arduino ,ArmMbedLPC.

Open source /commercial enterprise cloud platform for IoT-Ayla, iO Bridge, Libellium, Axeda, Cisco fog cloud.

Course Outcomes

Define IoT and respective protocols. (Remembering)

Explain the functions of different layers of communication protocol. (Understanding)

Identify the different functions with respect to different layers. (Applying)

Distinguish protocol and functionalities. (Analyzing)

Evaluate the sensor collected data in connection to communication layer. (Evaluating)

Create applications using different communication protocol. (Creating)

Module I (7 Hours)

Basic function and architecture of a sensor — sensor body, sensor mechanism, sensor calibration, sensor maintenance, cost and pricing structure, legacy and modern sensor network. Development of sensor electronics — IoTvs legacy, and open source vs traditional PCB design style Development of sensor communication protocols, Protocols: Modbus, relay, Zigbee, Zwave, X10,Bluetooth, ANT, etc. Business driver for sensor deployment — FDA/EPA regulation, fraud/ tempering detection, supervision, quality control and process management Different kind of calibration Techniques: manual, automation, infield, primary and secondary calibration — and their implication in IoT Powering options for sensors: battery, solar, Witricity, Mobile and PoE.

Module II (9 Hours)

Zigbee and Zwave — advantage of low power mesh networking. Long distance Zigbee. Introduction to different Zigbee chips. Bluetooth/BLE: Low power vs high power, speed of detection, class of BLE. Introduction of Bluetooth vendors & their review. Wireless protocols such as Piconet and packet structure for BLE and Zigbee Other long distance RF communication link. LOS vs NLOS links, Capacity and throughput calculation Application issues in wireless protocols: power consumption, reliability, PER, QoS, LOS.

Module III (9 Hours)

PCB vs FPGA vs ASIC design Prototyping electronics vs Production electronics, QA certificate for IoT CE/CSA/UL/IEC/RoHS/IP65 Basic introduction of multi-layer PCB design and its workflow Electronics reliability-basic concept of FIT and early mortality rate Environmental and reliability testing-basic concepts Basic Open source platforms: Arduino, Raspberry Pi, Beaglebone.

Module IV (7 Hours)

Introduction to Mobile app platform for IoT: Protocol stack of Mobile app for IoT, Mobile to server integration, iBeacon in IoS, Window Azure, Linkafy Mobile platform for IoT, Axeda, Xively.

Module V (8 Hours)

Database implementation for IoT : Cloud based IoT platforms, SQL vsNoSQL, Open sourced vs. Licensed Database, Available M2M cloud platform, AxedaXively, Omega NovoTech, Ayla Libellium, CISCO M2M platform, AT &T M2M platform, Google M2M platform.

Module VI (5 Hours)

Recent trends in home automation, IOT-locks, Energy optimization in home

Suggested Readings

Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley-Blackwell.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H	M			
CO 3			H	M		
CO 4			M	H	M	
CO 5					H	
CO 6						H

CSBD0106: BIG DATA ANALYTICS
(3 credits)
Objectives

Understand big data for business intelligence. Learn business case studies for big data analytics.

Understand nosql big data management. Perform map-reduce analytics using Hadoop and relatedtools.

Course Outcomes

Recall and illustrate big data and use cases from selected business domains. (Remembering & Understanding)

Applying NoSQL big data management. (Applying)

Install, configure, and run Hadoop and HDFS and analyze the data. (Analyzing)

Perform map-reduce analytics using Hadoop (Evaluating)

Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for creating big data analytics. (Creating)

Module I (8 Hours)

What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and bigdata, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, bigdatatechnologies, introduction to Hadoop, open source technologies, cloud and bigdata, mobile business intelligence, Crowd sourcing analytics, inter and transfirewall analytics.

Module II (8 Hours)

Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing mapreduce calculations.

Module III (8 Hours)

Data format, Analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures.

Module IV (8 Hours)

MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats.

Module V (7 Hours)

Hbase, data model and implementations, Hbase clients, Hbase examples, praxis. Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.

Module VI (6 Hours)

Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.

Suggested Readings

Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, Wiley-Blackwell.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H	M			
CO 3			H	M		
CO 4				H		
CO 5					H	H

CSNY0114: NETWORK SECURITY

(3 credits)

Objectives:

To learn the basics of security and various types of security issues.

To study different cryptography techniques available and various security attacks.

Explore network security and how they are implemented in real world.

To get an insight of various issues of Web security and biometric authentication.

Course Outcomes

Recall the basics of security and various types of security issues. (Remembering)

Explain the different cryptography techniques available and various security attacks. (Understanding)

Apply network security and how they are implemented in the real world. (Applying)

Analyse available biometric techniques and how they are used in today's world. (Analysing)

Evaluate the security issues on the web and how to tackle them. (Evaluating)

Elaborate the various issues of web security and biometric authentication. (Creating)

Module I (6 Hours)

Data security: Review of cryptography. Examples RSA, DES, ECC.

Module II (7 Hours)

Authentication, non-repudiation and message integrity. Digital signatures and certificates. Protocols using cryptography (example Kerberos). Attacks on protocols

Module III (9 Hours)

Network security: Firewalls, Proxy-Servers, Network intrusion detection. Transport security: Mechanisms of TLS, SSL, IPsec.

Module IV (10 Hours)

Web security – SQL injection, XSS, etc. Software security and buffer overflow. Malware types and case studies. Access Control, firewalls and host/network intrusion detection.

Module V (8 Hours)

Other topics: Biometric authentication, Secure E-Commerce (ex. SET), Smart Cards, Security in Wireless Communication.

Module VI (5 Hours)

Recent trends in IOT security, IDS and Biometric.

Suggested Readings

W. R. Cheswick and S. M. Bellovin. Firewalls and Internet Security. Addison Wesley, 1994.

W. Stallings. Cryptography and Network Security. Prentice Hall, 1999.

Schneier. Applied Cryptography. Wiley, 1999

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H				
CO 3		M	H			
CO 4			M	H		
CO 5				M	H	
CO 6					H	M

CSAM0115: ADVANCED MACHINE LEARNING**(3 credits)****Objectives:**

To introduce key concepts in pattern recognition and machine learning; including specific algorithms for classification, regression, clustering and probabilistic modeling.

To give a broad view of the general issues arising in the application of algorithms to analysing data, common terms used, and common errors made if applied incorrectly.

To demonstrate a toolbox of techniques that can be immediately applied to real world problems, or used as a basis for future research into the topic

Course Outcomes

Recall and explain the key concepts in pattern recognition and machine learning; including specific algorithms for classification, regression, clustering and probabilistic modeling. (Remembering, Understanding)

Explain the general issues arising in the application of algorithms, commonly used terms, and the common errors made if applied incorrectly. (Understanding)

Demonstrate a toolbox of techniques that can be immediately applied to real world problems, or used as a basis for future research into the topic. (Applying)

Analyse the Kernel methods for handling high dimensional and non-linear patterns. (Analysing)

Evaluate the State-of-the-art algorithms such as Support Vector Machines and Bayesian networks. (Evaluating)

Solve real-world machine learning tasks: from data to inference. (Creating)

Module I (7 Hours)

Key concepts, Supervised/Unsupervised Learning, Loss functions and generalization, Probability Theory, Parametric vs Non-parametric methods, Elements of Computational Learning Theory Ensemble Learning, Bagging, Boosting, Random Forest

Module II (7 Hours)

Kernel Methods for non-linear data, Support Vector Machines, Kernel Ridge Regression, Structure Kernels, Kernel PCA, Latent Semantic Analysis

Module III (8 Hours)

Bayesian methods for using prior knowledge and data, Bayesian inference, Bayesian Belief Networks and Graphical models, Probabilistic Latent Semantic Analysis, The Expectation-Maximisation (EM) algorithm, Gaussian Processes

Module IV (9 Hours)

Dimensionality Reduction - CCA, LDA, ICA, NMF – Canonical Variates - Feature Selection vs Feature Extraction

Module V (9 Hours)

Filter Methods - Sub-space approaches - Embedded methods, Low-Rank approaches - Recommender Systems Application areas - Security - Business - Scientific

Module VI (5 Hours)

Recent trends in supervised and unsupervised learning algorithm, dimensional reducibility, feature selection and extraction

Suggested Readings

Christopher M. Bishop, Pattern Recognition and Machine Learning.

John Shawe-Taylor and Nello Cristianini, Kernel Methods for Pattern Analysis

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H				
CO 3		M	H	M		
CO 4			M	H		
CO 5				M	H	
CO 6					M	H

CSDV6079: DATA VISUALISATION LAB

(2 credits)

Course Outcomes

Recall the design process to develop visualization methods and visualization systems, and methods for their evaluation. (Remembering)

Create and process data and visual mapping and the visualization (Creating).

Illustrate an understanding of large-scale abstract data. (Understanding)

Analyse data in various perspectives. (Analysing)

Evaluate the results generated from various applications. (Evaluating)

Create visualization methods for different applications. (Creating)

List of Experiments

Program to recursively subdivide a tetrahedron to form a 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.

Program to implement Liang-Barsky line clipping algorithm.

Program to draw a color cube and spin it using OpenGL transformation matrices.

Program to create a house-like figure and rotate it about a given fixed point using OpenGL functions.

Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.

Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively. Allow the user to specify the circle and the quadrilateral.

Program, using OpenGL functions, to draw a simple shaded scene consisting of a teapot on a table.

Define suitably the position and properties of the light source along with the properties of the properties of the surfaces of the solid object used in the scene.

Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.

Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)

Program to display a set of values {fij} as a rectangular mesh. Project: 11. Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL..

Program to recursively subdivide a tetrahedron to form 3D Sierpinski gasket. The number of recursive steps is to be specified by the user.

Program to implement Liang-Barsky line clipping algorithm.

Program to draw a color cube and spin it using OpenGL transformation matrices.

Program to create a house-like figure and rotate it about a given fixed point using OpenGL functions.

Program to implement the Cohen-Sutherland line-clipping algorithm. Make provision to specify the input line, window for clipping and view port for displaying the clipped image.

Program to create a cylinder and a parallelepiped by extruding a circle and quadrilateral respectively.

Allow the user to specify the circle and the quadrilateral.

Program, using OpenGL functions, to draw a simple shaded scene consisting of a tea pot on a table.

Define suitably the position and properties of the light source along with the properties of the properties of the surfaces of the solid object used in the scene.

Program to draw a color cube and allow the user to move the camera suitably to experiment with perspective viewing. Use OpenGL functions.
Program to fill any given polygon using scan-line area filling algorithm. (Use appropriate data structures.)
Program to display a set of values {fij} as a rectangular mesh.
Project: 1. Develop a suitable Graphics package to implement the skills learnt in the theory and the exercises indicated in Part A. Use the OpenGL.

CSCL0135: CLOUD COMPUTING

(3 credits)

Objectives:

The student will also learn how to apply trust-based security model to real-world security problems.

An overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.

Students will learn the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and Challenges for each Cloud type and service delivery model.

Course Outcomes

The basics of cloud computing (Remembering)

Illustrate cloud computing architecture and cloud computing model (Understanding)

Identify and apply security aspects of each cloud model (Applying)

Analyse a risk management strategy for moving to the cloud (Analysing)

Implement and evaluate a public cloud instance using a public cloud service provider (Evaluating)

Create a trust based security model to different layer (Creating)

Module I (10 Hours)

Introduction to Cloud Computing

Online Social Networks and Applications, Cloud introduction and overview, Different clouds, Risks, Novel applications of cloud computing.

Module II (11 Hours)

Cloud Computing Architecture Requirements, Introduction Cloud computing architecture, On Demand Computing Virtualization at the infrastructure level, Security in Cloud computing environments, CPU Virtualization, A discussion on Hypervisors Storage Virtualization Cloud Computing Defined, The SPI Framework for Cloud Computing, The Traditional Software Model, The Cloud Services Delivery Model Cloud Deployment Models Key Drivers to Adopting the Cloud, The Impact of Cloud Computing on Users, Governance in the Cloud, Barriers to Cloud Computing Adoption in the Enterprise

Module III (10 hours)

Security Issues in Cloud Computing, Infrastructure Security, Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security

Identity and Access Management, Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management

Module IV (11 hours)

Security Management in the Cloud: Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS

Privacy Issues: Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications,

U.S. Laws and Regulations, International Laws and Regulations.

Module V (8 hours)

Audit and Compliance: Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/ External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud

Module VI (4 hours)

ADVANCED TOPICS: Recent developments in hybrid cloud and cloud security

Suggested Readings

Cloud Computing Explained: Implementation Handbook for Enterprises, John Rhoton, Publication

Date: November 2, 2009

Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice),
Tim Mather, ISBN-10: 0596802765, O'Reilly Media, September 2009

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H				
CO 3			H	M		
CO 4			M	H	H	
CO 5					H	
CO 6						H

CSIS0137IOT AND SMART CITIES (3 Credits)

Objectives

Explain the basic methodologies and techniques of the arts and humanities, social sciences, business, and science and technology

To describe the current practices and future trends about smart city

Capacity of critique the current practice and provide recommendations

Course Outcomes

List the various applications of smart cities (Remembering)

Explain the IoT reference architecture, fundamental knowledge of the sustainable and smart city (Understanding)

Identify different technologies used for sustainable smart cities (Applying)

Analyze the learnt knowledge to conduct a case study in an organized way. (Analyzing)

Estimate the ability to present the study clearly to audiences; Demonstration of critical thinking and discovering. (Evaluating)

Formulate the methods to design public mobile services aimed at efficiency, cost-saving and participation with attention for e-inclusion (Creating)

Module I (8 hours)

Introduction and Applications: smart transportation, smart cities, smart living, smart energy, smart health, and smart learning.

Module II (9 hours)

IoT Reference Architecture- methods to assist local governments to develop international good e-practice

Module III (8 hours)

Methods to redesign and redefine back and front offices in order to build smarter and transparent governments

Module IV (8 hours)

Methods to design public mobile services aimed at efficiency, cost-saving and participation with attention for e-inclusion

Module V (10 hours)

Methodologies for user involvement, profiling customers and identifying needs; test methodologies to transfer these needs in appropriate services; and test techniques to fit the right channel to the specific services and customers thereby setting a framework for a higher level of e-services in the NSR

Module VI (5 hours)

Pilot new service channels, bluetooth services for public transport, online forms in mobile phones and wireless city services

Suggested Readings

Smart City on Future Life - Scientific Planning and Construction by Xianyi Li

The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos

Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H				
CO 3			H	M		
CO 4			M	H	H	
CO 5					H	
CO 6						H

CSEM0138: EMULATION AND SIMULATION METHODOLOGIES

(3 Credits)

Objectives

This module teaches the fundamentals of simulation and emulation methodologies providing guidance on how to design a performance evaluation campaign

Set up a test scenario, select the appropriate models, level of granularity

Metrics for statistical correctness, and discuss the differences between simulation and emulation platforms and how to use them for accurate performance evaluation of communications.

Course Outcomes

Define and explain the fundamental concepts of Discrete Event Simulations. (Remembering)

Explain about the communication and networking techniques used in DES. (Understanding)

Identify the various Application-based Granularity Requirements. (Applying)

Analyze the performance evaluation of Statistical Tools (Analyzing)

Assess the evaluation of communications for ITS. (Evaluating)

Discuss the recent trends of simulation and emulation for IOT. (Creating)

Module I (8 hours)

Fundamentals of Discrete Event Simulations (DES)

Module II (8 hours)

Model-based representation for DES, from communication and networking, to mobility and data traffic.

Module III (8 hours)

Application-based Granularity Requirements: from bit-level, packet-level, to system-level evaluation, and their appropriate selection as a function of the application requirements.

Module IV (12 hours)

Fundamentals on Random Numbers, Fundamentals on Statistical Tools for Performance Evaluation, Simulation vs. Emulations

Module V (8 hours)

Case study for the evaluation of communications for ITS.

Module VI (4 hours)

Recent trends in simulation and emulation for IOT, model based and application based granularity presentation

Suggested Readings

Jack L. Burbank, An Introduction to Network Simulator 3, Wiley

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H				
CO 3			H			
CO 4				H		
CO 5					H	
CO 6					M	H

CSDT0087ADVANCED DATA STRUCTURES**(3 Credits)****Course Outcomes**

Recall the mathematical background and abstractions for analysis of algorithms. (Remembering)

Explain the implementation of symbol tables using hashing techniques. (Understanding)

Apply amortized analysis on data structures, including binary search trees, mergeable heaps, and disjoint sets. (Applying)

Analyse algorithms for red-black trees, B-trees and Splay trees. (Analysing)

Determine and evaluate algorithms for text processing applications. (Evaluating)

Choose suitable data structures and develop algorithms for computational geometry problems. (Creating)

Syllabus**Module 1 (7 Hours)**

Dictionaries: Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.

Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

Module 2 (5 Hours)

Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists

Module 3 (7 Hours)

Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

Module 4 (11 Hours)

Text Processing: String Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.

Module 5 (10 Hours)

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadrees, k-D Trees.

Module 6 (5 Hours)

Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

Suggested Readings

Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.

M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2		H				
CO3				H	M	
CO4			H			

CO5						H
CO6					H	

CSDF0098 DIGITAL FORENSICS (3 Credits)

Course Outcomes

Recall the computer forensics related features of relevant legislations. (Remembering)

Explain the digital forensics related processes and procedures. (Understanding)

Utilize e-discovery tools to gather evidence from computers, mobiles, network, emails and the web. (Applying)

Analyse gathered forensics data to conduct an investigation. (Analysing)

Criticize a digital forensics related case. (Evaluating)

Formulate plans for investigating real-world cyber-crimes. (Creating)

Module 1 (8 Hours)

Digital Forensics Science: Forensics science, computer forensics, and digital forensics.

Computer Crime: Criminalistics as it relates to the investigative process, analysis of cyber- criminalistics area, holistic approach to cyber-forensics

Module 2 (7 Hours)

Cyber Crime Scene Analysis: Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Module 3 (8 Hours)

Evidence Management & Presentation: Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Module 4 (10 Hours)

Computer Forensics: Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, Network Forensics: open-source security tools for network forensic analysis, requirements for preservation of network data.

Module 5 (8 Hours)

Mobile Forensics: mobile forensics techniques, mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000, amendment of IT Act 2008

Module 6 (4 Hours)

Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

Suggested Readings

John Sammons, The Basics of Digital Forensics, Elsevier

John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H			M		
CO2		H				
CO3		M	H			
CO4				H		
CO5			M		H	
CO6				M		H

CSEH0099 ETHICAL HACKING (3 Credits)

Course Outcomes

Recall the features of various cyber laws related to ethical hacking and the code of ethics for ethical hacking. (Remembering)

Explain the terms penetration testing, vulnerability analysis, and malware analysis. (Understanding)
 Utilize various tools to gather data for penetration testing, vulnerability analysis, and malware analysis. (Applying)
 Analyse gathered data to discover vulnerabilities. (Analysing)
 Assess the exploitability of vulnerabilities present in a software or hardware. (Evaluating) CO6:
 Maximize a detected vulnerability to hack a computer, mobile or network. (Creating)

Module 1 (9 Hours)

Introduction to Ethical Disclosure: Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure

Module 2 (8 Hours)

Penetration Testing and Tools: Using Metasploit, Using Back Track Live CD Linux Distribution

Module 3 (9 Hours)

Vulnerability Analysis: Passive Analysis, Advanced Static Analysis with IDA Pro, Advanced Reverse Engineering

Module 4 (10 Hours)

Client-side browser exploits, Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit

Module 5 (5 Hours)

Malware Analysis: Collecting Malware and Initial Analysis, Hacking Malware

Module 6 (4 Hours)

Case study of vulnerability of cloud platforms and mobile platforms & devices.

Suggested Readings

Shon Harris, Allen Harper, Chris Eagle and Jonathan Ness, Gray Hat Hacking: The Ethical Hackers' Handbook, TMH Edition
 Jon Erickson, Hacking: The Art of Exploitation, SPD

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H			M		
CO2		H				
CO3		M		H		
CO4			H	M		
CO5			M		H	
CO6				M		H

CSID0100 INTRUSION DETECTION

(3 Credits)

Course Outcomes

Recall the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems. (Remembering)
 Explain the different classes of attacks and anomaly detection systems and algorithms. (Understanding)

Identify and describe the parts of all intrusion detection systems and characterize new and emerging IDS technologies according to the basic capabilities all intrusion detection systems share. (Applying)
 Compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion. (Analysing)
 Evaluate the security posture of an enterprise. (Evaluating)
 Formulate a plan to secure an enterprise network using an appropriate intrusion detection system. (Creating)

Module 1 (9 Hours)

The state of threats against computers, and networked systems-Overview of computer security solutions and why they fail-Vulnerability assessment, firewalls, VPN's -Overview of Intrusion Detection and Intrusion Prevention Network and Host-based IDS

Module 2 (8 Hours)

Classes of attacks - Network layer: scans, denial of service, penetration Application layer: software exploits, code injection-Human layer: identity theft, root access-Classes of attackers-Kids/hackers/ sophisticated groups-Automated: Drones, Worms, Viruses

Module 3 (8 Hours)

A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS

Module 4 (8 Hours)

Anomaly Detection Systems and Algorithms-Network Behavior Based Anomaly Detectors (rate based)-Host-based Anomaly Detectors-Software Vulnerabilities State transition, Immunology, Payload Anomaly Detection

Module 5 (8 Hours)

Attack trees and Correlation of alerts-Autopsy of Worms and Botnets-Malware Detection- Obfuscation, polymorphism-Dynamic vectors

Module 6 (4 Hours)

Email/IM security issues-Viruses/Spam-From signatures to thumbprints to zero day detection- Insider Threat issues-Taxonomy-Masquerade and Impersonation Traitors, Decoys and Deception- Future: Collaborative Security

Suggested Readings

The Art of Computer Virus Research and Defense, Peter Szor, SymantecPress ISBN 0-32130545-3
 Crimeware, Understanding New Attacks and Defenses, Markus Jakobsson and Zulfikar Ramzan, Symantec Press, ISBN: 978-0-321-50195-0 2008

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H			M		
CO2		H				
CO3		M	H	M		M
CO4			M	H		
CO5			M		M	H
CO6				M	H	M

CSMR0101 MALWARE ANALYSIS & REVERSE ENGINEERING

(3 Credits)

Course Outcomes

Recall an insight of fundamentals of malware analysis (Remembering)
 Explain the concept of malware and reverse engineering. (Understanding)
 Utilize tools and techniques of malware analysis (Applying)
 Analyse data with respect to Malware and Kernel Debugging (Analysing)
 Evaluate results from analysed data. (Evaluating)
 Create an environment to protect malware. (Creating)

Module 1 (11 Hours)

Fundamentals of Malware Analysis (MA), Reverse Engineering Malware (REM) Methodology, Brief Overview of Malware analysis lab setup and configuration, Introduction to key MA tools and techniques, Behavioral Analysis vs. Code Analysis, Resources for Reverse-Engineering Malware (REM) Understanding Malware Threats, Malware indicators, Malware Classification, Examining ClamAV Signatures, Creating Custom ClamAV Databases, Using YARA to Detect Malware Capabilities, Creating a Controlled and Isolated Laboratory, Introduction to MA Sandboxes, Ubuntu, Zeltser's REMnux, SANS SIFT, Sandbox-Setup and Configuration New Course Form, Routing TCP/IP Connections, Capturing and Analysing Network Traffic, Internet simulation using INetSim, Using Deep Freeze to Preserve Physical Systems, Using FOG for Cloning and Imaging Disks, Using MySQL Database to Automate FOG Tasks, Introduction to Python, Introduction to x86 Intel assembly language, Scanners: Virus Total, Jotti, and NoVirus Thanks, Analysers: Threat Expert, CWSandbox, Anubis, Joebox, Dynamic Analysis Tools: Process Monitor, Regshot, HandleDiff, Analysis Automation Tools: Virtual Box, VM Ware, Python, Other Analysis Tools

Module 2 (6 Hours)

Using TSK for Network and Host Discoveries, Using Microsoft Offline API to Registry Discoveries, Identifying Packers using PEiD, Registry Forensics with Reg Ripper Plu-gins:, Bypassing Poison Ivy's Locked Files, Bypassing Conficker's File System ACL Restrictions, Detecting Rogue PKI Certificates.

Module 3 (8 Hours)

Opening and Attaching to Processes, Configuration of JIT Debugger for Shellcode Analysis, Controlling Program Execution, Setting and Catching Breakpoints, Debugging with Python Scripts and Py Commands, DLL Export Enumeration, Execution, and Debugging, Debugging a VMware Workstation Guest (on Windows), Debugging a Parallels Guest (on Mac OS X). Introduction to WinDbg Commands and Controls, Detecting Rootkits with WinDbg Scripts, Kernel Debugging with IDA Pro.

Module 4 (8 Hours)

Memory Dumping with MoonSols Windows Memory Toolkit, Accessing VM Memory Files Overview of Volatility, Investigating Processes in Memory Dumps, Code Injection and Extraction, Detecting and Capturing Suspicious Loaded DLLs, Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA.

Module 5 (7 Hours)

Using WHOIS to Research Domains, DNS Hostname Resolution, Querying Passive DNS, Checking DNS Records, Reverse IP Search New Course Form, Creating Static Maps, Creating Interactive Maps.

Module 6 (5 Hours)

Case study of Finding Artifacts in Process Memory, Identifying Injected Code with Malfind and YARA

Suggested Readings

Michael Sikorski, Andrew Honig "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" publisher William Pollock

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2		H				
CO3		M	H			M
CO4				H		
CO5			M		H	
CO6				M		H

CSSC0102 SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING

(3 Credits)

Course Outcomes

Recall the various software vulnerabilities. (Remembering)

Explain the software process vulnerabilities for an organization. (Understanding)

Apply techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment (Applying)

Analyse and monitor resources consumption in a software. (Analysing)

Evaluate results by interrelating security and software development process. (Evaluating)

Create methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws. (Creating)

Syllabus

Module 1 (8 Hours)

Secure Software Design Identify software vulnerabilities and perform software security analysis, Master security programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance

Module 2 (9 Hours)

Enterprise Application Development Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.

Module 3 (8 Hours)

Enterprise Systems Administration Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).

Module 4 (8 Hours)

Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.

Module 5 (8 Hours)

Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.

Module 6 (4 Hours)

Case study of DNS server, DHCP configuration and SQL injection attack.

Suggested Readings

Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise SoftwareSecurity, Addison Wesley

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2		H				
CO3		M		H		M
CO4			H	M		
CO5			M		H	
CO6				M		H

CSDT6076 ADVANCED DATA STRUCTURES LAB

(3 Credits)

Course Outcomes:

Demonstrate and explain the various operations of Binary search trees. (Understanding)

Develop a program to implement B-Trees and 2-3 Trees. (Applying)

Develop a program and test for the pattern matching algorithms like Bayer-Moore and Knuth-Morris-Pratt algorithms. (Creating)

Demonstrate the implementation of compression algorithms using program. (Understanding)

Develop algorithms for text processing applications. (Creating)

Program List:

Experiment No.	List of Experiments

Module 1

- 1 Implementation of BST and AVL trees.
- 2 Implementation of 2-3 trees, B-trees.
- 3 Implementation of Red Black Trees

Module 2

- 4 Pattern matching using Boyer-Moore algorithm.
- 5 Knuth-Morris-Pratt algorithm for pattern matching.

Module 3

- 6 Huffman Algorithm for data compression.
- 7 Finding Longest Common Subsequence using a dynamic programming technique.
- 8 Implementation of Standard tries, Suffix tries and Compressed tries

Module 4

- 9 Construction of Priority Search Trees, Searching in a Priority Search Tree.
- 10 Construction of Priority range Trees

Module 5

- 11 Implementation of Quad Trees

Suggested Readings:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H				
CO 3			M			
CO 4				H	M	
CO 5						H

CSAA0103: ADVANCED ALGORITHMS
(3 credits)
Course Outcomes

Recall different algorithms (Remembering)

Explain the applications of various algorithms (Understanding)

Apply computer algorithms for different purposes. (Applying)

Analyse the complexity/ performance of different algorithms. Categorize the different problems in various classes according to their complexity. (Analysing)

Evaluate the different problems in various classes according to their complexity. (Evaluation)

Elaborate the recent activities in the field of the advanced data structure. (Creating)

Module 1 (6 Hours)

Sorting: Review of various sorting algorithms, topological sorting

Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge weighted case (Dijkstra's), depth-first search and computation of strongly connected, components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

Module 2 (7 Hours)

Matroids: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.

Graph Matching: Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting paths.

Module 3 (8 Hours)

Flow-Networks: Maxflow-mincut theorem, Ford-Fulkerson Method to compute, maximum flow, Edmond-Karp maximum-flow algorithm.

Matrix Computations: Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.

Module 4 (9 Hours)

Shortest Path in Graphs: Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming.

Modulo Representation of integers/polynomials: Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem.

Discrete Fourier Transform (DFT): In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm

Module 5 (10 Hours)

Linear Programming: Geometry of the feasibility region and Simplex algorithm NP-completeness: Examples, proof of NP-hardness and NP-completeness.

One or more of the following topics based on time and interest Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm

Module 6 (5 Hours)

Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.

Suggested Readings

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M			
CO 3		M	H	M		
CO 4			M	H	M	
CO 5					H	M
CO 6						H

CSEC0116: DATA ENCRYPTION AND COMPRESSION (3 Credits)

Course Outcomes

List the different encryption techniques adopted in both traditional and modern cryptographic mechanisms. (Remembering)

Infer the logic adopted in different cryptographic algorithms, and their countermeasures. (Understanding)

Apply the concepts gathered from the fundamentals of cryptographic approaches in solving related problems. (Applying)

Analyse the working of the different encryption and compression algorithms. (Analysing)

Compare and contrast the working of different data encryption and compression mechanisms. (Evaluating)

Choose appropriate encryption and compression algorithms to build real-world systems. (Creating)

Module 1 (8 Hours)

Introduction to Security: Need for security, Security approaches, Principles of security, Types of attacks. Encryption Techniques: Plaintext, Cipher text, Substitution Vs Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.

Module 2 (10 Hours)

Symmetric & Asymmetric Key Cryptography: Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric & Asymmetric key together, Digital signature, Knapsack algorithm. User Authentication Mechanism: Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication, Firewall.

Module 3 (9 Hours)

Case Studies Of Cryptography: Denial of service attacks, IP spoofing attacks, Secure inter branch payment transactions, Conventional Encryption and Message Confidentiality, Conventional Encryption Principles, Conventional Encryption Algorithms, Location of Encryption Devices, Key Distribution. Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management.

Module 4 (7 Hours)

Introduction: Need for data compression, Fundamental concept of data compression coding, Communication model, Compression ratio, Requirements of data compression, Classification. Methods of Data Compression: Data compression-- Loss less and Lossy.

Module 5 (10 Hours)

Entropy encoding-- Repetitive character encoding, Run length encoding, Zero/Blank encoding; Statistical encoding-- Huffman, Arithmetic & Lempel-Ziv coding; Source encoding-- Vector quantization (Simple vector quantization & with error term); Differential encoding-- Predictive coding, Differential pulse code modulation, Delta modulation, Adaptive differential pulse code modulation; Transform based coding : Discrete cosine transform JPEG standards; Fractal compression

Module 6 (4 Hours)

Recent trends in encryption and data compression techniques.

Suggested Readings

1. Cryptography and Network Security by B. Forouzan, McGraw-Hill.
2. The Data Compression Book by Nelson, BPB.
3. Cryptography & Network Security by AtulKahate, TMH.

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2	M	H	M	L		
CO 3		M	H	M		
CO 4		L	M	H	M	
CO 5				M	H	M
CO 6				L	M	H

CSSW0117: STEGANOGRAPHY AND DIGITAL WATERMARKING
(3 Credits)
COURSE OUTCOMES

Define the terms Steganography, Steganalysis and Digital Watermarking. (Remembering)
 Explain the various techniques for Steganography, Steganalysis and Digital Watermarking. (Understanding)
 Utilize various tools available to perform Steganography. (Applying)
 Analyse data to detect and extract hidden information. (Analysing)
 Defend against steganography and digital watermarking attacks. (Evaluating)
 Develop frameworks for secure communication. (Creating)

Module 1 (8 Hours)

Steganography: Overview, History, Methods for hiding (text, images, audio, video, speech etc.), Issues: Security, Capacity and Imperceptibility, Steganalysis: Active and Malicious Attackers, Active and passive steganalysis.

Module 2 (10 Hours)

Frameworks for secret communication (pure Steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive),

Module 3 (7 Hours)

Steganography techniques: Substitution systems, Spatial Domain, Transform domain techniques, Spread spectrum, Statistical steganography, Cover Generation and cover selection, Tools: EzStego, FFEncode, Hide 4PGP, Hide And Seek, S Tools etc.)

Module 4 (5 Hours)

Detection, Distortion, Techniques: LSB Embedding, LSB Steganalysis using primary sets, Texture based

Module 5 (10 Hours)

Digital Watermarking: Introduction, Difference between Watermarking and steganography, History, Classification (Characteristics and Applications), Types and techniques (Spatial-domain, Frequency-domain, and Vector quantization based watermarking), Attacks and Tools (Attacks by Filtering, Re-modulation, Distortion, Geometric Compression, Linear Compression etc.), Watermark security & authentication.

Module 6 (5 Hours)

Recent trends in Steganography and digital watermarking techniques. Case study of LSB Embedding, LSB Steganalysis using primary sets.

Suggested Readings

Peter Wayner, "Disappearing Cryptography—Information Hiding: Steganography & Watermarking", Morgan Kaufmann Publishers, New York, 2002.

Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, TonKalker, "Digital Watermarking and Steganography", Morgan Kaufmann Publishers, New York, 2008.

Information Hiding: Steganography and Watermarking—Attacks and Countermeasures by Neil F. Johnson, Zoran Duric, Sushil Jajodia.

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L			
CO 2	M	H	M	L		
CO 3		M	H	M		
CO 4		L	M	H	M	
CO 5					H	M
CO 6				L	M	H

CSIT0118: INFORMATION THEORY AND CODING

(3 Credits)

Course Outcomes

List the various coding and compression techniques. (Remembering)

Explain the working of lossless and lossy compression techniques. (Understanding)

Apply encoding techniques to encode data and perform error detection and correction.

(Applying)

Compare the various coding and compression techniques for text, video and image. (Analysing)

Measure information in terms of probability and entropy. (Evaluating)

Combine compression and coding techniques to build end-to-end systems. (Creating)

Module 1 (8 Hours)

Information and entropy information measures, Shannon's concept of Information. Channel coding, channel mutual information capacity (BW)

Module 2 (10 Hours)

Theorem for discrete memory less channel, information capacity theorem, Error Detecting and error correcting codes

Module 3 (8 Hours)

Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques

Module 4 (5 Hours)

Compression: loss less and lossy, Huffman codes, LZW algorithm, Binary Image compression schemes, run length encoding, CCITT group 3 1-D Compression, CCITT group 3 2D compression, CCITT group 4 2D Compression.

Module 5 (10 Hours)

Convolutional codes, sequential decoding. Video image Compression: CITT H261 Video coding algorithm, audio (speech) Compression. Cryptography and cipher.

Module 6 (4 Hours)

Case study of CCITT group 3 1-DCompression, CCITT group 3 2Dcompression.

Suggested Readings

Fundamentals in information theory and coding, Monica Borda, Springer.

Communication Systems: Analog and digital, Singh and Sapre, TataMcGraw Hill. Multimedia

Communications Fred Halsall.

Information Theory, Coding and Cryptography R Bose.

Multimedia system Design Prabhat K Andleigh and KiranThakrar.

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M	L		
CO 3	L	M	H	M		
CO 4		L	M	H	M	
CO 5				L	H	M
CO 6					M	H

CSRA0119: SECURITY ASSESSMENT AND RISK ANALYSIS

(3 Credits)

Course Outcomes

List and define the various Contingency Planning components. (Remembering)

Explain the escalation process from incident to disaster in case of security disaster. (Understanding)

Plan countermeasures to threats. (Applying)

Analyse risks. (Analysing)

Recommend contingency strategies including data backup and recovery and alternate site selection for business resumption planning. (Evaluating)

Design Incident Response Plan, Disaster Recovery Plan and Business Continuity Plan for sustained organizational operations. (Creating)

Module 1 (8 Hours)

SECURITY BASICS: Information Security (INFOSEC) Overview: critical information characteristics – availability information states – processing security counter measures education, training and awareness, critical information characteristics – confidentiality critical information characteristics–integrity, information-states – storage, information states – transmission, security countermeasures -policy, procedures and practices, threats, vulnerabilities.

Module 2 (11 Hours)

Threats to and Vulnerabilities of Systems: definition of terms (e.g., threats, vulnerabilities, risk), major categories of threats (e.g., fraud, Hostile Intelligence Service (HOIS), malicious logic, hackers, environmental and technological hazards, disgruntled employees, careless employees, HUMINT, and monitoring), threat impact areas, Countermeasures: assessments (e.g., surveys, inspections), Concepts of Risk Management: consequences (e.g., corrective action, risk assessment), cost/ benefit analysis of controls, implementation of cost effective controls, monitoring the efficiency and effectiveness of controls (e.g., unauthorized or inadvertent disclosure of information), threat and vulnerability assessment

Module 3 (8 Hours)

Security Planning: directives and procedures for policy mechanism, Risk Management: acceptance of risk (accreditation), corrective actions information identification, risk analysis and/or vulnerability assessment components, risk analysis results evaluation, roles and responsibilities of all the players in the risk analysis process, Contingency Planning/Disaster Recovery: agency response procedures and continuity of operations, contingency plan components, determination of backup requirements, development of plans for recovery actions after a disruptive event, development of procedures for off-site processing, emergency destruction procedures, guidelines for determining critical and essential workload, team member responsibilities in responding to an emergency situation

Module 4 (7 Hours)

Policies and Procedures Physical Security Measures: alarms, building construction, cabling, communications centre, environmental controls (humidity and air conditioning), filtered power, physical access control-

systems (key cards, locks and alarms) Personnel Security Practices and Procedures: access authorization/ verification(need-to-know), contractors, employee clearances, position sensitivity, security training and awareness, systems maintenance personnel, Administrative Security Procedural Controls: attribution, copyright protection and licensing, Auditing and Monitoring: conducting security reviews, effectiveness of security programs, investigation of security breaches, privacy review of accountability controls, review of audit trails and logs

Module 5 (8 Hours)

Operations Security (OPSEC): OPSEC surveys/OPSEC planning INFOSEC: computer security – audit, Cryptography-encryption (e.g., point-to-point network, link), cryptography-key management (to include electronic key), cryptography-strength (e.g., complexity, secrecy, characteristics of the key)

Module 6 (3 Hours)

Case study of threat and vulnerability assessment

Suggested Readings

Principles of Incident Response and Disaster Recovery, Whitman & Mattord, Course Technology

ISBN: 141883663X

(Web link) http://www.cnss.gov/Assets/pdf/nstissi_4011.pdf

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L			
CO 2	M	H	M	M		
CO 3		M	H	M	L	
CO 4			M	H	M	
CO 5			L	M	H	M
CO 6				L	M	H

CSCD0120: SECURE CODING (3 Credits)

Course Outcomes

Recall the basics of secure programming. (Remembering)

Explain the most frequent programming errors leading to software vulnerabilities. (Understanding)

Identify security problems in software. (Applying)

Compare the solutions for handling security problems in software. (Analysing)

Assess the vulnerabilities present in software. (Evaluating)

Design and develop secure programs. (Creating)

Module 1 (10 Hours)

Introduction to software security, managing software security risk, selecting software development Technologies, An open source and closed source, Guiding Principles for software security, Auditing software, Buffer overflows, Access control, Race conditions, Input validation, Password authentication

Module 2 (6 Hours)

Anti-tampering, Protecting against denial of service attack, Copy protection schemes, Client-side security, Database security, applied cryptography, Randomness and determinism

Module 3 (8 Hours)

Buffer Overrun, Format String Problems, Integer Overflow, and Software Security Fundamentals SQL Injection, Command Injection, Failure to Handle Errors, and Security Touch points

Module 4 (8 Hours)

Cross Site Scripting, Magic URLs, Weak Passwords, Failing to Protect Data, Weak random numbers, improper use of cryptography

Module 5 (8 Hours)

Information Leakage, Race Conditions, Poor usability, Failing to protect network traffic, improper use of PKI, trusting network name resolution

Module 6 (5 Hours)

Case study of Cross Site Scripting, Magic URLs, Weak Passwords Buffer Overflows, Access control, Race conditions

Suggested Readings

J. Viega, M. Messier. Secure Programming Cookbook, O'Reilly.
 M. Howard, D. LeBlanc. Writing Secure Code, Microsoft
 J. Viega, G. McGraw. Building Secure Software, Addison Wesley

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M			
CO 3	L	M	H	M		
CO 4	L		M	H	M	
CO 5			L	M	H	M
CO 6				L	M	H

CSBI0121: BIOMETRICS
(3 Credits)
Course Outcomes

Define biometrics. (Remembering)
 Explain the various modules constituting a biometric system. (Understanding)
 Identify Biometric System Vulnerabilities. (Applying)
 Compare the various Biometric technologies. (Analysing)
 Evaluate the challenges and limitations associated with biometrics. (Evaluating)
 Design security systems incorporating biometrics. (Creating)

Module 1 (7 Hours)

Introduction and Definitions of biometrics, Traditional authenticated methods and technologies.

Module 2 (10 Hours)

Biometric technologies: Fingerprint, Face, Iris, Hand Geometry, Gait Recognition, Ear, Voice, Palm print, On-Line Signature Verification, 3D Face Recognition, Dental Identification and DNA.

Module 3 (6 Hours)

The Law and the use of multi biometrics systems.

Module 4 (11 Hours)

Statistical measurement of Biometric. Biometrics in Government Sector and Commercial Sector.

Module 5 (9 Hours)

Case Studies of biometric system, Biometric Transaction. Biometric System Vulnerabilities.

Module 6 (5 Hours)

Recent trends in Biometric technologies and applications in various domains. Case study of 3D face recognition and DNA matching.

Suggested Readings

1. Biometrics for network security, Paul Reid, Hand book of Pearson
2. D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar, Handbook of Fingerprint Recognition, Springer Verlag, 2003.
3. A. K. Jain, R. Bolle, S. Pankanti (Eds.), BIOMETRICS: Personal Identification in Networked Society, Kluwer Academic Publishers, 1999.
4. J. Wayman, A.K. Jain, D. Maltoni, and D. Maio (Eds.), Biometric Systems: Technology, Design and Performance Evaluation, Springer, 2004.
5. Anil Jain, Arun A. Ross, Karthik Nanda Kumar, Introduction to biometric, Springer, 2011.
6. Biometric Systems: Technology, Design and Performance Evaluation, J. Wayman, A.K. Jain, D. Maltoni, and D. Maio.

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M			
CO 3		M	H	M	L	
CO 4		L	M	H	M	

CO 5					H	M
CO 6					M	H

CSAA6078: ADVANCED ALGORITHM LAB (3 Credits)

Course Outcomes

Recall and explain the fundamentals of design and analysis of basic data structures and experiment with the implementation process. (Remembering, Understanding, Applying)

Examine and evaluate the concepts in the specification and analysis of programs. (Analysing, Evaluating)

Elaborate the principles for good program design, especially the uses of data abstraction. (Creating)

Module 1:

1. Program to find Breadth First Search of a graph.
2. Program to find Depth First Search of a graph.
3. Program to find strongly connected components of a graph.
4. Implement Prim's algorithm to find a minimal spanning tree of a graph.
5. Implement Kruskal's algorithm to find a minimal spanning tree of a graph.
6. Implement Dijkstra's algorithm to find the shortest path in a graph.

Module 2:

7. Implementation of algorithms to compute a maximum weight maximal independent set.
8. Implementation of graph matching algorithms.
9. Implementation of Ford-Fulkerson Method to compute maximum flow.
10. Implementation of Edmond-Karp maximum-flow algorithm.

Module 3:

11. Implement Strassen's Algorithm.
12. Implement Floyd Warshall Algorithm.

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3
CO 1	H	M	
CO 2	M	H	M
CO 3		M	H

CSEN6080: DATA ENCRYPTION AND COMPRESSION LAB (3 Credits)

Course Outcomes

Recall the different encryption techniques adopted in both traditional and modern cryptographic mechanisms. (Remembering)

Interpret cryptographic algorithms, and their countermeasures. (Understanding)

Apply fundamental cryptographic approaches in solving related problems. (Applying)

Analyse the working of the different encryption and compression algorithms. (Analysing)

Compare and contrast the working of different data encryption and compression mechanisms. (Evaluating)

Choose appropriate encryption and compression algorithms to build real-world systems. (Creating)

Module 1:

1. Implementation of run length encoding
2. Implementation of Lempel-Ziv coding

Module 2:

3. Implementation of Huffman Encoding of a sequence
4. Implementation of Huffman Decoding of a compressed bit sequence.

Module 3:

5. Implementation of RC4 algorithm.

6. Implementation of S-DES algorithm for data encryption

Module 4:

7. Implementation of RSA Algorithm

Module 5:

8. Implementation of SHA

9. Implementation of MD5

Module 6:

10. Implementation of JPEG algorithm.

Mapping of COs to Syllabus:

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2	M	H	M			
CO 3		M	H	M		
CO 4			M	H	M	
CO 5				L	H	M
CO 6					M	H

CSBA0142 BUSINESS ANALYTICS

(3 Credits)

Course Outcomes

Recall the scope of business analytics (Remembering)

Interpret the modeling relationships and trends in data, simple linear regression. (Understanding)

Experiment with knowledge of data analytics (Applying)

Analyze critically in making decisions based on data and deep analytics. (Analysis)

Asses technical skills in predictive and prescriptive modeling to support business decision-making. (Evaluating)

Adapt the ability to translate data into clear, actionable insights.(Creating)

Syllabus

Module 1 (8 hours)

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Module 2 (8 hours)

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Module 3 (8 hours)

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predictive Modeling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modeling, nonlinear Optimization.

Module 4 (9 hours)

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.

Monte Carlo Simulation and Risk Analysis: Monte Carlo Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Module 5 (8 hours)

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, the Value of Information, Utility and Decision Making.

Module 6 (4 hours)

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Story-telling and Data journalism.

Suggested Readings

Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

Business Analytics by James Evans, persons Education.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO1	H					
CO2		H				
CO3		M	H			M
CO4				H		
CO5			M		H	
CO6				M		H

CSDM0139 DATA WAREHOUSING & MINING

(3 Credits)

Course Outcomes

Illustrate different classification, prediction, sequential pattern algorithms (remembering and Understanding)

Construct cluster, periodicity and social network analysis.(Applying)

Analyze technique to extract patterns from time series data and its application in real world (Analysing)

Apprise the Graph mining algorithms to Web mining (Evaluating)

Design computing framework for Big Data (Creating)

Syllabus**Module 1 (12 hours)**

Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods; Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns.

Module 2 (15 hours)

Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis; Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis;

Module 3 (12 hours)

Web Mining, Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.

Module 4 (6 hours)

Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis

Suggested Readings

Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.

Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley, 2006.

G Dong and J Pei, Sequence Data Mining, Springer, 2007

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H			M
CO2		H		
CO3		M	H	
CO4				H
CO5			M	H

CSWI0140 WEB SEARCH & INFORMATION RETRIEVAL**Course Outcomes**

Recall basic theories and analysis tools as they apply to information retrieval. (Remembering and Understanding)

Apply the understanding of problems and potentials of current IR systems. (Applying)

Analyze different retrieval algorithms and systems. (Analysing)

Evaluate various indexing, matching, organizing, and evaluating methods to IR problems. (Evaluating)

Formulate various theoretical IR research. (Creating)

Syllabus**Module 1 (15 hours)**

Information retrieval model, Information retrieval evaluation, Searching the Web, Document Representation, Query languages and query operation, Meta-datasearch.

Module 2 (15 hours)

Indexing and searching, Scoring and ranking feature vectors, Ontology, domain specific search, parallel and distributed information retrieval.

Module 3 (10 hours)

Text and multimedia languages, Social networks.

Module 4 (5 hours)

Recent trends in Web search and Information retrieval techniques.

Suggested Readings

C. D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, Cambridge University Press, 2008 (available at <http://nlp.stanford.edu/IR-book/>).

Chakrabarti, S. (2002). Mining the web: Mining the Web: Discovering knowledge from hypertext data. Morgan-kaufman.

B. Croft, D. Metzler, T. Strohman, Search Engines: Information Retrieval in Practice, AddisonWesley, 2009 (available at <http://ciir.cs.umass.edu/irbook/>).

R. Baeza-Yates, B. Ribeiro-Neto, Modern Information Retrieval, Addison-Wesley, 2011 (2ndEdition).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		H		
CO3		M	H	
CO4			M	H
CO5				H

CSDY0141: DATABASE SECURITY AND ACCESS CONTROL

(3 Credits)

Course Outcomes

Summarize the access control and implement classical models and algorithms. (Remembering and Understanding)

Identify the capabilities and limitations of various access control mechanisms. (Applying)

Analyze the data, identify the problems, and choose the relevant models and algorithms to apply.

(Analysing)

Assess the strengths and weaknesses of various access control models and to analyze their behaviour.

(Evaluating)

Design and develop access control mechanisms for enterprise IT infrastructures.(Creating)

Syllabus

Module 1 (15 hours)

Introduction to Access Control, Purpose and fundamentals of access control, brief history, Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non-Discretionary Access Control, Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations,

Module 2 (15 hours)

Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy, Biba Integrity model, Clark-Wilson model, Domain type enforcement model, mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance forms, using SoD in real system, Temporal Constraints in RBAC, MAC AND DAC. Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi line Insurance Company.

Module 3 (10 hours)

Smart Card based Information Security, Smart card operating system, fundamentals, design and implementation principles, memory organization, smartcard files, file management, atomic operation, smart card data transmission, ATR, PPS Security techniques- user identification, smart card security, quality, assurance and testing, smart card life cycle-5 phases, smart card terminals.

Module 4 (5 hours)

Recent trends in Database security and access control mechanisms. Case study of Role-Based Access Control (RBAC) systems.

Suggested Readings

Role Based Access Control: David F. Ferraiolo, D. Richard Kuhn, Ramaswamy Chandramouli.

<http://www.smartcard.co.uk/tutorials/sct-itsc.pdf> : Smart Card Tutorial.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		H		
CO3		M	H	
CO4				H
CO5			H	

CSDI6092: DISSERTATION- I / INDUSTRIAL PROJECT

(10 Credits)

Course Outcomes

Recall the enhanced research areas which can be undertaken (Remembering).

Illustrate the research gap within the topic that he / she undertakes (Understanding).

Apply algorithm to solve the problem stated (Applying).

Analyse and categorize the data to be collected to carry on with the research

(Analysis).

To evaluate the outcome which is expected from the research (Evaluating).
Create and implement the methodology to have an outcome (Creation).

CSDI6093:DISSERTATION II

(16 Credits)

Course Outcomes

Recall and relate desertation phase I to identify the basic problem specific outcome (Remembering).
Illustrate the research gap within the topic that he / she undertakes (Understanding).
Make use of the algorithm implemented in Phase I for accuracy (Application).
Compare the results with the existing system to identify its accuracy (Analysis).
Evaluate and summarize the outcome which is expected from the research (Evaluating).
creating an outcome based on the methodology implemented (Creation).

DEPARTMENT OF CIVIL ENGINEERING
M Tech in Civil Engineering

VISION

To be a recognized leader in Civil Engineering education and learning experiences providing state of the art education guided by innovative research and consultancy, inclusive technology and managerial skills for industry as well as societal needs towards sustainable development.

MISSION

To make the department a center of excellence in Civil Engineering education which equips students with a strong conceptual foundation coupled with practical insight to meet the global industrial and environmental challenges.

To produce spiritually inspired socially committed and intellectually competent professionals of high caliber and strong ethical principles to serve the society and nation through teamwork and societal leadership.

To establish the department as a recognized center of research for developing sustainable solutions to engineering problems by providing knowledge base and consultancy services to the community.

Programme outcomes

PO1. An ability to conduct field and laboratory experiments and interpret data in construction industry.

PO2. An ability to design a system to meet desired needs within realistic constraints such as economic, environmental, social, safety and sustainability in construction industry

PO3. An ability to use the techniques, skills and modern engineering tools

PO4. An understanding of professional and ethical responsibility while working in construction industry

PO5. an ability to engage in life-long learning to update the knowledge in construction materials and management

Programme Specific Outcomes

Exhibit detailed professional knowledge in core sub-specializations of civil engineering including structural engineering, geotechnical engineering, hydraulic and environmental engineering and transportation engineering.

Demonstrate analytical and design skills using various technical supports.

Display the ability to tackle research projects and development works in various field of civil engineering using analytical, computational and experimental techniques.

Ability to integrate the knowledge gained from the various core and elective courses for collaborative and multi-disciplinary solutions of different civil engineering challenges.

M.Tech in Civil Engineering – Autumn 2024
New Curriculum

Semester I (First year)						
	Type		Course Code	Course name	Teaching Scheme (Hrs)	Credits

SI No		Course Cate- gory			L	T	P	
1	Theory	Core I	CVSA0108	Advanced structural analysis	3	1	0	4
2		Core II	CVPW0109	Physico-chemical treatment of water and waste water	3	1	0	4
3		PE1	CVHS112	Hydraulic structures	3	0	0	3
			CVAP0113	Air Pollution and Control				
			CVTV0114	Theory of Vi- bration				
			CVGT0115	Geotextile in Civil Engi- neering				
4		PE2	CVIT0116	Ground Im- provement Techniques	3	0	0	3
			CVRD0117	Earthquake resistant de- sign of struc- tures				
			CVID0118	Irrigation and drainage				
			CVSD0119	Solid and Hazardous Waste Man- agement				
5	Lab	Core Lab 1	CVSD6050	Structural Design Lab-1	0	0	2	1
6		Core Lab 2	CVNA6051	Numerical Analysis Lab	0	0	2	1
7	Theory	MLC 1	ECRM0042	Research Methodology and IPR	2	0	0	2
9		Audit 1	EGRW0015	English in Research pa- per writing	2	0	0	0
TOTAL					16	2	4	18

Semester II (First year)						
	Type			Course name	Teaching Scheme (Hrs)	

SI N o		Course Cate- gory	Course Code					Cred- its
					L	T	P	
1	The- ory	Core III	CVAF0110	Advanced foundation Engineering	3	1	0	4
2		Core IV	CVAH0111	Advanced Hydrology	3	1	0	4
3		PE3	CVGE0120	Geotechnical Earth-quake Engineering	3	0	0	3
			CVDS0121	Design of Substruc- tures				
			CVAS0122	Advanced steel De- sign				
			CVFH0123	Fluvial Hydraulics				
4		PE4	CVAF0124	Advanced Fluid Me- chanics	4	0	0	4
			CVPA0125	Pavement Analysis and Design				
			CVCS0126	Design of Advanced Concrete Structures				
			CVEG0127	. Environmental Ge- otechnology				
5	Lab	Core Lab 3	CVSM6052	Soil Mechanics Lab	0	0	2	1
6		Core Lab 4	CVCF6053	Computational Fluid Lab	0	0	2	1
7			CVMI6054	Mini Project	0	0	4	2
9	The- ory	Audit 2	EDPC0201	Indian Polity and Con- stitution	2	0	0	0
TOTAL					15	2	8	19

Semester III (Second year)								
SI No	Type	Course Category	Course Code	Course name	Teaching Scheme (Hrs)			Cred-its
					L	T	P	
3		PE5	CVPS0128	Design of Pre-stressed Concrete Structures	3	0	0	3
			CVWT0129	Industrial waste treatment technology				
			CVCM0130	Cost management of Engineering Projects				
			CVER0131	Earth retaining structures				

4		PE6	CVCC0132	Cement Composite Materials	3	0	0	3
			CVOT0133	Optimization Techniques in Civil Engineering				
			CVEI0134	Environmental Impact Analysis and Assessment				
			CVGW0135	Ground Water Engineering				
7		Dissertation	ICVDI6055	Dissertation Phase -I	0	0	20	10
TOTAL					6	0	20	16

Semester IV (Second year)								
SI No	Type	Course Category	Course Code	Course name	Teaching Scheme (Hrs)			Credits
					L	T	P	
1		Dissertation	CVDI6056	Dissertation Phase II	0	0	32	16
TOTAL					0	0	32	16

Total Credits = 69

Detail Syllabus
M Tech In Civil Engineering

Core courses

Core 1: CVSA0108 : ADVANCED STRUCTURAL ANALYSIS (L-T-P: 3-1-0)

(4 Credit- 60 hours)

Objectives:

The main objective of the course is to equip students with an advanced understanding of structural analysis techniques and their practical application in solving complex engineering problems. This course will develop the analytical skills of students, to tackle real-world structural engineering challenges effectively.

Course/Learning Outcomes:

At the end of the course, students will be able to:

CO1: Identify the physical significance of coefficients on structural behavior using various approaches.

(Understanding)

CO2: Design large structural systems using Matrix analysis and advanced computational methods. (Create)

CO3: Examine the linear and nonlinear structures to ensure structural integrity under various conditions. (Analyze)

CO4: Develop the boundary values using approximate methods. (Create)

CO5: Evaluate the effectiveness of plastic analysis methods in predicting structural behavior. (Evaluate)

Syllabus:

Module I: (13 hours)

Influence Coefficients: Physical significance, effects of settlements, temperature change and lack of fit, member approach and structure approach.

Applications to Simple Problems: Beams, plane trusses, plane rigid jointed frames and grids by structure approach and member approach.

Module II: (22 hours)

Matrix Method (Flexibility Method and Stiffness Method) of Analysis: Local coordinates and global coordinates, boundary conditions, solution of matrix equations and calculation of reactions and member forces, Introduction to finite element method.

Module III: (13 hours)

Boundary Value Problems (BVP): Approximate solution of boundary value problems, modified Galerkin method for 1-D BVP, Matrix formulation of the modified Galerkin method.

Plastic Analysis: Incremental plastic analysis, formation of plastic hinges.

Module IV: (12 hours)

Linear Element: Shape functions, solution for Poisson's equation, general One Dimensional equilibrium problem.

Non-Linear Element: Consideration of geometric and material nonlinearity in direct stiffness method, P-delta effects.

Suggested Readings:

1. C. K. Wang. "Intermediate Structural Analysis", 1st edition (2017), Tata McGraw Hill.
2. W. Weaver Jr. and James M. Gere. "Matrix Analysis of Framed Structures", 3rd edition (1990), CBS Publishers.
3. W. McGuire, R. H. Gallagher and R. D. Ziemian. "Matrix Structural Analysis", 2nd edition (2020), Faculty Books.
4. Guo-Qiang Li and Jin-Jun Li. "Advanced Analysis and Design of Steel Frames", 1st edition, John Wiley & Sons Inc.
5. Pramod Singh. "Plastic Analysis and Design of Steel Structures", 1st edition (2008), Butterworth-Heinemann Ltd.

Mapping of COs to Syllabus:

	CO1	CO2	CO3	CO4	CO5
Module 1	H		L		
Module 2		H	M		
Module 3				H	H
Module 4		M	H		

CVPW0109: Physico- chemical treatment of water and waste water**4 Credits [4-0-0]**

Course Objectives: The goal is to provide a theoretical understanding of various chemical and physical unit operations, with direct application of these operations to the design and operation of water and wastewater treatment systems. Students will use the concepts learned in this class to better understand the design and operation of engineered and natural aquatic systems.

Course Outcomes:

On successful Completion of the course , students will be able to:

CO1: Assess and analyze the quality of water and wastewater by examining impurities, characteristics, and conducting various tests to ensure compliance with potable water standards.(Analyse)

CO2: Apply principles of unit operations and processes to design and operate the systems effectively(Create)

CO3: Utilize process techniques to enhance water and wastewater treatment and sludge treatment and understand mechanisms of treatment processes to , manage select suitable treatment system to execute different processes for treating and disinfecting water and wastewater and the sludge , ensuring compliance with quality standards(Analyse)

CO4: Assess the quantity of water and wastewater, understand the spectrum of particulate size distribution, and manage variation of flows to design efficient water and wastewater systems. (Evaluate)

Module I: 10 Hours

Quality of water and wastewater, Wholesome water, Impurity of water, Characteristics of water, Examination of water, Standards of potable water quality, Characteristics of sewage, Examination of sewage, Standards of quality of treated water and wastewater, Quantity of water and waste water, Waste water and gas flow, Water requirement for domestic and industrial purposes, Waste water formation and estimation, Spectrum of particulate size distribution, Variation of flows.

Module II: 5 Hours

Purpose of screenings and terms: blinding, stratification, contamination, gradation, grading, Flow equalization, Types of bar racks and screens, Disposal of screenings, Removal of oil, grease etc. Floatation Skimming tank, Disposal of skimming.

Module III: 15 Hours

SEDIMENTATION - Principles of Sedimentation and Stokes' law applied to fluids, Characteristics of the settleable solids, Classification of sedimentation tanks for water and waste water, Factors influencing sedimentation, Deciding size of sedimentation tank for water and wastewater, Standard design loading, Detention period.

Coagulation – purpose, principle, Types of coagulants and its suitability, Determination of optimum coagulation dose, Feeding of coagulant and feeding devices, Flocculation and flocculation tanks and design criteria of flocculator, Clarifiers, its types and design criteria, Settling efficiency of particles. Grit removal

Module IV: 5 Hours

Theory of filtration- Mechanism for particle size, Hydraulics of filters, Types of filters and their flow direction, Filter clogging, Filter washing, Break through, Deciding size of filter unit, Advances in filtration

Module V: 15 Hours

Chemical precipitation, Water and wastewater softening, Estimation of dose of chemical, Methods of softening - ammonia, borax, lye, lime-soda, chelating, Ion exchange method etc., Methods of removal of dissolved solids - solar distillation gadgets and plants, direct freezing, reverse osmosis, electrolysis, Methods of disinfection - chlorination – chlorine dose, chlorine demand, application of chlorine, Use of various forms of chlorine, break through chlorination, Removal of colour

Module VI: 10 Hours

Sources of sludge- Estimation of bulk density of sludge, Estimation of rate of filtration. Principles of dewatering, Methods of dewatering and suitability, Thickening of sludge, Chemical conditioning, Elutriation of sludge, Vacuum and pressure filtration, Sludge lagging

References:

1. Weber, W.J., "Physico-chemical Processes", Wiley Interscience, 1983.
2. Eckenfelder W.W., "Industrial Water Pollution Control", 2nd Ed., McGraw Hill, 1999.
3. Tchobanoglous G., Burton F.L., Stensel H.D., "Metcalf and Eddy Inc.- Waste Water Engineering Treatment and Reuse", Tata McGraw-Hill, 2017
4. Arceivala S.J. and Asolekar S.R., "Wastewater Treatment for Pollution Control and Reuse", 3rd Ed., Tata McGraw Hill, 2007.
5. Sincero A.P. and Sincero G.A., "Environmental Engineering – A Design Approach", Prentice-Hall, 1996.
6. R.L. Droste, "Theory and Practice of Water and Wastewater Treatment", John Wiley, 1997.
7. S. Vigneswaran and C. Visvanathan, "Water Treatment Processes: Simple Options", CRC Press, 1995.

Mapping of Course objectives to Syllabus

Module No.	CO1	CO2	CO3	CO4	CO5	CO6
I	H					H
II		H				M
III		H	H			
IV			H	H		
V	M			H		

VI					H	

Core III: CVAF0110: Advanced Foundation Engineering

4 credits-60 Hours (L:T:P:4:0:0)

Course Objective:

The students will be able to decide the type of foundations to be recommended for construction of different engineering structures

The students will be able to design different types of foundations

Course Outcomes:

CO1: Identify a suitable foundation system for a structure, methods of soil exploration, (understand)

CO2: Calculate Lateral earth pressure and retaining wall, Bearing capacity and settlement of shallow foundation, Analyse and design shallow foundations, and pile foundations.(Evaluate, Apply)

CO3: Evaluate the importance of raft foundation, analyse and design of well foundation.(Analyse , Apply)

CO4: Examine and discuss various machine foundations, Analyse and design Sheet piles and coffer-dams, foundation on problematic soil. (Create)

Module 1: [10 hour]

Introduction: Foundation Engineering, Importance and Purpose, Classification and general requirement, Factors influencing the choice of a foundation, Selection of the type

Soil Exploration Introduction, Methods of exploration, Planning the exploration programme, Method of boring, Soil sampling and soil samplers, Vertical and lateral extent of borings, Field tests like Penetration test (Standard Penetration Test, Static Cone Penetration Test, Dynamic Cone Penetration Test) Pressure meter tests, dilatometer test and field Vane shear test. Groundwater observations, Borehole logs, Site investigation reports

Module II: [15 Hours]

Lateral Earth Pressure Theories and Retaining Walls [10 Hours]: Introduction, Effect of wall movement on Earth pressure, Earth pressure at Rest, Classical Earth Pressure Theories, Rankine's theory, Coulomb's theory, Yielding of wall of limited height, Graphical solution for coulomb's earth pressure, Trial wedge method for earth pressure, proportioning of retaining walls, Stability of retaining walls

Flexible Retaining Structures and Cofferdams [3 Hours]: Introduction, Cantilever sheet pile wall, Anchored wall, Cofferdams

Module V:[10 Hours]

Bearing Capacity and Settlement of Shallow Foundations [6 Hours]: Introduction, Basic Definitions and their relationship, Principle modes of soil failure, Bearing capacity by classical Earth pressure theory of Rankine, Pauker and Bell's bearing capacity theory of failure, Prandtl's theory of failure, Terzaghi's method of determining bearing capacity of soil, Effect of water table on bearing capacity, Extension of Terzaghi's bearing capacity theory, Recent bearing capacity theories, Bearing capacity from In-situ tests (Plate load test), Types of settlement and their relationships. Allowable settlement and allowable bearing pressure, Steps involved in the proportion of footings. Design of shallow Foundation

Module VI:[8 Hours]

Mat Foundations [4 Hours]: Introduction, Common types of mat foundation, bearing capacity and settlement of mat foundations Compensated foundation, Analysis of mat foundation.

Beams on Elastic Foundation

Module VII:[7 Hours]

Pile Foundations [6 Hours]: Introduction, Types and uses of piles, Construction of piles, Selection of pile type, Types of foundations to suit subsoil conditions, Pile driving formula, Static pile load formulae, Load test on piles, Dynamics pile formulae, Pile capacity from in-situ tests. Group action of piles, Negative skin friction, laterally load piles, Piles subjected to uplift loads, Uplift capacity of piles, foundations/anchors under uplift loads, well foundation

Module VIII: [10 Hours]

Well Foundations : Introduction, Types of wells or caissons, Components of a well foundation, Shapes of wells, Depth of a well foundation, Forces acting on well foundation, Lateral stability of well foundation, Construction and sinking of a well.

Foundations on problematic soils: Foundations for collapsible and expansive soil. : IS and IRC codal provisions, elastic theory and ultimate resistance methods for well foundations, foundations on problematic soils: foundations for collapsible and expansive soil.

Suggested Readings:

"Foundation Analysis and Design" Joseph E.Bowels. McGraw-Hill International Editions, Fifth Edition, 1997

"Principles of Foundation Engineering" Braja M. Das, Fifth Edition, 2003. Thomson/Brookscole

"Basic and Applied soil mechanics "Gopal Ranjan and ASR Rao, Second Edition New Age International Publishers,2000

"Soil mechanics and Foundation Engineering" K. R. Arora Standard Publisher Distribution 1997

"A Text Book of Soil Mechanics and Foundation Engineering in SI units "V.N.S. Murthy UBS Publishers Distributors Ltd.Fourth Edition 1993.

"A Text Book of Foundation Engineering", Dr. R.K.Poudel and R.Neupane, 1st Edition, 2006.

"Pile Foundation Analysis and Design" H.G.Poulos and E.H.Davis, John Wiley and Sons, 1980

Mapping of Course objectives to Syllabus

	CO1	CO2	CO3	CO4
Module I	H	L		
Module II	H			
Module III		H		
Module IV				H
Module V	L	H		
Module VI			H	
Module VII			H	
Module VIII				H

Core IV**CVAH0111: ADVANCED HYDROLOGY**

4 Credits-3L: 1 T: 0P

COURSE OBJECTIVES: *The objective of this course is to provide students with an advanced understanding of the analysis and development of the basic tools for analysis of hydrologic processes, apply time series models for hydrologic data generation and forecasting, estimate the design flows and assess impact of climate change and Land use/Land cover on water availability.*

COURSE OUTCOME: At the end of the course, students will be able to ,

CO1: Understand the hydrologic systems and hydrologic inputs(Understand)

CO2. Analyse the hydrologic abstractions, streamflow measurement and Unit hydrographs(Analyse)

CO3. Analyse and solve problems on Linear and Nonlinear models, Physically based models and hydrological routing.(Apply)

CO4. Analyse and solve problems on frequency analysis, time series analysis, impact of climate change- and Land use/Land cover on basin response.(Evaluate)

Detailed Syllabus**Module I: (15 hours)**

Introduction to hydrologic system and hydrologic budget, fundamental laws of hydrology; atmospheric water vapor, introduction to hydrologic Inputs like precipitation and its forms, snowfall and rainfall; measurement techniques and space-time characteristics.

Module II: (15 hours)

Introduction to Hydrologic Abstractions like infiltration, depression storage, evapotranspiration and its measurement techniques, space time characteristics and their modeling, introduction to stream flow measurement techniques, space-time characteristics, rating curves, introduction to Unit Hydrograph IUH, GIUH.

Module III: (15 hours) :

Mathematical Modelling using Linear and Nonlinear models, physically based models, hydrological routing, flood forecasting.

Module IV: (15 hours)

Advanced method of frequency analysis, outliers, time series analysis, study the impact of climate change and Land use/Land cover on basin response.

Course Mapping

	CO I	CO II	CO III	CO IV
Module I	H			
Module II		H		
Module III			H	
Module IV				H

Suggested Readings

Chow, V.T., Maidment, D.R. and Mays, W.L., "Applied Hydrology", McGraw Hill. 1988
 Ojha, C.S.P., Berndtsson, R. and Bhunya, P., "Engineering Hydrology", Oxford University Press. 200
 Wanielista, M., Kersten, R. and Eaglin, R., "Hydrology", John Wiley. 1997

Professional Elective Courses**Professional Elective 1****1.CVHS0112:Hydraulic Structures-3 Credits-3L: 0 T: 0P**

COURSE OBJECTIVES: *The objective of this course is to provide students with an advanced understanding of the analysis and design of various types of hydraulic structures.*

COURSE OUTCOME

CO1: Understand the hydraulic structures for water resources projects(Understand)

CO2: Analyse the construction and design principles of embankment and gravity dam(Analyse)

CO3: Analyse and solve problems on dam outlet works and terminal structures(Apply)

CO4: Analyse and solve problems on dimensional analysis and design of physical models of hydraulic structures(Apply)

Syllabus

Module I: Introduction: Hydraulic structures for water resources projects. (10 hours)

Module II: Introduction to embankment dams, its types, design considerations, seepage analysis and control, stability analysis, construction techniques, introduction to gravity dam, forces acting on and failure of a gravity dam, stress analysis, elementary profile, design of gravity dam, other functional features of a gravity dam. (15 hours)

Module III: Introduction to dam outlet works, types of outlet structures, ogee spillway, chute spillway, siphon spillway, side channel spillway, labyrinth and piano key weir, introduction to terminal structure, hydraulic jump types, stilling basin, roller bucket, ski jump basin, baffled spillway, drop structure. (10 hours)

Module IV: Introduction to hydraulic modeling and its basic principles, dimensional analysis, design of physical models of hydraulic structures. (10 hours)

Course Mapping

	CO I	CO II	CO III	CO IV
Module I	H			
Module II		H		
Module III			H	
Module IV				H

References:

Peterka, A.J, "Hydraulic Design of Stilling Basins and Energy Dissipators", USBR Engineering Monographs No. 25". 1984
 Design of Small Dams", Third Edition, Water Resources Technical Publication – US Bureau of Reclamation. 1987
 Singh, B., and Varshney, R.S., "Embankment Dam and Engineering", Nem Chand and Brothers. 2004
 Novak, P. and Nalluri, C., "Hydraulic Structures", Edition 4, Taylor & Francis. 2007
 Creager, Justin and Hinds, "Engineering for Dams", Vol. I and II, John Wiley

2.CVAP0113: Air Pollution and control

(3 credits) (L: T:P: 3-0-0)

Objective:

The objective of the course is to provide the understanding of causes and effects of air pollution and their controlling mechanisms. The course also imparts knowledge on the impacts of air pollution on policy, human health and various contemporary technological innovation for betterment of air quality.

Course outcomes:

After Successful completion of this course, the student should be able to:

CO1. Identify several types of air pollution problems and the chemistry and physics affecting them (Understand)

CO2. Discuss (physical, chemical, biological, and social) mechanisms leading to impacts of air pollution on human health, welfare, and the environment. (Understand)

CO3. Discuss air pollution management practices (regulations, strategies, technologies). (Apply)

CO4. Analyze (quantitatively and qualitatively) impacts of air pollution management decisions on air quality, human health, and the environment. (Analyse)

CO5. Select methods for measurement, control, and prevention of air pollution. (Apply)

Detailed syllabus**Module I:[10 Hours]**

Air Pollution: Introduction and Impacts of air pollution on human health, vegetation, animals, building materials, structures, and atmosphere, soil and water bodies. Sources, classification and formation/transformation of air pollutants:

Indoor air pollution: sources, types and health impacts. Sampling, assessment and evaluation of Indoor air quality.

Module II:[15 Hours]

Meteorology and Atmospheric Stability. Lapse Rate, Plume Behaviour, and Air Quality Monitoring, Air Quality Index (AQI); Air Quality Modelling, Gaussian dispersion models: point, line and area source models;

Emissions Inventory: Transport, Industrial, Agricultural, Residential and Commercial sectors.

Global and regional environmental issues of air pollution: Ozone depletion, Climate change, Global warming, Acid rain.

Module III:[8 Hours]

Air pollution control devices, equipment and their design.

Module IV : [7 Hours]

Air pollution emission standards, National and international policies, acts, rules and regulations.

Emerging technologies and strategies to mitigate air pollution, Current challenges and way forward.

Module V :[5 Hours]

Lab-based measurements of air pollutants.

Suggested Readings:

1. Wark, K., Warner, C.F., and Davis, W.T., "Air Pollution: Its Origin and Control", Addison-Wesley Longman. 1998.
2. Boubel, R.W., Fox, D.L., Turner, D.B., Stern, A.C., "Fundamentals of Air Pollution", Academic Press. 2005.
3. Seinfeld, J.H., Pandis, S.N., "Atmospheric Chemistry and Physics", John Wiley. 2006.
4. Lodge, J.P. (Ed.), "Methods of Air Sampling and Analysis", CRC Press. 1988.
5. Gurjar, B.R., Molina, L., Ojha, C.S.P. (Eds.), "Air Pollution: Health and Environmental Impacts", CRC Press. 2010.
6. Mooc course : https://onlinecourses.nptel.ac.in/noc23_ce14/preview

Course Mapping

	CO I	CO II	CO III	CO IV	CO V
Module I	H				
Module II		H			L
Module III			H		H
Module IV				H	
Module V				L	

3. CVTV0114:Theory of Vibration (3-0-0)**Course Objectives**

The course deals with the dynamic analysis of structures and applications in design. The main objectives are listed below:

To understand and apply the method to develop dynamic equation of motions

To know the method to find out the response time history of structure subjected to different types of excitations.

To be familiar with the analysis of single degree freedom, multi degree freedom and continuous system

To know the numerical techniques to solve the problems in structural dynamics

Course Outcomes

After successful completion of the course , students will be able to:

CO1: Familiarize with the formulation of problems for dynamic analysis (Understand)

CO2: Develop equations of motions for SDF system and different approaches for solution (Apply)

CO3: Find the response of MDF and continuous systems using modal analysis(Evaluate)

CO4: Familiar with different numerical methods to find out the dynamic response of a system (Understand)

Module I Introduction (4 hours)

Importance of vibration analysis, effects of vibration, Nature of excitation, deterministic and random excitation, vibration terminology, Degrees of freedom, Mathematical modelling of dynamic system, initial value and boundary value problems, Types of vibration-Free and forced vibration, Characteristics of discrete systems.

Module II Single Degree Freedom system (12 hours)

Equation of motion, energy method, natural frequency of SDF, viscous damping, damped and undamped oscillation, free vibration response, underdamped, critically damped and overdamped system, logarithmic decrement. Forced vibration, response to harmonic excitation, support motion, vibration isolation, vibration measuring instruments, response to arbitrary excitation, Duhamel integral, concept of response spectra.

Module III Multidegree freedom system (8 hours)

Two degrees of freedom system, natural frequencies and normal modes, forced vibration of multi degree freedom system, mode superposition technique, orthogonality condition of normal modes, modelling of multistoried buildings, response of shear building to base excitation, Rayleigh's approximate method, state-space solution,

Module IV: Numerical approach in Structural Dynamics (8 hours)

Numerical solutions of Duhamel integral, numerical Solution to Response using Newmark Method and Wilson Method, Numerical Solution for State Space Response using Direct Integration,

Module V: Continuous system (8 hours)

Relation between discrete and continuous system, Axial vibration of rods, Bending vibrations of beams, boundary conditions and eigen value problems, mode shape functions and natural frequencies, orthogonality of mode shape functions, modal analysis.

Module VI: Special topics in Structural Dynamics (5 hours)

Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations of industrial machines, wave propagation

Suggested Readings

Thompson, W. T , "Theory of Vibration with applications", CBS Publishers, New Delhi, 1990

Meriovitch, L "Elements of Vibration Analysis", Mc Graw Hill Book Co., New York, 1996

Chopra, A. K, "Dynamics of Structures: Theory and Applications to Earthquake Engineering" , Prentice Hall of India, New Delhi, 2001

Clough R J; Penzien J, "Dynamics of Structures", Mc Graw Hill, New Delhi, 1993

Inman, D , "Engineering Vibration" Pearson, New Delhi, 2014

Paz, M and Kim , Y. H, "Structural Dynamics: Theory and Computation", Springer, 2018

Mapping of Course objectives to Syllabus

Module No.	CO1	CO2	CO3	CO4
I	L			
II		M	H	H

III	M	H	H	M
IV		L	L	H
V				H
VI	H			

4. Geo textile in Civil Engineering (3-0-0=3)

Course objectives

The course is framed for Master Degree students with the following objects

Understand different types of geotextiles

Design of geotextiles for various geotechnical challenge

Understand the usage of geotextiles in pavement construction, slope stability and drainage

Course Outcomes

CO1: Understand different types of geotextiles(Understand)

CO2: Summerise the properties and tests for geotextiles(Understand)

CO3: Design of reinforced soil earthen wall(Create)

CO4: Application to different Civil Engineering problems(Apply)

Module I Introduction (4 hours)

Introduction to Geotextiles, historical background, functions, reinforced earth-mechanism and concepts

Module II Types of geotextiles (6 hours)

Classification of geotextiles, woven, nonwoven and combined, natural fibres, manufacturing process

Module III Properties of geotextiles (10 hours)

Tensile strength, impact strength, resistance to stress induced crack, heat resistance and hydraulic properties, laboratory tests, quality control and assurance, sustainability aspects of using geotextiles.

Module IV Geogrid Reinforced Soil wall (10 hours)

Geo-grid reinforced soil wall, guide lines for design of reinforced slopes, geotextiles in road construction, controlling soil erosion, backfill pressure in bridge abutment

Module V Slope Stability (9 hours)

Slope stability analysis-finite and infinite slopes, in-situ slope stabilization, design of reinforced slope, embankments on soft soil

Module VI Drainage facility (6 hours)

Drainage facility improvement using geo synthetics, accelerated consolidation of soft clays using geosynthetics, geotextile tubes for dewatering and decontamination of soil.

Suggested readings:

Senthil Kumar R, "Textiles for Industrial Applications " CRC Press

Koerner, R. M, "Geotextiles: From Design to Applications" Woodhead Publishing series

Koeerner, R. M, Designing with Geosynthesis, Prentice Hall

Shukla, S K, "Geosynthesis and their applications", Thomas Telford Publishig, London UK

Professional Elective II**1. CVIT0116: GROUND IMPROVEMENT TECHNIQUES****3 credits - (L-T-P: 3-0-0)**

Objectives: This course aims to provide students with a comprehensive understanding of ground improvement techniques and their applications to various soil conditions and construction requirements. It covers mechanical, hydraulic, chemical and thermal modification methods as well as soil reinforcement with geosynthetics and promotes the ability to design and analyze stable and efficient reinforced soil structures.

COURSE / LEARNING OUTCOMES

CO1: Understand the need and different situations requiring ground improvement.

CO2: Explain and apply various mechanical and hydraulic modification techniques for ground improvement.(Understand)

CO3: Demonstrate knowledge of chemical modification techniques and their application.(Apply)

CO4: Understand and apply thermal modification techniques for ground improvement.(Understand)

CO5: Analyze and select appropriate soil reinforcement techniques for different scenarios.(Analyse)

CO6: Design and analyze structures using soil reinforcement techniques.(Create)

Syllabus Contents:

Unit I: Introduction: Need for Ground Improvement, Different types of problematic soils, Emerging trends in ground Improvement.

Unit II: Mechanical modification: Dynamic compaction, impact loading, compaction by blasting, vibro-compaction; pre-compression, stone columns; Hydraulic modification: dewatering systems, preloading and vertical drains, electro-kinetic dewatering

Unit III: Chemical modification: Modification by admixtures, stabilization using industrial wastes, grouting

Unit IV: Thermal modification: Ground freezing and thawing.

Unit V: Soil reinforcement: Reinforced earth, basic mechanism, type of reinforcements, selection of stabilisation/improvement of ground using Geotextiles, Goegrid, geomembranes, geocells, geonets, and soil nails.

Unit VI: Application of soil reinforcement: Shallow foundations on reinforced earth, design of reinforced earth retaining walls, reinforced earth embankments structures, wall with reinforced backfill, analysis and design of shallow foundations on reinforced earth, road designs with geosynthetics.

Suggested Readings

S. K. Gulhati and M. Datta, "Geotechnical Engineering", Tata McGraw Hill.

H.R. Hausmann, "Principles of Ground Modification", McGraw-Hill Book Company.

Purushothama Raj. P, "Ground Improvement Techniques", Firewall Media. Supplementary Readings

M. R. Hausmann, "Engineering Principles of Ground Modification", McGraw-Hill Pub, Co.

P. Nicholson, "Soil Improvement and Ground Modification Methods", Butterworth-Heinemann Ltd.

R. M. Koerner, "Designing with Geosynthetics", Prentice Hall Inc

Mapping of COs to Syllabus

Unit/COs	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
I	H					
II	L	H				

III	L		H			
IV	L			H		
V	L	M	M	M	H	
VI	L	M	M	M	H	H

2. CVRD0117: Earthquake Resistant Design of Structures (3-0-0)

Course Objectives

The course deals with the principles of earthquake resistant design of structures, measures to be taken to identify seismically deficient buildings and to improve their resistance. The main objectives are listed below:

To understand the effects of earthquakes on structures

To carry out lateral load analysis with reference to Indian standard codes

To be familiar with earthquake resistant design of buildings

To know the methods for improving earthquake resistance of buildings

Course Outcome

After successful completion of the course, students will be able to,

CO1: Familiarization with the damaging effects of earthquakes on different types of buildings ?

(Understand)

CO2: Mode the structures to find dynamic characteristics needed to find seismic forces (Apply)

CO3: Estimate seismic forces on buildings using guidelines of Indian Standard codes(evaluate)

CO4: Understanding earthquake resistant design philosophy, design procedure and to improve earthquake resistance of the buildings.(Understand ,Apply)

Module I: Effect of earthquake on structures (6 hours)

Earthquake and its consequences, force generation mechanics, factors affecting structural damage, seismic waves, intensity, magnitude and energy of an earthquake, measurement of ground motions, prominent past earthquakes.

Module II: Modelling of structure for seismic analysis (9 hours)

Basics of structural dynamics, SDF and MDF systems in modelling of structures for dynamic load, Time periods and modes of oscillation, resonance condition, role of damping, base excitation in structure, vibration transmission and isolation, concept of response spectrum.

Module III: Estimation of seismic forces in buildings (10 hours)

Philosophy of earthquake resistant design, lessons learnt from past earthquakes, seismic codes and guidelines, Seismic load calculation as per IS 1893- 2016, Seismic zones in India, Equivalent static approach, Dynamic analysis methods modal participation factors, combination of modes, unsymmetrical configuration of buildings and torsion.

Module IV: Earthquake resistant design of RC building (8 hours)

Earthquake resistant measures at planning stage, architectural features, horizontal and vertical layout of buildings, provisions of IS 4326-1993, Reinforced concrete framed buildings, capacity based design, beam-column joint in moment resistant frame, ductile detailing, provisions of IS 13920-13.

Module V: Earthquake resistant design of Masonry Buildings (6 hours)

Earthquake resistant design of masonry structures, stresses in brick wall due to lateral load, damaging effect of earthquakes and earthquake resistant features of masonry load bearing structures, seismic bands, improving earthquake resistance of low strength brick wall, provisions of IS 13828-1993.

Module VI: Geotechnical consideration and vulnerability studies (6 hours)

Geotechnical consideration in design of structures, liquefaction and its effects, measures to reduce liquefaction potential, vulnerability atlas of India, assessment of seismic vulnerability of buildings, retrofitting and rehabilitation of structures.

Suggested Readings:

Dowrick D J, "Earthquake resistance Design for Engineers and Architects", John Wiley and Sons, New York, 1987

Agarwal, P ; Shrikhande, M, "Earthquake resistant design of structures", Prentice Hall of India, New Delhi, 2011

Chopra, A. K, "Dynamics of Structures: Theory and Applications to Earthquake Engineering" Prentice Hall of India, New Delhi, 2001

Arya, A. S, "Masonry and timber structures including earthquake resistant design", Nemchand and Brothers, Roorkee, 1987

Krishna J, Chandrasekaran A R, Chandra, B, "Elements of Earthquake Engineering", South Asian Publisher, New Delhi, 1976

Guidelines: Improving earthquake resistance of housing, Building Materials and Technology Promotion Council, New Delhi; 2000

Mapping of Course objectives to Syllabus

Module No.	CO1	CO2	CO3	CO4
I	L			
II	M	H	H	
III	M	H	H	M
IV	L		M	H
V				H
VI				H

3. CVID0118: IRRIGATION AND DRAINAGE (3 credits) (L-T-P:3-0-0)

Objective:

To take up the basic concepts of irrigation and basic concepts of water, plants, and their interactions, as well as irrigation and drainage systems design. The structures involved the elementary hydraulic design of different structures and the concepts of maintenance shall also form part. To develop analytical skills relevant to the areas mentioned above, particularly the design of irrigation and drainage projects.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

Explain the objectives, types, and suitability of different irrigation methods, along with the concepts of soil-water relationships, crop evaporative needs, and irrigation efficiency.(Understand)

Apply various surface irrigation techniques and employ field measurement techniques for flow measurement.(Apply)

Design irrigation systems and evaluate drainage needs.(create)

Module I: (10 Hours)

Introduction, objectives of irrigation, type of irrigation and suitability; selection of irrigation method. Irrigation requirement, water balance, soil water relationships, water storage zone, infiltration. Flow of moisture through root zone, soil physical and chemical properties, crop evaporative and drainage requirements, irrigation efficiency and uniformity.

Module II: (10 Hours)

Surface irrigation systems, types of surface systems, basin irrigation, border irrigation, furrow irrigation, field measurement techniques, flow measurement, flumes, weirs, irrigation events, advance, wetting, depletion and recession phases.

Module III: (10 Hours)

Infiltration, infiltrometer, ponding methods, soil water, tensiometers, neutron probe, time domain reflectometer, evapotranspiration, crop coefficient, leaf area index, FAO guide lines on evapotranspiration estimation.

Module IV: (10 Hours)

Fundamentals of surface irrigation hydraulics, continuity equation, momentum equation

Module V: (5 Hours)

Drainage principles, need for drainage, steady state equations, Hooghoudt, Kirkham, Dagan and Ernst equations.

COURSE MAPPING:

	CO1	CO2	CO3
Module I	H		
Module II	L	H	
Module III	L	H	
Module IV			M
Module V		M	H

Suggested Readings

Walker, W.R., and Skogerboe, G.V., "Surface Irrigation Theory and Practice", Prentice Hall, INC. 1987
 Drainage Principles and Applications, "International Institute for Land Reclamation and Improvement", Wageningen. 1973
 Michael, A.M., "Irrigation: Theory and Practice", Vikas Publishing House. 1978
 Asawa, G.L., "Irrigation Engineering", New Age International Publishers. 1996
 Majumdar, D.K., "Irrigation Water Management", PHI Learning. 2009
 Luthin, J.N., "Drainage Engineering", John Wiley. 1966

4. CVSD0119: Solid and Hazardous Waste Management

3 Credits-[L-T-P:3-0-0]

Course objectives:

1. Understanding of problems of municipal waste, biomedical waste, hazardous waste, e waste, industrial waste etc.
2. Knowledge of legal, institutional and financial aspects of management of solid wastes.
3. Become aware of Environment and health impacts solid waste mismanagement

4. Understand engineering, financial and technical options for waste management

Course Outcomes:

After completion of the course students should be able to:

CO I:Comprehend the health and environmental impacts associated with solid waste management.(Understand)

CO II:-Perform sampling and characterization of solid waste.(Apply)

CO III:Analyze hazardous waste constituents, addressing quality assurance and quality control (QA/QC) issues.(Analyze)

CO IV: Implement the steps in solid waste management, including waste reduction at the source, collection techniques, materials and resource recovery/recycling, transportation and disposal.(Apply)

CO V:Develop sustainable waste management practices tailored to rural settings.(Apply)

Detailed Syllabus

Module I:

Solid Wastes: Origin, Analysis, Composition and Characteristics:Solid Waste- Types and classification
Waste sources and generation rates ,Integrated Solid Waste Management System: Collection, Storage, Segregation,Reuse and Recycling possibilities, Transportation, Treatment / Processing and Transformation Techniques, Final Disposal. Factors influencing waste generation and health hazards ,Waste composition ,Waste collection , Characterization of wastes

Module II

Management of: Municipal, Biomedical, Nuclear, Electronic and Industrial Solid Wastes and the rules and regulations.Waste processing : Size and volume reduction ,Waste minimization, waste hierarchy and waste audit,Recycling of solid wastes.

Hazardous waste- Definition, sources, classification, collection and segregation,Hazardous waste characterization, treatment and disposal,Radioactive wastes

Module III

Composting ,Vermicomposting ,Biogas production from solid waste,Thermal treatment of solid waste – Incineration Thermal treatment of solid waste – Pyrolysis and gasification

Module IV

Landfill disposal, Current Management Practices, Environmental audit, Pollution Prevention, Facility Development and operation, Site Remediation: Quantitative risk assessment, site and subsurface characterization, Containment,remedial alternatives.

Module V

Solid waste disposal – Sanitary landfilling- , Landfill leachate, Ground water contamination and gas management,Landfill bioreactors, Fly ash- Generation and management ,Fly ash management ,Solid waste management rules, 2016 , Hazardous and other waste (management and transboundary movement) amendment rules, 2016, Plastic waste management rules, 2016,Basel Convention on the control of transboundary movement of hazardous waste and their disposal ,Mechanical biological treatment of solid wastes

Module VI

Solid waste management in rural areas ,Swachh Bharat Abhiyan , Recent advances in solid waste management

Suggested readings :

1. Prüss A., Giroult E. and Rushbrook P. (1999) Safe Management of Wastes from Health-care Activities, Geneva, World Health Organization.
2. SW-846 (1980) Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Washington, DC, USEPA, Available at <http://www.epa.gov/epawaste/hazard/testmethods/sw846/index.htm>.
3. Tchobanoglous G., Theisen H. and Vigil S. (1993) Integrated Solid Waste Management: Engineering Principles and Management Issues, New York, McGraw-Hill.
4. Vesilind P.A., Worrell W.A. and Reinhart D.R. (2001) Solid Waste Engineering, Australia, CL Engineering
5. qu Batstone R., Smith J.E. (Jr.) and Wilson D. (1989) The Safe Disposal of Hazardous Wastes-the Special Needs and Problems of Developing Countries, The World Bank Technical Paper No. 93, Vol. I, II and III, Washington, DC, The World Bank.
6. Central Public Health and Environmental Engineering Organization (CPHEEO) (2000) Manual on Municipal Solid Waste Management, New Delhi, Controller of Publications.
7. Freeman H.M. (1988) Standard Handbook of Hazardous Waste Treatment and Disposal, New York, McGraw-Hill.
- 8.e Resources: https://onlinecourses.swayam2.ac.in/ugc19_bt18/preview

Course Mapping:

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H	H			
Module II	H		H		
Module III					
Module IV	H				
Module V	M			H	
Module VI					H

PE3:**1. CVGE0120: GEOTECHNICAL EARTHQUAKE ENGINEERING**

3 credits - (L-T-P: 3-0-0)

Objectives: The aim of the course is to familiarise students with the causes and quantification of earthquakes and to familiarise them with the effects of earthquakes and the design criteria required for the design of various geotechnical structures.

COURSE / LEARNING OUTCOMES

Upon completion of this course, students will be able to

CO1: Demonstrate the principles of earthquake loading (Apply)

CO2: Quantify earthquake intensity and various ground motions(Evaluate))

CO3: Perform a deterministic and probabilistic seismic hazard analysis considering different soil properties and site conditions (Apply)

CO4: Analyse the liquefaction susceptibility of a site(Analyze)

CO 5: Design earthquake-resistant foundations, retaining walls, slopes etc.(Create)

Syllabus Contents:

Unit I: Earthquake seismology: Causes of earthquake, Plate tectonics, Earthquake fault sources, Seismic waves, Elastic rebound theory, Quantification of earthquake, Intensity and magnitudes, Earthquake source models.

Unit II: Earthquake ground motion: -Strong motion measurement, ground motion parameters and their estimation, seismic hazard analysis - deterministic and probabilistic, wave Propagation - Waves in a Semi- infinite body, layered body, attenuation of stress waves.

Unit III: Ground response analysis: One, two and three-dimensional ground response analysis.

Unit IV: Liquefaction and lateral spreading - Liquefaction related phenomena, Liquefaction susceptibility: Historical, Geological, Compositional and State criteria. Evaluation of liquefaction by cyclic stress and cyclic strain approaches, Lateral deformation and spreading, Criteria for mapping liquefaction hazard zones.

Unit V: Seismic design of foundations, Seismic slope stability analysis: Internal stability and weakening instability and Seismic design of retaining walls.

Text / Reference Books

S.L. Kramer, Geotechnical Earthquake Engineering, Pentice Hall, international series, Pearson Education (Singapore) Pvt. Ltd., 2004.

S.Saran, Soil Dynamics and Machine Foundation, Galgotia publications Pvt. Ltd., New Delhi 1999.

Ansari, Recent Advances in Earthquake Geotechnical Engineering and Microzonation, Springer, 2006.

Towhata, Geotechnical Earthquake Engineering, Springer, 2008.

Mapping of COs to Syllabus

Unit/COs	CO 1	CO 2	CO 3	CO 4	CO 5
I	H				
II	H	H			
III		M	H		
IV	L			H	
V	L	L	M	M	H

2. CVDS0121Design of Sub-Structure

3 credits-45 Hours (L:T:P:3:0:0)

Course Objective:

Course Outcomes: At the end of the course, students will be able to

CO1. Decide the suitability of soil strata for different projects.(Understand)

CO2. Design shallow foundations deciding the bearing capacity of soil, and Analyze and design the pile foundation, foundation on expansive soil. (Apply)

CO3. Understand analysis methods for well foundation, Analyze and design of the machine foundation (Understand, Create)

Module I [10 hours]: Shallow Foundation

Soil investigation – Basic requirements of foundation, types and selection of foundations, bearing capacity of soil, plate load test, design of reinforced concrete isolated, strip, combined and strap footings, mat foundation.

Module II [10 hours]: Pile Foundation

Introduction, Types of pile foundations, load carrying capacity, pile load test, structural design of straight piles, configuration of piles, different shapes of pile cap, structural design of pile cap.

Module III [10 hours]: Well Foundation

Types of well foundation, grip length, load carrying capacity, construction of wells, failures and remedies, design of well foundation, lateral stability

Module IV [8 hours]: Machine Foundation

Introduction, types of machine foundation, basic principles of design of machine foundation, dynamic properties of soil, vibration analysis of machine foundation, design of foundation for reciprocating machines and impact machines, reinforcement and construction details, vibration analysis.

Module V [7 hours]: Special Foundation

Foundation on expansive soils, choice of foundation, under-reamed pile foundation, foundation for concrete towers, chimneys, design of anchors, reinforced earth retaining walls.

References:

"Foundation Analysis and Design" Joseph E. Bowels. McGraw-Hill International Editions, Fifth Edition, 1997

"Principles of Foundation Engineering" Braja M. Das, Fifth Edition, 2003. Thomson/Brookscole

"Basic and Applied soil mechanics" Gopal Ranjan and ASR Rao, Second Edition New Age International Publishers, 2000

"Soil mechanics and Foundation Engineering" K. R. Arora Standard Publisher Distribution 1997

"A Text Book of Soil Mechanics and Foundation Engineering in SI units" V.N.S. Murthy UBS Publishers Distributors Ltd. Fourth Edition 1993.

"A Text Book of Foundation Engineering", Dr. R.K. Poudel and R. Neupane, 1st Edition, 2006.

"Pile Foundation Analysis and Design" H.G. Poulos and E.H. Davis, John Wiley and Sons, 1980

	CO1	CO2	CO3
Module I	1	3	
Module II	1	3	
Module III			3
Module IV			3
Module V	1	3	

3. CVAS0122: Advanced Steel Design (3: 0: 0=3 Credits)**Course Objectives**

The steel structures have found significant applications in different infrastructural projects as they offer various advantages over reinforced concrete construction. To understand the behaviour of steel structures and design philosophy, the course is framed for the post graduate students with following objectives:

To apply the design principles in beams and frames

To understand design philosophy and stability of beams and columns

To apply the design methods for industrial buildings.

Course Outcomes

After Successful completion of the course, students will be able to :

CO1: Familiarize with plastic design of steel structures and its applications (Understand)

CO2: Understand failure criteria of tension member and stability of steel columns (Understand)

CO3: Understand the concept of shear centre in steel structure and calculation of stresses in unsymmetrical bending. (Evaluate)

CO4: Design components of industrial buildings (create)

Detailed Syllabus:**Module-I: Properties of Steel (5 hours)**

Introduction, Types of structural steel, Mechanical Properties, Residual stress, stress concentration, hysteresis, ductility, Cold formed steel, hot rolled section, High performance and stainless steel.

Module II: Basis of Structural Design (10 hours)

Structural systems and integrity, Joints and mechanical fasteners, Design actions, Methods of Design- Allowable stress, plastic method, Load resistance Factor design, Strength and Drift Criteria: P- Δ Effect, Deformation Based Design; elastic and inelastic analysis, plastic analysis of steel structures, concept of plastic hinge and collapse mechanism, effect of axial force on plastic moment capacity, deflection at ultimate load.

Module III: Axially loaded member (10 hours)

Failure criteria of tension member, staggered bolts, stress concentration due to holes, stability of steel column, Buckling analysis, imperfection in column and its effect on the strength of column, compound columns for heavily loaded structures, Members subjected to combined axial force and bending moment, local buckling of flanges and webs, critical load for steel frames, torsional buckling, column base, design of anchor bolts

Module IV: Flexural member (8 hours)

Stability of Beams, laterally restrained beams, unrestrained beams, flexure-torsional buckling in unrestrained beam, Plastic design of continuous beams and frames, Built up beams, prevention of web buckling, stiffener design, steel-concrete composite construction, composite sectional properties, design of shear connector.

Module V: Unsymmetrical bending (6 hours)

Unsymmetrical steel sections, principal axes, maximum bending stress, shear centre and its calculation for steel section, design of beams under unsymmetrical bending.

Module VI: Industrial Building (6 hours)

Structural framing, selection of roofing and wall material, Roof trusses, Wind load calculations as per IS 875-Pt III, gantry girder, design of sections, columns and foundations.

Suggested Reading:

Subramanian, N, "Design of Steel Structures", Oxford University Press, 2008

Duggal S K, "Limit state design of steel structures" Tata Mc Graw Hill, New Delhi 2010

Neal, B. G, "Plastic Methods of Structural Analysis" Chapman and Hall London, 1977

Arya A S ; Ajmani A S, "Design of Steel Structures" Nemchand and Bros, Roorkee. 2011

IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.

IS-875 Pt III: 2015- "Design loads for building (other than earthquake), Wind load BIS New Delhi

Mapping of Course objectives to Syllabus

Module No.	CO1	CO2	CO3	CO4
I	L			
II		H	H	M
III		M	H	H
IV		M	H	H
V			M	H
VI			M	H

4. CVFH0123: Fluvial Hydraulics
(3 credits) (L-T-P:3-0-0)
Objective:

The primary objective of this course is to provide students with a comprehensive understanding of sediment dynamics in river systems. The course covers the properties of sediments, the mechanisms of sediment transport, and the challenges associated with sediment problems. Students will learn to analyze and design stable channels and sediment control structures using both physical and mathematical models. Emphasis will be placed on practical applications such as bed level variations, local scour, degradation, aggradation, and reservoir sedimentation, along with the design of guide bunds and other river training banks.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

CO1. Explain the properties of sediments, the challenges associated with sediment problems, and the concepts of incipient motion for both uniform and non-uniform sediments. (Understand)

CO2. Analyze the formation of bed forms and the factors contributing to channel resistance and evaluate sediment transport mechanisms, including bed load and suspended load transport, for both uniform and non-uniform bed materials. (Analyse)

CO3. Design stable channels and guide bunds and other river training banks, addressing issues such as bed level variations, local scour, degradation, aggradation, and reservoir sedimentation. (Create)

Syllabus:**Module I : (10 Hours)**

The sediment problems, properties of sediments, incipient motion of uniform and nonuniform sediments.

Module II : (10 Hours)

Bed forms and channel resistance. Bed load and suspended load transport for uniform and non-uniform bed material, total load equations, sediment sampling.

Module III: (15 Hours)

Stable channel design and sediment control. Bed level variations, local scour, degradation, aggradation and reservoir sedimentation. Physical and mathematical models.

Module IV: (10 Hours)

Design of guide bunds and other river training banks.

Suggested Readings

1. Garde, R.J., "River Morphology", New International Publishers. 2006
2. Julien, P.Y., "Erosion and Sedimentation", Cambridge University Press. 1998
3. Jansen, P.P.H., "Principals of River Engineering", VSSD Publications. 1994
4. Garde, R.J. and Ranga Raju, K.G., "Mechanics of Sediment Transportation and Alluvial Stream Problems", Wiley Eastern Limited. 2006

Course Mapping:

	CO1	CO2	CO3
Module I	H		
Module II		H	L
Module III		M	H
Module IV			H

PE4.**1. CVAF0124: ADVANCED FLUID MECHANICS**

(3 credits) (L-T-P:3-0-0)

Objective:

The subject Fluid Mechanics has a wide scope and is of prime importance in several fields of engineering and science. Present course emphasizes the fundamental underlying fluid mechanical principles and application of those principles to solve real life problems.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

Understand and explain the kinematics of fluid flow and the equation of continuity. (Understand)

Apply standard 2D flow patterns, such as sources, sinks, and doublets, to construct complex flows through superposition and solve the Laplace equation using graphical, relaxation methods, and conformal mapping. (Apply)

Evaluate and analyze turbulent flows and interpret turbulence characteristics. (Evaluate, Analyse)

Module I : (5 Hours)

Kinematics of Flow: Equation of continuity in cartesian, polar and cylindrical coordinates.

Module II: (10 Hours)

Standard 2D Flow Patterns: Source, sink, doublet and their combinations, construction of flows by superposition, D'Alembert's paradox, Laplace Equation: Solution by graphical and relaxation methods, conformal mapping, solution by separation of variables

Module III: (8 Hours)

Laminar Flow: Derivation of Navier-Stokes equations – exact solutions for flow between parallel plates, Couette flow, flow near a suddenly accelerated plate and an oscillating plate.

Module IV: (10 Hours)

Boundary Layers: Similarity solutions of boundary layer equations, Falkner-Skan Wedge flows, Karman's momentum integral equations, Karman-Pohlhausen approximate solution, separation in boundary layer under adverse pressure gradient, turbulent boundary layer.

Module V: (12 Hours)

Turbulent Flows: Reynolds equations of motion, semi-empirical theories of turbulence, velocity profiles for inner, outer and overlap layers, equilibrium boundary layers. Measurement of Turbulence and Statistical Theory of Turbulence: Isotropic and homogeneous turbulence, probability density functions, correlation coefficients, decay of isotropic turbulence.

COURSE MAPPING:

	CO1	CO2	CO3
Module I	H		
Module II	L	H	
Module III		H	
Module IV		M	L
Module V			H

Suggested Readings

White, F.M., "Fluid Mechanics", McGraw-Hill. 1979
Schlichting, H., "Boundary Layer Theory", McGraw-Hill. 1979
Garde, R.J., "Turbulent Flow", Wiley Eastern Limited. 1994
Pope, S. B., "Turbulent Flows", Cambridge University Press. 2000
Rouse, H., "Advanced Mechanics of Fluids", John Wiley and Sons. 1959
Ojha, C.S.P., Berndtsson, R. and Chandaramouli, P.N., "Fluid Mechanics", Oxford University Press. 2010

2. CVPA0125: PAVEMENT ANALYSIS AND DESIGN

(3 credits — 45 hours) (L-T-P:3-0-0)

Objectives: *The objective of the course is to provide postgraduate students with a thorough understanding of the principles and practices involved in the design of flexible and rigid pavements. The course covers analytical methods for pavement analysis, selection of design input parameters, material characterisation, drainage, and failure criteria. Students will learn to design pavements using various methods, compare different design approaches, and design overlays and drainage systems, enhancing their expertise in pavement engineering.*

COURSE /LEARNING OUTCOMES

At the end of the course students will be able to:

- CO1:** Understand the fundamental principles behind the design of flexible and rigid pavements, demonstrating foundational knowledge in pavement engineering. (Understand)
- CO2:** Analyse and apply various analytical methods to evaluate pavement structures, enhancing their analytical and problem-solving skills. Analyse. Apply)
- CO3:** Evaluate design inputs, critically assess and select appropriate pavement design input parameters such as traffic loading, volume, and material properties, ensuring accurate and reliable design. (Evaluate)
- CO4:** Design flexible and rigid pavements using different methodologies, showcasing their ability to synthesise and apply theoretical knowledge to practical scenarios. (Apply)
- CO5:** Evaluate and compare different pavement design approaches, including overlays and drainage systems, to determine the most effective solutions, demonstrating their capacity for critical thinking and optimisation.(Evaluate)

Module I: Fundamentals and Philosophy of Pavement Design (8 hours)

Introduction to pavement types: flexible and rigid pavements, Basic principles and philosophies underlying pavement design, Functional requirements of pavements: structural and serviceability considerations. Analytical methods for pavement analysis: empirical, mechanistic-empirical, and theoretical approaches, Stress-strain behaviour of pavement materials under load.

Module II: Pavement Design Input Parameters and Material Characterisation (10 hours)

- a) Traffic data collection and analysis for pavement design, Load equivalency factors and load spectra, Impact of axle loads and tire pressures on pavement performance.
- b) Material properties and characterisation techniques for pavement materials, Failure criteria for flexible and rigid pavements, Reliability concepts in pavement design and performance prediction.

Module III: Design Methods for Flexible and Rigid Pavements (17 hours)

Design methodologies for flexible and rigid pavements, Mechanistic-empirical design approaches for both flexible and rigid pavements, Software tools for pavement design

Module IV: Comparative Approaches, Overlays, and Drainage Systems (10 hours)

Comparative analysis of different pavement design approaches: strengths and limitations, Design and rehabilitation of pavement overlays: flexible and rigid, Advanced drainage system design and its integration with pavement structures.

Suggested Readings

Yang and H. Huang, Pavement Analysis and Design, Pearson Prentice Hall, 2004.

Yoder and Witzech, Pavement Design, McGraw-Hill, 1982.

Sharma and Sharma, Principles and Practice of Highway Engg., Asia Publishing House, 1980.

Teng, Functional Designing of Pavements, McGraw- Hill, 1980.

Mapping of COs to Syllabus

	CO 1	CO 2	CO 3	CO 4	CO 5
Module I	H			L	L
Module II	L	H	L		
Module III		H	H	M	L
Module IV	M	L	M	H	H

3. CVCS0126: Design of Advanced Concrete Structures

Credit: 3 (L:T:P-3:0:0)

Course Objective:

The objective of this course is to provide students with an advanced understanding of the principles and practices involved in the structural design of reinforced concrete and steel structures.

Course Outcomes:

At the end of the course, students will be able to

CO1: Evaluate different design approaches and select appropriate methodologies for analyzing and designing structural systems.(Evaluate)

CO2: Design reinforced concrete structures with advanced techniques using various relevant design codes and able to apply them in practical design scenarios.(create)

CO3: Analyze various steel structures for various engineering applications applying relevant standards such as IS code, AISC standards, and Eurocode. (Analyse)

Syllabus:**Module I: (8 hours)**

Design Philosophy: Modeling of Loads, Material Characteristics, principles that prioritize safety, durability, sustainability, and efficiency.

Module II: (22 hours)

Reinforced Concrete Structure: Axial load (P) - Bending moment (M), M-phi Relationships, Strut-and-Tie Method, Design of Deep Beam and Corbel, Design of Shear Walls, Compression Field Theory for Shear Design, Design against Torsion; IS, ACI and Eurocode.

Module III: (15hours)

Steel Structures: Stability Design, Torsional Buckling - Pure, Flexural and Lateral, Design of Beam-Columns, Fatigue Resistant Design, IS code, AISC Standards and Eurocode.

Course Mapping:

	CO1	CO2	CO3
Module I	H		
Module II		H	
Module III			H

4. CVEG0127: ENVIRONMENTAL GEOTECHNOLOGY

3 Credits : 45 Hours (L:T:P-3:0:0)

Course Objectives

The main objectives of this course are:

To understand the soil-environment interaction, Soil mineralogy and Mechanisms of soil-water interaction
To learn ground water flow and contaminant transport phenomenon.

To Learn about the principles and practices of waste management, including the design and construction of landfills, hazardous waste containment systems, and other waste disposal methods.

Course Outcomes:

After Successful completion of the course students will be able to:

CO1: Understand Soil-environment interaction, Soil mineralogy and Mechanism of soil-water interaction (Understand)

CO2: Demonstrate a thorough understanding of the physical, chemical, and biological processes that govern the behavior and transport of contaminants in soil and groundwater. (Apply)

CO3: Apply principles of geotechnical engineering to design effective waste management systems, including landfills and hazardous waste containment systems. (Apply)

CO4: Select and implement appropriate remediation technologies for various types of contaminated sites, assessing their effectiveness and limitations. (Understand, Apply)

Module I:[8 hours]

Introduction to Geo Environmental Engineering., Sources & Impact of Contamination and Soil-Waste Interaction

Concepts of Integrated SWM & Geoenvironmental Engineering.

Module II:[7 Hours]

Concepts of waste containment; Sources, production and classification of wastes, Environmental laws and regulations, ground water flow and contaminant transport, desirable properties of soil; contaminant transport and retention; contaminated site remediation.

Module II:[10 Hours]

Mechanisms of soil-water interaction: Diffuse double layer models; Force of attraction and repulsion; Soil-water-contaminant interaction; Theories of ion exchange; Influence of organic and inorganic chemical interaction

Principles and Planning of Landfills, Liners for Landfills, Landfill Covers, Generation and Control of Leachate and Gas from Landfills, Stability of Slopes and Settlement of Landfills

Module III: [10 Hours]

Contaminant analysis. Contaminated site characterization, estimation of landfill quantities, landfill site location, design of various landfill components such as liners, covers, leachate collection and removal, gas generation and management, ground water monitoring, end uses of landfill sites.

Solved examples, Monitoring and Detection of Subsurface Contamination, Costs, Construction Aspects and Site Selection of Landfills. Control, Rehabilitation of Old Dumps and Contaminated Sites.

Module IV: [10 Hours]

Slurry Deposited Waste and their Geotechnical Properties .Planning & Design, Incremental Raisings and Failures of Slurry Ponds ,slurry walls and barrier systems, design and construction, stability, compatibility and performance, remediation technologies, stabilization of contaminated soils and risk assessment approaches. Environmental Control Measures at Slurry Ponds, Geotechnical Reuse of Waste

Suggested readings:

Mitchell, J.K and Soga, K., Fundamentals of Soil Behavior, John Wiley and Sons Inc., 2005.
 Fang, H-Y., Introduction to Environmental Geotechnology, CRC Press, 1997.
 Daniel, D.E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993.
 Rowe, R.K., Quigley, R.M. and Booker, J.R., Clay Barrier Systems for Waste Disposal Facilities, E & FN Spon, 1995.
 Rowe, R.K, Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
 Reddi, L.N. and Inyang, H.F, Geoenvironmental Engineering - Principles and Applications, Marcel Dekker Inc, 2000.
 Sharma, H.D. and Lewis, S.P, Waste Containment Systems, Waste Stabilization and Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994.
 Moocs Course :<https://archive.nptel.ac.in/courses/105/102/105102160/>

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4
Module I	H			
Module II	M	H		
Module III			H	M
Module IV				H

PE5:**1. CVPS0128: Design of Prestressed Concrete Structures**

Credit: 3 (L:T:P-3:0:0)

Course Objective:

The objective of the course is to provide students with a comprehensive understanding of the principles and practices involved in the design and analysis of prestressed concrete systems. At the end of this course, students will be equipped with the necessary knowledge and skills to effectively design and analyze prestressed concrete structures, preparing them for professional practice in the field of civil and structural engineering.

Course Outcomes: At the end of the course, students will be able to

CO1: Identify different prestressing systems and understand the behavior of high-strength concrete and high-strength steel.

CO2: Perform deflection and crack width calculations to assess the serviceability of prestressed concrete structures under various loading conditions(Evaluate)

CO3: Perform analysis and design of prestressed flexural members for limit states of collapse, serviceability, shear and torsion (Apply)

CO4: Analyze the transmission of prestress in anchorage zones and design the end blocks. (Analyze)

CO5: Perform analysis and design of statically indeterminate members leading to the determination of cable profile (Apply)

Syllabus:

Module I: (4 hours)

Concept of Prestressing, Types of Prestressing, Advantages, Limitations, Pre stressing systems - Pre-tensioning and Post tensioning methods, Anchoring devices, Materials - High strength concrete and High strength steel, Stress-Strain curve for High strength concrete, Analysis of prestressed concrete flexural members – Basic concepts, Ultimate strength in flexure – Codal provisions.

Module II: (5 hours)

Losses in Pre stress: Loss of Prestress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel, Deflection and Crack Width Calculations - Deflection due to gravity loads, Deflection due to prestressing force, Total deflection, Limits of deflection, Limits of span-to-effective depth ratio, Calculation of Crack Width - Limits of crack width.

Module III: (14 hours)

Statically Determinate members – Analyze and Design flexural members for ultimate and serviceability limit states, Analyze and design for Shear and Torsion, Codal provisions

Module IV: (14 hours)

Design of End Blocks - Transmission of prestress in Pre-tensioned members, Anchorage zone stresses for Post-tensioned members.

Module V: (8 hours)

Statically Indeterminate members - Analysis and design of continuous beams and frames, Choice of cable profile, Linear transformation and concordancy, Analysis and design of prestressed concrete pipes and columns with moments.

Course Mapping:

	CO1	CO2	CO3	CO4	CO5
Module I	H				
Module II		H			
Module III			H		
Module IV				H	
Module V					H

Books and References:

Prestressed Concrete, Author: N. Krishna Raju, Publisher: McGraw-Hill.

Design of Prestressed Concrete Structures, Author: T.Y. Lin and Ned H. Burns, Publisher: John Wiley and Sons.

Prestressed Concrete: A Fundamental Approach, Author: Edward G. Nawy, Publisher: Pearson College Div.

Principles of Prestressed Concrete, Author: N. Rajagopalan, Publisher: Narosa Book Distributors

Prestressed Concrete Structures, Author: P. Dayaratnam, Publisher: Medtech

IS 1343: Code of Practice for Prestressed Concrete, Publisher: Bureau of Indian Standards

IRC 112: Code of Practice for Concrete Road Bridges, Publisher: The Indian Roads Congress

2. CVWT0129: Industrial waste treatment technology[3-0-0]

Course Objectives:

This course aims to provide a comprehensive understanding of the characteristics and environmental impacts of industrial wastewater. Students will learn about the physico-chemical and biological treatment

methods, and sludge management. This course equips students with the knowledge and skills to develop sustainable and efficient industrial waste treatment solutions.

Course outcomes:

Upon completing the course "Industrial Waste Treatment," students will be able to:

CO1:Analyze and Characterize Industrial Wastewater.?(Analyze)

CO2:Design and Implement Waste Minimization Strategies.(Apply)

CO3:Apply Physico-Chemical and Biological Treatment Methods for Industrial waste water.(Apply)

CO4:Manage the production of Sludge and its treatment.(Understand , Apply)

CO5: Evaluate and Implement Wastewater Reuse Systems. (Apply)

Detailed Syllabus

Module I [5 Hours]

Industrial wastewater – Characteristics – Environmental impacts – Effects of industrial wastes on streams, land – Effluent standards – Scenario in India –

Module II [10 Hours]

Regulatory requirements for industrial wastewater – Prevention Vs control of industrial pollution – Volume reduction – Process Modification – Strength reduction – Methods and materials changes – Waste minimization strategies – Zero discharge concept.

Module III [10 Hours]

Physico-chemical treatment of industrial wastewater – Equalization and neutralization – Separation of solids – Removal of organic and inorganic solids – Oil separation – Precipitation – Membrane methods – Reverse Osmosis – Biological treatment methods – Aerobic and anaerobic methods.

Module IV[10 Hours]

Separation Vs degradation methods – Chemical oxidation – Photocatalysis – Ozonation – Ion exchange – Advanced oxidation processes – Electrochemical methods – Nutrient removal – Land treatment – Sludge production and its management – Quantification and characteristics of sludge – Treatment of sludge and its disposal.

Module V[10 Hours]

Reuse of industrial wastewater – Advantages – Quality requirements for reuse – Zero effluent discharge systems – Residuals of industrial wastewater treatments – Individual and common effluent treatment plants.

References:

Eckenfelder, W. W., Industrial Water Pollution Control, McGraw Hill, 2014.

Nemerow N. L., Industrial Water Pollution, Addison-Wesley Publishing Company Inc., USA, 1978.

Narayana Rao M. and Amal K. Dutta, Wastewater Treatment, Oxford & IBH Publishing Co., Pvt., Ltd. New Delhi, 2001.

Bhatia S. C., Handbook of Industrial Pollution and Control, Volume I & II, CBS Publishers, New Delhi, 2003

Mahajan, S. P., Pollution Control in Process Industries, Tata McGraw Hill Publishing company, New Delhi, 1991.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Module I	H	L			
Module II	M	H			
Module III			H		
Module IV			H	H	
Module V					H

3. CVCM0130: COST MANAGEMENT OF ENGINEERING PROJECTS

3 credits - (L-T-P: 3-0-0)

Objectives: The course aims to provide comprehensive knowledge of the cost management process and cost accounting systems and to enable students to understand basic concepts of project planning, implementation and control. It covers different types of costs and their behavior, integrates the principles of quality management, and identifies different types of budgets involved in the cost management process. In addition, the course is designed to enhance students' career potential by equipping them with advanced techniques and problem-solving skills in cost management.

COURSE / LEARNING OUTCOMES

After Completion of the Course, Student will able to

CO1: Understand the concepts of the strategic cost management process.(Understand)

CO2: Apply cost concepts in decision making and cost management projects.(Apply)

CO3: Implement different phases of project execution in a team project.(Apply)

CO4: Analyse different decision problems.(Analyse)

CO5: Evaluate different qualitative techniques and cost behaviour.(Evaluate)

Detailed Syllabus :

Module I:3 Hours

Introduction: Introduction and overview of the process of strategic cost management.

ModuleII: 7 Hours

Cost concepts: cost concepts in decision making; relevant costs, differential costs, incremental costs and opportunity costs. Objectives of a cost accounting system; inventory valuation; creating a database for operational control; providing data for decision making.

Module III:15 hours

Project: meaning, different types, why manage, cost overrun centres, different phases of project execution: conception to commissioning. Project execution as a conglomerate of technical and non-technical activities. Detailed engineering activities. The most important approvals and documents prior to project implementation. Project team: role of the individual members. Significance of the project location: Required data with significance. Project contracts: Types and contents. Project implementation Project cost control. Bar charts and network diagrams. Project commissioning: mechanics and procedures.

Module IV: 15 Hours

Cost behavior and profit planning Marginal costing: Distinction between marginal costing and absorption costing; break-even analysis, cost-volume-profit analysis. Various decision problems. Standard cost accounting and variance analysis. Pricing strategies: Pareto analysis. Target costing, life cycle costing. Cost accounting in the service sector. Just-in-time approach, material requirements planning, enterprise resource planning, total quality management and theory of constraints. Activity-based cost management, benchmarking; balanced score card and value chain analysis. Budget control; flexible budgets; performance budgets; zero-based budgets. Measuring the profitability of business units; pricing decisions including transfer pricing.

Module V: 5 Hours

Quantitative techniques for cost management, linear programming, PERT/CPM, transportation problems, allocation problems, simulation, learning curve theory.

References:

Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi

Charles T. Horngren and George Foster, Advanced Management Accounting

Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting

Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher

N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Mapping of COs to Syllabus

Unit/COs	CO 1	CO 2	CO 3	CO 4	CO 5
I	H				
II	M	H			
III			H		
IV	L			H	
V	L			M	H

4. CVER0131:Earth Retaining Structures**(3 credits – 45 hours) (L-T-P: 3-0-0)****Objectives**

The objective of this course is to prepare students to analyze and design various types of earth retaining structures.

COURSE / LEARNING OUTCOMES

At the end of the course students will be able to

CO1: Understand various theories in Earth Pressure. (Understanding)

CO2: Explore the Stability of retaining structure. (Applying)

CO3: Analyze the sheet pile walls. (Analyzing)

CO4: Explain aspects related to the design of bulkheads, tunnels, conduits, and braced excavations. (Creating)

Module I: 5 Hours

Earth Pressure: Rankine and Coulomb theories, active, passive and pressure at rest; concentrated surcharge above the back fill, earth pressure due to uniform surcharge, earth pressure of stratified backfills, saturated and partially saturated backfill.

Module II: 10 Hours

Retaining walls: Proportioning of retaining walls, stability of retaining walls, mechanically stabilized retaining walls/reinforced earth retaining walls.

Module III: 15 Hours

Sheet Pile wall: free earth system, fixed earth system.

Module IV: 15 Hours

Bulkheads: bulkheads with free and fixed earth supports, equivalent beam method, Anchorage of bulkheads and resistance of anchor walls, spacing between bulkheads and anchor walls, resistance of anchor plates.

Module V: 15 Hours

Tunnel and Conduit: Stress distribution around tunnels, Types of conduits, Load on projecting conduits; Arching and Open Cuts: Arching in soils.

Module VI: 15 Hours

Braced excavations: Earth pressure against bracings in cuts, Heave of the bottom of cut in soft clays.

Suggested Readings:

1. Das, Braja M., "Principles of Foundation Engineering", PWS Publishing. 1998
2. Bowles. J.E., Foundation Analysis and Design, Tata McGraw-Hill International Edition, 5th Edn, 1997.

Mapping of COs to Syllabus

Course outcomes	CO1	CO2	CO3	CO4
Module I	H			
Module II		H		

Module III			H	
Module IV				H
Module V				H
Module VI				H

PE6:**1. CVCC0132: Cement Composite materials****(3 credits) (L-T-P:3-0-0)****Objective:**

The course aims to equip students with a solid foundation in composite materials, particularly cement composites, and their applications in various structural elements. The course emphasizes both theoretical knowledge and practical skills necessary for analyzing and designing composite material structures.

Module I : (10 Hours)

Introduction: Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

Module II : (10 Hours)

Mechanical Behaviour: Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

Module III : (10 Hours)

Cement Composites: Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete - Ferrocement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing. Mechanical Properties of Cement Composites: Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

Module IV : (10 Hours)

Application of Cement Composites: FRC and Ferrocement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship, Elastic Constants.

Module V : (5 Hours)

Analysis and Design of Cement Composite Structural Elements - Ferrocement, SIFCON and Fibre Reinforced Concrete.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

Understand and explain the classification, characteristics, and stress-strain relations of composite materials, including orthotropic and anisotropic materials.

Analyze the mechanical behavior of composite materials using the mechanics of materials approach and elasticity approach to stiffness, and compare different methods.

Design and apply various types of cement composites such as ferrocement, SIFCON, and fiber-reinforced concrete in practical applications.

COURSE MAPPING:

	CO1	CO2	CO3
Module I	H	M	
Module II		H	
Module III		L	H
Module IV		M	H
Module V		M	H

Suggested Readings

Mechanics of Composite Materials, Jones R. M., 2nd Ed., Taylor and Francis, BSP Books, 1998.

Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.

New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman & Hall, 1983.

Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

Hand Book of Composite Materials-ed-Lubin.

Composite Materials – K.K.Chawla.

Composite Materials Science and Applications – Deborah D.L. Chung.

2. CVOT0133: OPTIMIZATION TECHNIQUES IN CIVIL ENGINEERING

(3 Credits) (L: T:P: 3-0-0)

Objectives

Impart knowledge on the theory of optimization and conditions for optimality for unconstrained and constrained optimization problems

Instil modelling skills necessary to formulate and solve optimization problems in the domain of Civil Engineering.

Familiarize the learners with the working principle of optimization algorithms used to solve linear and non-linear problems

Course/ Learning Outcomes

At the end of this course:

Students will learn the basic philosophy of optimization problems.

Students will be able to formulate and solve linear programming problems.

Students will be able to demonstrate the usage of various direct and indirect non-linear search methods in solving design problems.

Students will be able to find the optimum solution of their problems using genetic algorithm.

Module I (5 hours)

Introduction to optimization, classification of optimization problems, classical optimization techniques.

Module II (10 hours)

Linear Programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming.

Module III (10 hours)

Non-Linear Programming: - One dimensional minimization, unconstrained and constrained minimization, direct and indirect methods.

Module IV (10 hours)

Geometric programming, Optimum design of structural elements like beams and columns.

Module V (10 hours)

Introduction to Genetic Algorithms, Operators, applications to engineering optimization problems.

Suggested Readings

S. S. Rao, "Engineering Optimization: Theory and Practice", Wiley, 2008.

K. Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall, 2005.

S. R. Komaragiri and N. Kumar, "Multicriterion Analysis in Engineering and Management", Prentice Hall, 2010.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4
Module I	H		L	
Module II	M	H		
Module III	M		H	
Module IV	M		H	
Module V				H

CVEI0134: Environmental Impact Analysis and Assessment

(3 Credits) (L: T:P: 3-0-0)

Objectives:

Understand the concept, historical context and wider importance of EIA

Know the key steps in the EIA process.

Understand the importance of Social Impact Assessments and public participation in the EIA process.

Gain an overview of methods and tools that are commonly used to develop an EIA.

Improve collaborative skills and thus gain skills relevant for collaborative EIA development.

Course Outcomes

CO1. Identify Environmental Impacts and methods of their assessment. (Understand)

CO2. Select the mitigation methods of different Environmental Impacts. (Apply)

CO3. Interpret the implications Environmental attributes, Environmental settings and EIA notifications.(Evaluate)

CO4. Implement the Prediction Methods of assessments of Impacts (Apply)

Syllabus:**Module I:(5 Hours)**

Introduction to Environment Management & EIA, Legal, Policy & Regulatory Framework

Module II:[8 Hours]

EIA Procedure - Scoping & Screening and Establishing Baseline Conditions, EIA Methodologies

Module III: [8 Hours]

Connectedness: connected spaces and subspaces, Connectedness of the real line, Intermediate value theorem, EIA Methods, Tools and Techniques

Module IV:[8 Hours]

Public Involvement in EIA , Impact Management - Mitigation & Preparation of Environment Management Plans (EMP)

Module V: [8 Hours]

EIA Reporting & Review of EIA Quality, Decision Making & Project Management

Module VI:[8 Hours]

Implementation & Follow up, EIA Case Examples

Suggested Readings:

- 1) Wathern P., "Environmental Impact Assessment: Theory and Practice", Routledge Publishers, 1990
- 2) Marriott B., "Environmental Impact Assessment: A Practical Guide", McGraw-Hill Publication, 1997
- 3) Shrivastava A.K., Baxter Nicola, Grimm Jacob, "Environmental Impact Assessment", APH Publishers, 2003
- 4) Anjaneyulu Y., Manickam Valli, "Environmental Impact Assessment Methodologies", CRC Press 2011
- 5) Glasson J., Therivel Riki, Chadwick Andrew, "Introduction to Environmental Impact Assessment", Oxford Brookes University 2012/ 4th edition
- 6) E resource: https://onlinecourses.nptel.ac.in/noc22_ar07/preview

Mapping of COs to Syllabus

	CO1	CO2	CO3	CO4
Module I	H			
Module II			H	
Module III	H			
Module IV		H		
Module V				M
Module VI				H

4. CVGW0135: GROUND WATER ENGINEERING**(3 Credits) (L: T:P: 3-0-0)****Objectives**

To learn the fundamentals of groundwater flow.

To learn the hydraulics of different kinds of wells.

To evaluate the aquifer parameters and groundwater level variations for different hydro-geological boundary conditions.

To understand the various facets of ground water quality modelling.

Enable the learners to understand the significance of conjunctive use of ground water along with other fresh water sources.

Course/ Learning Outcomes

At the end of this course students will be able to:

Understand aquifer properties and movement of ground water.(Understand)

Comprehend well hydraulics problems under various hydro-geological scenarios.(Understand)
 Summerise basic concepts and techniques associated with ground water flow modelling.(Understand)
 Identify major sources and types of groundwater contamination.(Understand)
 Understand the challenges and subsequent strategies necessary for groundwater management.
 (Understand)

Module I (15 hours)

Introduction: Definition of groundwater, role of groundwater in hydrological cycle, groundwater bearing formations, classification of aquifers, flow and storage characteristics of aquifers, Darcy's law, anisotropy and heterogeneity, Governing Equations for Groundwater Flow: Dupuit-Forchheimer assumptions, general differential equations governing groundwater flows and their analytical solutions.

Module II (10 hours)

Wells and Well Hydraulics: Different types of wells, construction of wells, steady and unsteady state solutions for confined, unconfined and leaky aquifers, effect of boundaries, method of images, pumping test analysis.

Module III (10 hours)

Groundwater Flow Modelling: Role of groundwater flow models, basic introduction to hydraulic, Hele-Shaw and analog models, introduction to numerical modeling.

Module IV (5 hours)

Groundwater Quality: General problem of contamination of groundwater, sources, remedial and preventive measures, seawater intrusion in coastal aquifers.

Module V (5 hours)

Groundwater Conservation: Regional groundwater budget; resource assessment; estimation of recharge, Indian practice for artificial recharge, Planning of Groundwater Development: constraints on the development, role of flow models, optimal groundwater development.

Suggested Readings

Todd, D.K., "Groundwater Hydrology", John Wiley. 1959
 Bear, J., "Hydraulics of Groundwater", McGraw. 1979
 Bouwer, H., "Groundwater Hydrology", McGraw Hill. 1978
 Walton, W.C., "Groundwater Resources Evaluation", McGraw Hill. 1970
 Freeze and Cherry, "Groundwater", Prentice Hall. 1979
 Driscoll, F.G., "Ground Water and Wells", Johnson Division. 1986
 Raghunath, H. M., "Ground Water", New Age International (P) Limited. 2007

Mapping of COs to Syllabus

Course Out-comes	CO1	CO2	CO3	CO4	CO5
Module I	H	M	M		
Module II	M	H	M		
Module III	H	M	H		
Module IV				H	M
Module V		L	M	H	H

Core Lab1 – CVSD6050: Structural Design Lab

Credits: 2 (L:T:P--0:0:4)

Course Objective:

The course will equip students with the necessary skills and knowledge to independently design and produce detailed drawings of complete structures. Through hands-on projects, students will gain practical experience in applying design principles and standards to real-world structural engineering scenarios. Furthermore, students will learn to design complete multistory buildings using both the Equivalent Static Method and Dynamic Analysis Method.

Course Outcomes: At the end of the course, students will be able to

CO1: Design and Detail all the Structural Components of Frame Buildings.

CO2: Design and Detail complete Multi-Storey Buildings using equivalent static and dynamic analysis method.

List of Experiments/Assignments:

Experiment I: Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.

Experiment II: Design a Multi-Storey building using Equivalent Static Method.

Experiment III: Design a Multi-Storey building using Dynamic Analysis Method.

Suggested Readings:

Sap2000 (Structural Analysis and Design) software.

STADD Pro (3D Structural Analysis and Design) Software.

AutoCAD software for 2D and 3D structures

ETABS (Building Analysis and Design) software.

Core Lab 2-

CVNA6051: Numerical Analysis lab

2 credits-30 Hours (L:T:P:0:0:2)

Course Objectives: The course aims to provide the knowledge of computer programming to write the codes for the numerical methods learned in “Numerical Analysis” using C language and/or MATLAB.

Course Outcomes: Upon successful completion of the course, students will be able to:

CO1. Write computer programs to solve engineering problems with MATLAB and/or C Language.(Apply)

CO2. Implement numerical methods in MATLAB /C Language.(Apply)

CO3. Analyze the stability of the algorithm.(Analyze)

CO4. Analyze and evaluate the accuracy of common numerical methods.(Evaluate)

CO5. Ability to use approximation algorithms in real-world problems.(Apply)

List of Practicals:

Gaussian elimination, Jacobi, Gauss Seidel methods.

Bisection method, fixed point iteration scheme, Newton-Raphson method, secant method.

Lagrange's interpolation formula, Newton's divided difference formula.

Trapezoidal rule, Simpson's 1/3,3/8-rules.

Euler's method modified Euler's method, Runge-Kutta method, Milne's method, Adams-predictor-corrector method.

Essential Readings:

1. W. H. Press, B. P. Flannery, S. A. Teukolsky, W. T. Vetterling, “Numerical Recipes in C”, Cambridge University Press, 1st edition,1988.

Supplementary Readings:

1. M. Pal, Numerical Analysis for Scientists and Engineers: Theory and C Programs, Narosa, 2008.

Core Lab 3-
CVSM6052: Soil Mechanics Lab
2 credits - (L-T-P: 0-0-4)

COURSE / LEARNING OUTCOMES

At the end of the course student will be able

CO1: Identify the index properties of soil (Understand)

CO2: Determine the engineering properties of soil (Apply)

CO3: Assess shear strength using the vane shear test (Evaluate)

CO4: Analyze data from standard, static, and dynamic cone penetration tests (Analyze)

List of Practicals:

Determination of Moisture Content and Specific gravity of soil

Grain Size Distribution Analysis and Hydrometer Analysis

Atterberg Limits (Liquid Limit, Plastic limit, Shrinkage limit)

Standard and modified proctor compaction test

Falling head permeability test and Constant head permeability test

Consolidation test

Unconfined compression test

Direct shear test

Tri-axial compression test – UU, CU, CD tests

Laboratory vane shear test

Field Vane shear test

Standard penetration test

Static cone penetration test

Dynamic cone penetration test

Core Lab 4
CVCF6053: COMPUTATIONAL FLUID DYNAMICS LAB
(2 Credits)

Objectives

To develop basic programming skills in computational fluid dynamics to address engineering problems.

To understand the basic structure and capabilities of free and opensource CFD framework OpenFOAM.

To demonstrate the capabilities of OpenFOAM, in conjunction with other opensource software, for simulating flow past 2-dimensional bluff bodies.

Course/ Learning Outcomes

At the end of this course students will be able to:

Write simple scripts in GNU Octave for solving partial differential equations using explicit and implicit finite difference method. (Apply)

Learn the basic methodology of adopted for any CFD simulation process. (Understand)

Comprehend the strengths and weaknesses of the opensource finite volume framework OpenFOAM. (Understand)

Understand the basic structure and usage of OpenFOAM and other opensource packages like GMSH and ParaView demonstrating the significant steps involved in CFD analysis. (Understand)

Analyze basic bluff body hydrodynamics problems using OpenFOAM. (Analyze)

List of Experiments

Solution of one-dimensional unsteady diffusion equation using explicit finite difference method (FDM).

Solution of one-dimensional unsteady diffusion equation using implicit FDM.

Solution of elliptic partial differential equation – Laplace Equation using FDM.

Geometry creation and mesh generation of a 2-dimensional circular cylinder.
Simulation of laminar flow past a circular cylinder using OpenFOAM
Post-processing of the simulation data using ParaView.

Mapping of COs to Syllabus

Course Outcomes	CO1	CO2	CO3	CO4	CO5
Expt. 1	H				
Expt. 2	H				
Expt. 3	H				
Expt. 4		H	L	H	L
Expt. 5		H	H	H	M
Expt. 6		H	M	H	H

Mapping of POs, PSOs vs. Courses

Course	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
Advanced Structural Analysis		H	M		H	H	H	H	M
Physico- chemical Processes of water and waste water	L	H	M		M	H	H	H	L
Advanced foundation Engineering		H	M		H	H	H	H	H
Advanced Hydrology		H	M			H	H	M	L
Hydraulic Structures						H	H	M	L
Air Pollution			H	H		H	H	H	L
Theory of Vibration	L		H	H	M	H	H	H	M
Geotextile in Civil Engineering			H		H	H	H	M	M
Ground Improvement Techniques	L	H	H	H	H	H	H	M	M
Earthquake resistant design of structures		H	H	H	M	H	H	M	H
Irrigation and drainage		H	H	H		H	M	M	L
Solid and hazardous Waste Management	M	H	H	H	L				
Structural Design Lab	H					H	H	M	L
Numerical Analysis Lab	H					H	L	H	L
Research Methodology and IPR	M								
Constitution of India				H					
Geotechnical Earthquake Engineering	L	H	H			H	H	H	M
Design of Substructures		H	H		M	H	H	H	M
Advanced steel Design		H	H			H	H	H	L
Fluvial Hydraulics	L	H	M		H	H	H	H	L
Advanced Fluid Mechanics	H	H	H			H	H	H	L

Pavement Analysis and Design	M	H	H		H	H	H	H	L
Design of Advanced Concrete Structures		H	H		H	H	H	H	M
Environmental Geotechnology	H	H	H	H	H	H	H	M	M
Soil Mechanics Lab	H	M	M	L	H	H	H	H	L
Computational Fluid Lab	H		H			H	H	H	L
Mini Project	H			H		H	H	H	H
English in Research paper writing				H				M	
Design of Prestressed Concrete Structures		H	H			H	H	M	M
Industrial waste treatment technology	M	M	M	H		H	M	H	H
Cost management of Engineering Projects		M	M	H	L	M	M	L	M
Earth retaining structures		H	H	M	M	M	M	H	H
Cement Composite Materials	M	H	H		M	H	L	H	H
Optimization Techniques in Civil Engineering		H	M		M	H	H		M
Environmental Impact Analysis and Assessment				H		M			M
Ground water Engineering	M	H			M	H	L	H	M
Dissertation Phase I	H			M	H	H	H	H	H
Dissertation Phase II	H			M	H	H	H	H	H

Programme outcomes

PO1. An ability to conduct field and laboratory experiments and interpret data in construction industry.

PO2. An ability to design a system to meet desired needs within realistic constraints such as economic, environmental, social, safety and sustainability in construction industry

PO3. An ability to use the techniques, skills and modern engineering tools

PO4. An understanding of professional and ethical responsibility while working in construction industry

PO5. an ability to engage in life-long learning to update the knowledge in construction materials and management

Programme Specific Outcomes

Exhibit detailed professional knowledge in core sub-specializations of civil engineering including structural engineering, geotechnical engineering, hydraulic and environmental engineering and transportation engineering.

Demonstrate analytical and design skills using various technical supports.

Display the ability to tackle research projects and development works in various field of civil engineering using analytical, computational and experimental techniques.

Ability to integrate the knowledge gained from the various core and elective courses for collaborative and multi-disciplinary solutions of different civil engineering challenges.

**M.Tech in Civil Engineering – Autumn 2024
New Curriculum**

Semester I (First year)								
SI N o	Type	Course Cate- gory	Course Code	Course name	Teaching Scheme (Hrs)			Credits
					L	T	P	
1	The- ory	Core I	CVSA0108	Advanced structural analysis	3	1	0	4
2		Core II	CVPW0109	Physico-chemical treatment of water and waste water	3	1	0	4
3		PE1	CVHS112	Hydraulic structures	3	0	0	3
			CVAP0113	Air Pollution and Control				
			CVTV0114	Theory of Vi- bration				
			CVGT0115	Geotextile in Civil Engi- neering				
4		PE2	CVIT0116	Ground Im- provement Techniques	3	0	0	3
			CVRD0117	Earthquake resistant de- sign of struc- tures				
			CVID0118	Irrigation and drainage				
			CVSD0119	Solid and Hazardous Waste Man- agement				
5	Lab	Core Lab 1	CVSD6050	Structural De- sign Lab-1	0	0	2	1
6		Core Lab 2	CVNA6051	Numerical Analysis Lab	0	0	2	1

7	Theory	MLC 1	ECRM0042	Research Methodology and IPR	2	0	0	2
9		Audit 1	EGRW0015	English in Research paper writing	2	0	0	0
TOTAL					16	2	4	18

Semester II (First year)								
SI N o	Type	Course Cate- gory	Course Code	Course name	Teaching Scheme (Hrs)			Cred- its
					L	T	P	
1	The- ory	Core III	CVAF0110	Advanced foundation Engineering	3	1	0	4
2		Core IV	CVAH0111	Advanced Hydrology	3	1	0	4
3		PE3	CVGE0120	Geotechnical Earth- quake Engineering	3	0	0	3
			CVDS0121	Design of Substruc- tures				
			CVAS0122	Advanced steel De- sign				
			CVFH0123	Fluvial Hydraulics				
4		PE4	CVAF0124	Advanced Fluid Me- chanics	4	0	0	4
			CVPA0125	Pavement Analysis and Design				
			CVCS0126	Design of Advanced Concrete Structures				
			CVEG0127	. Environmental Ge- otechnology				
5	Lab	Core Lab 3	CVSM6052	Soil Mechanics Lab	0	0	2	1
6		Core Lab 4	CVCF6053	Computational Fluid Lab	0	0	2	1
7			CVMI6054	Mini Project	0	0	4	2
9	The- ory	Audit 2	EDPC0201	Indian Polity and Con- stitution	2	0	0	0
TOTAL					15	2	8	19

Semester III (Second year)						
SI No	Type	Course Category		Course name	Teaching Scheme (Hrs)	Credits

			Course Code		L	T	P	
3		PE5	CVPS0128	Design of Pre-stressed Concrete Structures	3	0	0	3
			CVWT0129	Industrial waste treatment technology				
			CVCM0130	Cost management of Engineering Projects				
			CVER0131	Earth retaining structures				
4		PE6	CVCC0132	Cement Composite Materials	3	0	0	3
			CVOT0133	Optimization Techniques in Civil Engineering				
			CVEI0134	Environmental Impact Analysis and Assessment				
			CVGW0135	Ground Water Engineering				
7		Dissertation	ICVDI6055	Dissertation Phase -I	0	0	20	10
TOTAL					6	0	20	16

Semester IV (Second year)								
SI No	Type	Course Category	Course Code	Course name	Teaching Scheme (Hrs)			Credits
					L	T	P	
1		Dissertation	CVDI6056	Dissertation Phase II	0	0	32	16
TOTAL					0	0	32	16

Total Credits = 69

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PROGRAMME: MASTER OF TECHNOLOGY (MTECH) - ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER I						
Type	Course Type/Category	Course Code	Course Name	L-T-P	Credits	Page No
Specialization: Power Systems						
Theory	Core 1	EESA0048	Power System Analysis	3-0-0	3	1537
	Core 2	EESD0049	Power System Dynamics-I	3-0-0	3	1538
	Core	ECRM0042	Research Methodology and IPR	2-0-0	2	
	Programme Specific Elective I	EEHP0050	High Power Converters	3-0-0	3	1539
		EEWS0051	Wind and Solar Systems			1540
	Programme Specific Elective II	EEPD0052	Electrical Power Distribution System	3-0-0	3	1541
		EEMM0053	Mathematical Methods for Power Engineering			1542
Lab	Lab1	EESS6033	Power System Steady State Analysis Lab	0-0-4	2	1561
	Lab2	EERE6034	Renewable Energy Lab	0-0-4	2	1561
Specialization: Control Systems						
Theory	Core 1	EEMC0054	Mathematical Methods in Control	3-0-0	3	1543
	Core 2	EENS0055	Non-Linear Systems	3-0-0	3	1544
	Core	ECRM0042	Research Methodology and IPR	2-0-0	2	
	Programme Specific Elective I		Robotics and Automation	3-0-0	3	
		EECL0056	Digital Control			1544
		EENC0057	Non-Linear Control			1545
	Programme Specific Elective II		Systems Biology	3-0-0	3	
		EESC0058	SCADA system and Applications			1546
		EEDA0059	Design Aspects in Control			1547
Lab	Lab1	EECT6035	Control Lab 1	0-0-4	2	1562
	Lab 2	EECL6036	Control Lab 2	0-0-4	2	1562
Audit	Audit 1	EGRW0015	English for Research Paper Writing	2-0-0	0	
Total Credits				16-0-8	18	
SEMESTER II						
Specialization: Power Systems						
Theory	Core 3	EEDP0060	Digital Protection of Power System	3-0-0	3	1547
	Core 4	EEPD0061	Power System Dynamics-II	3-0-0	3	1548
	Programme Specific Elective III	EERP0062	Restructured Power Systems	3-0-0	3	1549
		EEAS0063	Advanced Digital Signal Processing			1550
	Programme Specific Elective IV	EEAS0064	Power System Transients	3-0-0	3	1551
		EEFC0065	FACTS and Custom Power Devices			1552
Lab	Lab3	EEPL6037	Power System Protection Lab	0-0-4	2	1562
	Lab4	EEPA6038	Power Electronics Applications to Power Systems Lab	0-0-4	2	1563

	Specialization: Control Systems					
Theory	Core 3	EEOC0066	Optimal Control Theory	3-0-0	3	1553
	Core 4	EESF0067	Stochastic Filtering and Identification	3-0-0	3	1554
	Programme Specific Elective III	EECS0068	Advance Control System	3-0-0	3	1555
		EEAL0069	Adaptive Learning and Control	3-0-0	3	1556
	Programme Specific Elective IV	EEMR0070	Model Reduction in Control	3-0-0	3	1556
		EERC0071	Robust Control	3-0-0	3	1557
			Networked and Multi agent Control Systems			
			Advanced DSP			
Lab	Lab3	EEAL6039	Advanced Control Lab 1	0-0-4	2	
	Lab4	EEAC6040	Advanced Control Lab 2	0-0-4	2	
Project		EEMP6041	Mini Project	0-0-4	2	1564
Audit	Audit (MOOCs)	2 EDCI0100	Constitution of India	0-0-4	2	
Total Credits				14-0-12	18	
SEMESTER III						
	Specialization: Power Systems					
Theory	Prog. Specific Elective V	EESC0058	SCADA System and Applications	3-0-0	3	1546
		EEMC0087	Advanced Micro-Controller Based Systems	3-0-0	3	1558
		EEPQ0088	Power Quality			1559
	Specialization: Control Systems					
	Prog. Specific Elective V	EEMD0089	Modeling and Control of Distributed parameter system	3-0-0	3	
		EESC0090	Stochastic Control	3-0-0	3	
			Computational Methods	3-0-0	3	
	Open Elective		1. Business Analytics	3-0-0	3	
			2. Industrial Safety	3-0-0	3	
			3. Operations Research	3-0-0	3	
			4. Cost Management of Engineering Projects	3-0-0	3	
			5. Composite Materials	3-0-0	3	
		EEWE0092	6. Waste to Energy	3-0-0	3	1560
Project	Dissertation	EEDI6050	Dissertation Phase – I	0-0-20	10	1564
Total Credits				6-0-20	16	
SEMESTER IV						
Project	Specialization: Power Systems					
	Dissertation	EEDI6051	Dissertation Phase – II	0-0-32	16	1564
	Specialization: Control Systems					
	Dissertation	EEDI6051	Dissertation Phase – II	0-0-32	16	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

SCHOOL OF TECHNOLOGY

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

VISION

To be a centre of technological excellence for outstanding education and research in electrical and electronics engineering, contributing to the world socially committed engineers capable of accepting the continuous challenges of technological advancements.

MISSION

The department of Electrical and Electronics Engineering of Don Bosco College of Engineering and Technology, School of Technology, Assam Don Bosco University seeks to:

Achieve excellence in teaching, research, practice and extension activities in the fields of Engineering in general and Electrical and Electronics Engineering in particular.

Provide a strong foundation for the students to make them professionally competent for industry and research.

Create an environment for the holistic development of individuals, encouraging them to serve the society with commitment and integrity.

Offer necessary support and guidance to individuals to shape their ideas into reality.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOS)

To create an environment, give opportunity and also encourage the individuals to build a strong foundation of Electrical and Electronics Engineering as well as in related interdisciplinary fields of study, to be able to contribute to the need of the industry and the society at large.

To make students capable of generating ideas, apply their knowledge and analyse the situations for executing live projects in Electrical and Electronics Engineering, with modern tools, equipment and software.

To inculcate the habit of teamwork and infuse management skills in the students for their future professional life.

To guide students to become ethical professionals in their own fields of work and be conscious about the effect of technology on the environment.

PROGRAMME-SPECIFIC OUTCOMES (PSO) OF M.TECH. IN ELECTRICAL AND ELECTRONICS ENGINEERING (SPECIALIZATION- POWER SYSTEMS)

PSO 1: Ability to apply the enhanced knowledge in advanced technologies for modeling, analyzing and solving contemporary issues in the power sector with a global perspective and to carry out detailed and independent investigation on multifaceted complex problems in the area of power systems and to envisage advanced research in allied thrust areas.

PSO 2: Ability to express ideas clearly and communicate orally as well as in writing with others in an effective manner, adhering to various national and international standards and practices for the documentation and presentation of the contents.

PSO 3: Ability to critically analyze and identify real-life engineering problems in the area of power systems; and professionally and ethically provide strategic solutions satisfying the safety, societal, cultural, financial and environmental aspects/ needs with an eagerness for continued pursuance of research to design, develop or propose theoretical and practical methodologies towards the research and development support for the power system infrastructure.

PSO 4: Ability to utilize and develop modern tools for modeling, analyzing and solving various scientific problems related to power systems and to take up technical/administrative challenges including the management of various projects of interdisciplinary nature, working in a team with mutual understandings to take unsophisticated challenges leading and motivating the group to inculcate multidisciplinary and collaborative approach.

PROGRAMME-SPECIFIC OUTCOMES (PSO) OF M.TECH. IN ELECTRICAL AND ELECTRONICS ENGINEERING (SPECIALIZATION- CONTROL SYSTEMS)

- PSO 1: Ability to apply the enhanced knowledge in advanced technologies for modeling, analyzing and solving contemporary issues in system and control engineering with a global perspective and to carry out detailed and independent investigation on multifaceted complex problems in the area of system engineering and control and to envisage advanced research in allied thrust areas.
- PSO 2: Ability to express ideas clearly and communicate orally as well as in writing with others in an effective manner, adhering to various national and international standards and practices for the documentation and presentation of the contents.
- PSO 3: Ability to critically analyze and identify real-life engineering problems in the area of control systems; and professionally as well as ethically provide strategic solutions satisfying the safety, societal, cultural, financial and environmental aspects/ needs with an eagerness for continued pursuance of research to design, develop or propose methodologies, both of academic and applied nature, in the area of mathematical and applied control systems.
- PSO 4: Ability to use the techniques, skills and modern control engineering tools necessary for engineering practices and to take up technical/administrative challenges including the management of various projects of interdisciplinary nature, while working in a team with mutual understandings to take unsophisticated challenges leading and motivating the group to inculcate multidisciplinary and collaborative approach.

DETAILED SYLLABUS THEORY COURSES

EESA0048: POWER SYSTEM ANALYSIS (3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to give the knowledge of various methods of load flow, analysis of various types of faults in power systems, concept of security & contingency analysis of power systems and their needs for maintaining security of the system. It also introduces the concept of state estimation and the phenomenon of voltage instability in power systems.

Course Outcomes

- Find different parameters for the analysis of power system. (Remembering)
- Explain methods of state estimation in power system. (Understanding)
- Organize various contingencies according to their severity. (Applying)
- Analyse simultaneous fault using generalized method. (Analysing)
- Determine voltage magnitude and phase-angles at all buses for the given data using various methods of load flow. (Evaluating)

Module I: Load Flow (10 hours)

Overview of Newton-Raphson, Gauss-Seidel, fast-decoupled methods, convergence properties, sparsity techniques, handling Q- max violations in constant matrix, inclusion in frequency effects, AVR in load flow, handling of discrete variables in load flow.

Module II: Fault Analysis (7 hours)

Simultaneous faults, short circuit and open conductor faults, generalized method of analysis of simultaneous faults in power systems.

Module III: Security Analysis (7 hours)

Security state diagram, contingency analysis, generator shift distribution factors, line outage distribution factor, multiple line outages, overload index ranking.

Module IV: Power System Equivalents (5 hours)

WARD equivalents (Kron reduction), WARD equivalent circuits for power flow studies, REI equivalents for power systems.

Module V: State Estimation (8 hours)

Sources of errors in measurement, Virtual and Pseudo, Measurement, Observability, Tracking state estimation, WSL method, bad data correction.

Module VI: Voltage Stability (8 hours)

Introduction to voltage instability scenario in a single machine infinite bus system, Voltage collapse, P-V curve, multiple power flow solution, continuation power flow, optimal multiplies load flow.

Suggested Readings

- J. J. Grainger and W. D. Stevenson, "Power system analysis", McGraw Hill, 2003.
 A. R. Bergen and Vijay Vittal, "Power System Analysis", Pearson, 2000.
 L. P. Singh, "Advanced Power System Analysis and Dynamics", New Age International, 2006.
 G. L. Kusic, "Computer aided power system analysis", Prentice Hall India, 1986.
 A. J. Wood, "Power generation, operation and control", John Wiley, 1994.
 P. M. Anderson, "Faulted power system analysis", IEEE Press, 1995.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	M		H			H
CO 2		M		M	H	
CO 3			H	H		
CO 4		H	M			
CO 5	H					H

EESD0049: POWER SYSTEM DYNAMICS-I
(3 Credits - 45 hours) (L-T-P: 3-0-0)
Objective

The objective of this course is to give the concept of power system dynamics and its physical interpretation, development of mathematical models for synchronous machine and modeling of induction motor, prime mover controller, load modeling in power systems and stability analysis with and without power system stabilizer.

Course Outcomes

- List the various stability problems in power systems. (Remembering)
- Describe the modeling of electrical machines and excitation systems. (Understanding)
- Solve problems related to various electrical machines and excitation systems. (Applying)
- Find different parameters of Electrical machines. (Analyzing)
- Experiments to observe power system dynamics using simulation. (Evaluating)

Module I: Synchronous Machine (8 hours)

Basic concepts of stability, types of stability, stability phenomena Armature and field structure, MMF waveforms, equations, Direct and quadrature axes, Mathematical description of a synchronous machine, Basic equations of synchronous machine.
 Park's Transformation (modified), Flux-linkage equations.

Module II: Synchronous Machine Equations (8 hours)

Voltage and current equations, Stator self and mutual inductances, mutual inductances between stator and rotor, Electrical power and torque equations
 per unit stator and rotor voltage, flux, inductance, power and torque, phasor representation, dq-0 transformations of stator and rotor Current and Voltage, rotor angle, Formulation of State-space equations, Equivalent

Module III: Modeling and Analysis of Synchronous Machine (6 hours)

Sub-transient and transient inductance and Time constants, Simplified models of synchronous machines

Module IV: Small Signal Model (8 hours)

Introduction to frequency model. Models of governor, turbine, power system stabilizer and FACTS devices.

Module V: Excitation System and Load (8 hours)

Excitation systems requirements, Elements of an excitation system, types of excitation systems: dc excitation systems, ac excitation systems, static excitation systems, Recent developments and future trends, Philips-Heffron model, PSS Load modeling.

Module VI: Induction Motors (7 hours)

Modeling of Induction Motors, equation of induction machines, steady state characteristics modeling of Prime mover, Prime mover controllers.

Suggested Readings

- P. M. Anderson & A. A. Fouad "Power System Control and Stability", Galgotia, New Delhi, 1981.
 J. Machowski, J. Bialek & J. R. W. Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997.
 P. Kundur, "Power System Stability and Control", McGraw Hill Inc., 1994.
 E. W. Kimbark, "Power system stability", Vol. I & III, John Wiley & Sons, New York 2002.
 D. Mondal, A. Chakrabarti & A. Sengupta, "Power System Small Signal Stability Analysis and Control", Academic Press, 2014.
 J Machowski, J Bialek & J. R W. Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997.
 E.W. Kimbark, "Power system stability", Vol. I & III, John Wiley & Sons, New York 2002.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2	H	H	L		M	M
CO 3	H	H				M
CO 4		H	M	M	M	
CO 5	L					

EEHP0050: HIGH POWER CONVERTERS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

Students will be able to understand the need of high power rated converters and analyze the different topologies involved for these converters. It will provide a holistic approach to comprehend the design of protection circuits for these converters.

Course Outcomes

Define the characteristics of PSDs such as SCRs, GTOs, IGBTs and use them in practical systems. (Remembering)

Explain the working of multi-level VSIs, DC-DC switched mode converters, Cyclo-converters and PWM techniques. (Understanding)

Analyze performance of converters based on output characteristics. (Analyzing)

Compare various types of Power Inverters. (Evaluating)

Module I: Power Switching Devices (10 hours)

Power electronic systems: an overview of PSDs, multi-pulse diode rectifier, multi-pulse SCR rectifier .

Module II: Power Inverters (15 hours)

Phase shifting transformers, multilevel voltage source inverters: two level voltage source inverter, Cascaded, H bridge multilevel inverter. Diode clamped multilevel inverters, flying capacitor multilevel inverter, PWM current source inverters.

Module III: Power Inverters (13 hours)

DC to DC switch mode converters, AC voltage controllers: Cyclo-converters, matrix converter.

Module IV: Power Inverters (7 hours)

Power conditioners and UPS, design aspects of converters, protection of devices and circuits.

Suggested Readings

N. Mohan, T. M. Undel & W. P. Robbins, "Power Electronics: Converter, Applications and Design", John Wiley and Sons, 1989.

M. H. Rashid, "Power Electronics", Prentice Hall of India, 1994.

B. K. Bose, "Power Electronics and A.C. Drives", Prentice Hall, 1986.

Bin Wu, "High power converters and drives", IEEE press, Wiley Enter science.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2			M	
CO 3			M	M
CO 4				M

EEWS0051: WIND AND SOLAR SYSTEMS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective:

The objectives of this course are-

To expose the students to wind and solar energy systems. To make the students understand the factors involved in installation and commissioning of a Solar or Wind plant and to facilitate the students learn the dynamics involved when solar and wind energy systems are interconnected with power system grid.

Course Outcomes

Distinguish the various renewable energy sources. (Understanding)

Identify various advantages and disadvantages of wind and solar energy systems. (Applying)

Identify the possibility of solar power generation in India and across the globe. (Applying)

Develop new renewable energy generation system. (Creating)

Module I (8 hours)

Historical development and current status of wind and solar systems. Characteristics of wind and solar power generation. Network integration issues of renewable energy systems.

Module II (8 hours)

Generators and power electronics for wind turbines, Use of DFIG for wind energy, power quality standards for wind turbines, Technical regulations for interconnections of wind farms with power systems.

Module III (8 hours)

Isolated wind systems, reactive power and voltage control, economic aspects.

Module IV (8 hours)

Impact of wind energy systems on power system dynamics and stability, Wind energy systems grid connection and power system interconnection issues.

Module V (6 hours)

Introduction of solar systems, merits and demerits of solar energy conversion systems, solar concentrators, various applications of solar energy conversion systems.

Module VI (7 hours)

Solar thermal power generation, PV power generation, Energy Storage device. Designing the solar system for small installations.

Suggested Readings

Thomas Ackermann (Editor), "Wind Power in Power Systems", John Wiley & Sons. Ltd., 2005.

Siegfried Heier, "Grid Integration of Wind Energy Conversion Systems", 2nd Edition, John Wiley and Sons Ltd, 2006.

K. Sukhatme & S. P. Sukhatme, "Solar Energy", 3rd Edition, Tata McGraw Hill, 1996.

NPTEL Lectures

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M			
CO 3					H	H
CO 4				H	H	

EEPD0052: ELECTRICAL POWER DISTRIBUTION SYSTEM

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to make the students familiar with topics on electrical distribution system planning, load characteristics, application of distribution transformers, design of sub-transmission lines, distribution substations, primary systems, and secondary systems, voltage drop and power-loss calculations, application of capacitors, harmonics on distribution systems, voltage regulation, and smart grid concepts.

Course Outcomes

Demonstrate the knowledge of various distribution transformers, load characteristics, and associated factors. (Understanding)

Illustrate primary and secondary distribution networks. (Understanding)

Analyze voltage drops in distribution systems and choose proper measures to counteract voltage drops. (Analyzing)

Explain the integration of smart grid with the distribution management system. (Evaluating)

Module I: Distribution System Planning and Automation (8 hours)

Introduction, Distribution System Planning, Factors Affecting System Planning, Present Distribution System Planning Techniques, Central Role of the Computer in Distribution Planning, Distribution System Automation, load characteristics, Diversified demand, Non-coincident demand, Coincidence factor, Contribution factor problems, Relationship between the Load and Loss Factors, Load Forecasting, Rate structure, Customer billing.

Module II: Application of Distribution Transformers (8 hours)

Types of Distribution transformers, Regulation, Efficiency, single-phase transformer connections, Three-phase transformer connections, Auto-transformer, Booster transformer, phasor diagrams, Grounding Transformers.

Module III: Design of Sub-transmission Lines and Distribution Substations (8 hours)

Sub-station bus schemes, Rating of distribution substation, Service area with multiple feeders, Sub-station application curves, Percent voltage drop calculations, Substation Grounding, Types of Ground Faults.

Module IV: Design Considerations of Primary and Secondary Systems (8 hours)

Radial type, Loop type primary feeder, primary feeder loading, Radial Feeders with Uniformly Distributed Load, Introduction to Secondary Systems, secondary Banking, Secondary networks, Network transformers, Economic Design of Secondaries - General Total Annual cost (TAC), equation with and without constraints, Unbalanced loads and voltages.

Module V: Voltage-Drop and Application of capacitors (8 hours)

3-phase and Non 3-phase primary lines, Single-phase two-wire laterals with ungrounded neutral, Single-phase two-wire ungrounded laterals, Application of capacitors to distribution systems, Effect of series and shunt capacitors, power factor correction, Economic justification for capacitors, Optimum location for capacitor bank.

Module VI: Concept of Smart Grid (5 hours)

Need for Establishment of Smart Grid, Distributed Automation, SCADA, Integration of Smart Grid with the Distribution Management System, Evolution of Smart Grid, Smart Microgrids, Topology of a Microgrid, Consumer Information Service (CIS), Automatic Meter Reading (AMR).

Suggested Readings

Turan Gönen, "Electric Power Distribution Engineering", CRC Press, 2014.

A. S. Pabla, "Electric Power Distribution", McGraw Hill Education (India) Private Limited, 2011.

T. A. Short, "Electric Power Distribution Equipment And Systems", CRC Press, 2004.

Kamalesh Das, "Electrical power Systems for Industrial Plants", Jaico Publishing House, 2007.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H		M		L
CO 2			H	H		
CO 3			M		H	
CO 4	M					H

EEMM0053: MATHEMATICAL METHODS OF POWER ENGINEERING

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

The objective of this course is to make the students understand the relevance of mathematical methods to solve engineering problems and to facilitate the students to learn how to apply the mathematical methods for a given engineering problem.

Course Outcomes

Demonstrate an understanding about vector sources, linear transformation, Eigen values and eigenvectors of linear operators. (Understanding).

Apply the knowledge of linear programming problems in various fields of power engineering. (Applying).

Utilize various techniques of nonlinear programming for solving constrained and unconstrained nonlinear programming problems. (Applying)

Justify the use of stochastic processes in the field of power engineering. (Evaluating)

Module I: Vectors and Linear Transformation (6 hours)

Definition of group and field, Vectors and vector spaces, Characterization of vector spaces, Linear transformation, Singular and Non-singular transformation, Matrix representation of linear transformation.

Module II: Eigen Vectors of Linear Operator (6 hours)

Eigen values and Eigen vectors of linear operator, Eigen spaces, Eigen basis for matrices, Eigen decomposition.

Module III: Introduction to Linear Programming (9 hours)

Linear programming problems, Graphical method, Simplex method, Dual-Simplex method, Duality, Non Linear programming problems.

Module IV: Introduction to Non-Linear Programming (8 hours)

Unconstrained problems, Newton's method, Hessian matrix, Search methods, Constrained problems.

Module V: Constrained Optimization (8 hours)

Lagrange method, Interpretation of Lagrange multipliers, Quadratic Programming problem, Kuhn-Tucker conditions, Random variables, Distributions.

Module VI: Stochastic Model/ Process (8 hours)

Definition, Independent random variables, Marginal and Conditional distributions, Elements of Stochastic process, State space, Index set.

Suggested Readings

Kenneth Hoffman & Ray Kunze, "Linear Algebra", 2nd Edition, PHI, 1992.

Erwin Kreyszig, "Introductory Functional Analysis with Applications", John Wiley & Sons, 2004.

Irwin Miller and Marylees Miller, "John E. Freund's Mathematical Statistics", 6th Edition, PHI, 2002.
 J. Medhi, "Stochastic Processes", New Age International, New Delhi, 1994.
 Papoulis and S. Pillai, "Probability, Random Variables and Stochastic Processes", 3rd Edition, McGraw Hill, 2002.
 John B. Thomas, "An Introduction to Applied Probability and Random Processes", John Wiley, 2000.
 Hillier F. S. and Lieberman G. J., "Introduction to Operations Research", 7th Edition, McGraw Hill, 2001.
 Simmons D. M., "Non Linear Programming for Operations Research", PHI, 1975.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H				
CO 2			H			
CO 3				H	H	
CO 4						H

EEMC0054: MATHEMATICAL METHODS IN CONTROL

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

This course aims to give the students an understanding of foundational concepts in linear algebra and random processes for use in control systems. Students will understand Probability and Random variables.

Course Outcomes

Define vector space vector space axioms, vector space properties. (Remembering)
 Explain responses of linear systems to any given input signal. (Understanding)
 Apply matrix properties and functions to a given problem. (Applying)
 Solve problems of control system Engineering using probability theory. (Creating)

Module I (10 hours)

Linear Spaces – Vectors and Matrices, Transformations, Norms, Matrix Factorization.

Module II (10 hours)

Eigen value, Eigenvectors and Applications, SVD and Applications, Projections and Least Square Solutions.

Module III (10 hours)

Probability, Random variables, Probability distribution and density functions, Joint density and conditional distribution, Functions of random variables and random vectors.

Module IV (5 hours)

Characteristic functions and correlation matrices, Random Processes and properties.

Module V (5 hours)

Response of Linear systems to stochastic inputs, PSD theorem.

Suggested Readings

G. Strang, "Introduction to Linear Algebra", 4th Edition, Wellesley-Cambridge Press, 2009.
 Papoulis and S. Pillai, "Probability, random variable and stochastic processes", McGraw Hill, 2002.
 H. Stark and J. W. Woods, "Probability and random processes with application to signal processing", Pearson Education Asia, 2002.
 J. A. Gubner, "Probability and Random processes for Electrical and Computer engineers", Cambridge Univ. Press. 2006.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L			
CO 2			H		

CO 3				H	
CO 4					H

EENS0055: NON-LINEAR SYSTEMS**(3 Credits - 45 hours) (L-T-P: 3-0-0)****Objective**

This course aims at introducing fundamental concepts of nonlinear dynamical systems and understanding basic tools for mathematical analysis as well as applications.

Course Outcomes

Choose tools for stability analysis and response evaluation of control problems with significant nonlinearities. (Remembering)

Identify the design problem and distinguish between the controls strategies. (Applying)

Analyse non linear systems using describing function methods. (Analysing)

Interpret stability of nonlinear systems from Lyapunov stability analysis. (Understanding)

Module I (10 hours)

Introduction to nonlinear systems: Examples of phenomena, models & derivation of system equations.

Module II (15 hours)

Fundamental properties: Existence & uniqueness, Dependence on initial conditions & parameters.

Phase plane analysis. Limit cycles & oscillations. Describing function method and applications. Circle criterion.

Module III (12 hours)

Lyapunov stability of autonomous systems. Perturbation theory & Averaging. Singular perturbation model and stability analysis.

Module IV (8 hours)

Basic results on Lie algebra. Controllability and Observability of nonlinear systems. Bifurcations. Chaos. Synchronization.

Suggested Readings

H. K. Khalil, "Nonlinear systems", 3rd edition, Prentice Hall, 2001.

J. J. E. Slotine and W. Li, "Applied nonlinear systems", Prentice Hall, 1991.

A. Nijemjer and A. van der schaft, "Nonlinear dynamical control systems", Springer, 1989.

M. Vidyasagar, "Nonlinear Systems Analysis, Society for Industrial and Applied Mathematics", 2002.

S. Strogatz, "Nonlinear Dynamics and Chaos", West view Press, 2001.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1		H	H	
CO 2	H	L	L	
CO 3		H		
CO 4			H	

EECL0056: DIGITAL CONTROL**(3 Credits - 45 hours) (L-T-P: 3-0-0)****Objective**

This course aims to familiarize the student with the concept of discretization. The objective is to introduce the students to discrete-time system representations and digital control and make the learn to design controllers for digital systems.

Course Outcomes

Define a discrete time system. (Remembering)

Explain sampled data system. (Understanding)

Model control system on differential sampling. (Applying)
Analyse digital systems in time domain and frequency domain. (Analysing)

Module I (15 hours)

Introduction to discrete-time systems, Frequency domain approach – Analysis and discretization, Time domain approach, analysis and discretization, State space formulation for discretized systems.

Module II (15 hours)

Engineering aspects of computer controlled systems, Sampled data systems, Control of Sampled data systems.

Module III (15 hours)

Concept of differential sampling, Closed loop analysis of differentially sampled systems, Control design based on differential sampling, Recent applications of Digital Control.

Suggested Readings

K. Ogata, "Discrete-time Control Systems", 2nd Ed., Prentice-Hall, 1995.

Benjamin C. Kuo, "Digital Control Systems", 2nd Ed., Oxford University Press, 1999.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2		H	
CO 3			H
CO 4	H		

EENC0057: NONLINEAR CONTROL (3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

This course aims to study concepts and techniques for stability analysis and learning control design of nonlinear systems.

Course Outcomes

Define tangent vectors, vector fields. (Remembering)

Explain Passivity analysis and applications to control design. (Understanding)

Apply deeper ideas from mathematics and specifically from geometry to engineering problems. (Applying)

Design control system using disturbance decoupling.(creating)

Module I (8 hours)

Overview of nonlinear Control-Introduction to Advanced Calculus, Elementary notions of Topology, Smooth Manifolds, Submanifolds, Tangent Vectors, Vector Fields.

Module II (7 hours)

Lyapunov stability for autonomous and non-autonomous systems, Input-Output Stability and Input-to-State Stability Absolute Stability.

Module III (8 hours)

Passivity analysis and applications to control design, Lyapunov-based feedback control design. Feedback linearization and back stepping.

Module IV (7 hours)

Sussmann's Theorem and global Decompositions, The Control Lie Algebra, the observation space.

Module V (8 hours)

Local Co-ordinates, Transformations, Exact Linearization via Feedback, The Zero dynamics, Local Asymptotic Stabilization, Asymptotic Output Tracking.

Module VI (7 hours)

Disturbance Decoupling, High Gain Feedback, Additional Results on Exact Linearization, Observers with Linear Error Dynamics.

Suggested Readings

H. K. Khalil, "Nonlinear Systems", 3rd edition, Prentice Hall, 2001.
 H. K. Khalil, "Nonlinear Control", Pearson, 2015.
 J. J. E. Slotine and W. Li, "Applied nonlinear systems", Prentice Hall, 1991.
 A. Nijemjer and A. van der schaft, "Nonlinear dynamical control systems", Springer, 1989.
 M. Vidyasagar, "Nonlinear Systems Analysis", Society for Industrial and Applied Mathematics, 2002.
 Alberto Isidori, "Nonlinear Control Systems", Third Edition, Springer, 1995.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2			H			
CO 3				L	H	
CO 4						H

EESC0058: SCADA SYSTEM AND APPLICATIONS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Objective

This course aims to familiarize the student with the concept of SCADA and its functions, to know SCADA communication and to get an insight into its application.

Course Outcomes

Explain the basic tasks of Supervisory Control Systems (SCADA) as well as their typical applications. (Understanding)

Make use of knowledge about SCADA architecture, various advantages and disadvantages of each system. (Applying)

Analyse the single unified standard architecture IEC 61850. (Analysing)

Select suitable SCADA system components: remote terminal units, PLCs, intelligent electronic devices, HMI systems, SCADA server. (Evaluating)

Module I (15 hours)

Introduction to SCADA: Data acquisition system, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation and Industries SCADA.

Module II (15 hours)

Industries SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Programmable Logic Controller (PLC), Communication Network, SCADA Server, SCADA/HMI Systems, SCADA Architecture: Various SCADA architectures, advantages and disadvantages of each system - single unified standard architecture -IEC 61850.

Module III (15 hours)

SCADA Communication: various industrial communication technologies - wired and wireless methods and fiber optics, Industries - oil, gas and water. Case studies, Implementation, Simulation Exercises.

Suggested Readings

Stuart A. Boyer, "SCADA-Supervisory Control and Data Acquisition", Instrument Society of America Publications, USA, 2004.
 Gordon Clarke and Deon Reynders, "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes Publications, Oxford, UK, 2004.
 William T. Shaw, "Cybersecurity for SCADA systems", Penn Well Books, 2006.
 David Bailey and Edwin Wright, "Practical SCADA for industry", Newnes, 2003.
 Michael Wiebe, "A guide to utility automation: AMR, SCADA, and IT systems for electric power", Penn Well, 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M	L			L
CO 2				H		
CO 3				H	M	
CO4			H			

EDA0059: DESIGN ASPECTS IN CONTROL**(3 Credits - 45 hours) (L-T-P: 3-0-0)****Objective**

This course aims to familiarize the student to the tools and techniques of control system design. Introduction to various aspects of controller design philosophy, learning PID Controller are incorporated into the course.

Course Outcomes

Tell about FOPDT and SOPDT systems. (Remembering)

Explain zero dynamics in servo control. (Understanding)

Model a control system given its parameters. (Applying)

Design observer. controllers like PI, PID in a given control system. (Evaluating)

Module I (15 hours)

System Modelling, review of concepts, FOPDT and SOPDT systems and identification of Smith Predictor and its variations.

Module II (15 hours)

PID Controllers – review PID Tuning – Ziegler Nichols, Cohen-Coon techniques. State feedback review – pole placement, Eigen structure assignment, Eigen structure – time response relation, Controller gain selection, controller robustness, disturbance rejection.

Module III (15 hours)

Frequency Domain Loop Shaping, Lag, Lead and Lag-lead compensators, Zero dynamics in servo control, Unstable zero dynamics – control design, Observer – concept and design, Case studies – Applications.

Suggested Readings

Karl J. Astrom and Richard M. Murray, "Feedback Systems: An Introduction for Scientists and Engineers", Princeton University Press, 2010.

Thomas Kailath, "Linear Systems", Prentice-Hall.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2			H
CO 3		H	
CO4	M		H

EEDP0060: DIGITAL PROTECTION OF POWER SYSTEM**(3 Credits - 45 hours) (L-T-P: 3-0-0)****Course Outcomes**

Illustrate the use of mathematical methods for relaying purposes. (Understanding)

Apply the digital relaying techniques in power system protection. (Applying)

Assess effectiveness of digital relays over the electromechanical ones for power system protection requirements. (Evaluating)

Design digital protection systems for power system applications. (Creating)

Objective

The objectives of this course are-

To provide an overview of the numerical relays and their working

Introduce a mathematical approach towards protection

To provide a detailed treatment of algorithms for numerical protection

Module I (6 hours)

Evolution of digital relays from electromechanical relays, Types of digital relays, Performance and operational characteristics of digital protection.

Module II (6 hours)

Mathematical background to protection algorithms, Finite difference techniques.

Module III (8 hours)

Interpolation formulae, forward, backward and central difference interpolation, Numerical differentiation, Curve fitting and smoothing, Least squares method, Fourier analysis, Fourier series and Fourier transform, Walsh function analysis.

Module IV (8 hours)

Basic elements of digital protection, Signal conditioning: transducers, surge protection, analog filtering, analog multiplexers, Conversion subsystem: the sampling theorem, signal aliasing. Error, sample and hold circuits, multiplexers, analog to digital conversion, digital filtering concepts, digital relay as a unit consisting of hardware and software, Integration of Digital Relays into SCADA systems.

Module V (8 hours)

Mathematical basis of numerical techniques and relay algorithms, Sinusoidal wave based algorithms, Sample and first derivative (Mann and Morrison) algorithm. Fourier and Walsh based algorithms.

Module VI (8 hours)

Fourier Algorithm: Full cycle window algorithm, fractional cycle window algorithm, Walsh function based algorithm. Least Squares based algorithms. Differential equation based algorithms. Traveling Wave based Techniques. Digital Differential Protection of Transformers. Digital Line Differential Protection. Recent Advances in Digital Protection of Power Systems.

Suggested Readings

A. G. Phadke and J. S. Thorp, "Computer Relaying for Power Systems", Wiley/Research studies Press, 2009.

A. T. Johns and S. K. Salman, "Digital Protection of Power Systems", IEEE Press, 1999.

Gerhard Zeigler, "Numerical Distance Protection", Siemens Publicis Corporate Publishing, 2006.

S. R. Bhide, "Digital Power System Protection" PHI Learning Pvt. Ltd., 2014.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1		H		M	
CO 2	M		H		L
CO 3	H		L		
CO 4			M		H

EEPD0061: POWER SYSTEM DYNAMICS-II

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Recall the basic concepts of dynamic systems and stability definition. (Remembering)

Explain the different stability problems arise in power system. (Understanding)

Identify different stability problems faced by modern power systems, e.g., multi-machine stability, large signal stability, etc. (Applying)

Analyze the stability problems and implement modern control strategies, e.g., damper, AGC etc. (Analyzing)

Assess voltage and frequency stability in power systems. (Evaluating)

Objective

The objective of this course is to give the concept of power system dynamics, interpretation of power system dynamic phenomena and various forms of stability problems in power systems & their mitigation technique.

Module I: Power System Stability (8 hours)

Basic Concepts of Dynamic Systems and Stability Definition, Small Signal Stability (Low Frequency Oscillations) of Unregulated and Regulated System, Analysis of stability.

Module II: Damper (8 hours)

Effect of Damper, Flux Linkage Variation and AVR.

Module III: Large Signal Stability (8 hours)

Large Signal Rotor Angle Stability, Dynamic Equivalents and Coherency, Direct Method of Stability Assessment, Stability Enhancing Techniques, Mitigation Using Power System Stabilizer.

Module IV: Multi-Machine Stability (6 hours)

Asynchronous Operation and Resynchronization, concept of multi-Machine Stability.

Module V: Voltage Stability (6 hours)

Dynamic Analysis of Voltage Stability, Voltage Collapse and classification, typical scenario of voltage collapse, Prevention of voltage collapse.

Module VI: Frequency Stability (6 hours)

Introduction to Frequency Stability, Automatic Generation Control, Primary and Secondary Control, Sub-Synchronous Resonance and Counter Measures.

Suggested Readings

P. Kundur, "Power System Stability and Control", McGraw Hill Inc, 1994.

J. Machowski, J. Bialek and J. Bumby, "Power System Dynamics and Stability", John Wiley & Sons, 1997.

L. Leonard Grigsby (Ed.), "Power System Stability and Control", Second edition, CRC Press, 2007.

V. Ajjarapu, "Computational Techniques for voltage stability assessment & control", Springer, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H		M		M	M
CO 2		H	H	M	L	L
CO 3			H	H	M	
CO 4		H		H		
CO 5					H	H

EERP0062: RESTRUCTURED POWER SYSTEMS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Explain the various types of regulations in power systems. (Understanding).

Illustrate the Technical and Non-technical issues in Deregulated Power Industry. (Understanding).

Identify the need of regulation and deregulation. (Applying)

Interpret different market mechanisms and various entities in the market. (Applying)

Objective

The objective of this course is to introduce the concepts of restructuring and deregulation of electricity market. This will enable the students to understand the need behind the requirement for deregulation of the electricity market. This course focuses on the understanding of the money, power & information flow in a deregulated power system.

Module I: Introduction to Electricity Market (10 hours)

Fundamentals of electricity market deregulation and restructured system, Market power, Market models and architecture, Independent System Operator (ISO), Power Exchange (PX), Market Clearing Price (MCP), Day-Ahead and Hour-Ahead Markets, Elastic and Inelastic Markets, Social welfare maximization.

Module II: Optimal Power Flow (11 hours)

OPF: Role in vertically integrated systems and in restructured markets, Transmission Open Access, Power Wheeling, Congestion management, Transfer Capability: Definitions and calculations- Available Transfer Capability (ATC).

Module III: Hedging Tools for Managing Risks in Electricity Markets (8 hours)

Optimal bidding; Risk assessment, Hedging; Transmission Pricing; Electricity Pricing: Volatility, Risk and Forecasting.

Module IV: Ancillary Services & Distributed Generations (6 hours)

Ancillary Services, Distributed generation in restructured markets, IT applications in restructured markets.

Module V: Indian sector and Global Electric Utility Markets (10 hours)

Developments in India, Working of restructured power systems in various countries, Standard Market Design (SMD), PJM, Recent trends in Restructuring.

Suggested Readings

Mohammad Shahidehpour and Muwaffaq Alomoush, "Restructured electrical power systems: operation, trading and volatility", Marcel Dekker.

Kankar Bhattacharya, Jaap E. Daadler and Math H. J. Boelen, "Operation of restructured power systems", Kluwer Academic Pub., 2001.

Lorrin Philipson and H. Lee Willis, "Understanding electric utilities and de-regulation", Marcel Dekker Pub., 1998.

L. L. Lai, "Power System Restructuring and Deregulation: Trading, Performance and Information Technology", Wiley, 2001.

Steven Stoft, "Power system economics: designing markets for electricity", John Wiley and Sons, 2002.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	L			
CO 2		H	H		
CO 3			M	H	
CO 4				M	H

EEAS0063: ADVANCED DIGITAL SIGNAL PROCESSING

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Demonstrate knowledge about the time domain and frequency domain representations as well analysis of discrete time. (Understanding)

Apply the design techniques for IIR and FIR filters and their realization structures. (Applying)

Utilize knowledge about the finite word length effects in implementation of digital filters. (Applying)

Make use of the knowledge about the various linear signal models and estimation of the power spectrum of stationary random signals. (Applying)

Objective

The course helps to develop an in-depth understanding of the digital signal processing techniques. The course helps in learning of the methods used to structure and design various filters and understand their characteristics.

Module I: Fundamentals of Discrete-Time Signal and System (8 hours)

Discrete time signals, Linear shift invariant systems, Stability and causality, Sampling of continuous time signals, discrete time Fourier transform- Discrete Fourier series- Discrete Fourier transform, Z transform- Properties of different transforms.

Module II: Discrete-Time Signals in the Transfer Domain (8 hours)

Linear convolution using DFT, Computation of DFT Design of IIR digital filters from analog filters, Impulse invariance method, Bilinear transformation method.

Module III: Digital Filter Structures and Design (8 hours)

FIR filter design using window functions, Comparison of IIR and FIR digital filters, Basic IIR and FIR filter realization structures, Signal flow graph representations Quantization process and errors, Coefficient quantization effects in IIR and FIR filters.

Module IV: Analysis of Finite Word length Effects (8 hours)

A/D conversion noise- Arithmetic round-off errors, Dynamic range scaling, Overflow oscillations and zero Input limit cycles in IIR filters, Linear Signal Models.

Module V: Linear Signal Models and Power Spectrum Estimation (7 hours)

All pole, All zero and Pole-zero models, Power spectrum estimation- Spectral analysis of deterministic signals, Estimation of power spectrum of stationary random signals.

Module VI: Optimum Linear Filters (6 hours)

Optimum linear filters, Optimum signal estimation, Mean square error estimation, Optimum FIR and IIR Filters.

Suggested Readings

1. Sanjit K. Mitra, "Digital Signal Processing: A computer-based approach", Tata McGraw-Hill Edition, 1998.
2. Dimitris G. Manolakis, Vinay K. Ingle & Stephen M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill international edition 2000.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H				L
CO 2			H	M	L	H
CO 3	M		M	H		
CO 4		M			H	M

EEAS0064: POWER SYSTEM TRANSIENTS

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Explain the reasons for occurrence of transients in a power system. (Understanding)

Utilize the knowledge of various transients that could occur in power systems and their mathematical formulation. (Applying)

Illustrate the use of insulation in various equipment in power systems. (Applying)

Analyze the power system for transient analysis. (Analyzing)

Design various protective devices in power systems for protecting equipment and personnel. (Creating)

Objective

The objective of this course is to introduce the concepts of power system transients. Students will be able to learn the reasons for occurrence of transients in a power system. This will enable the students to understand the change in parameters like voltage & frequency during transient. This course also focuses on the lightning phenomenon and its effect on the power system.

Module I: (8 hours)

Fundamental circuit analysis of electrical transients; Laplace Transform method of solving simple Switching transients; Damping circuits-Abnormal switching transients; Three-phase circuits and transients; Computation of power system transients.

Module II (7 hours)

Principle of digital computation-Matrix method of solution; Modal analysis- Z transform; Computation using EMTP; Lightning, switching and temporary over voltage; Physical phenomena of lightning.

Module III (6 hours)

Interaction between lightning and power system; Influence of tower footing resistance and Earth Resistance; Switching: Short line or kilometric fault; Energizing transients - closing and re-closing of lines; line dropping, load rejection - over voltages induced by faults.

Module IV (8 hours)

Switching HVDC line; Travelling waves on transmission line, Circuits with distributed Parameters; Wave Equation; Reflection, Refraction, Behaviour of Travelling waves at the line terminations; Lattice Diagrams - Attenuation and Distortion; Multiconductor system and Velocity wave.

Module V (8 hours)

Insulation co-ordination: Principle of insulation co-ordination in Air Insulated substation (AIS) and Gas Insulated Substation (GIS); Coordination between insulation and protection level; Statistical approach.

Module VI (8 hours)

Protective devices; Protection of system against over voltages, lightning arresters, substation earthing.

Suggested Readings

Allan Greenwood, "Electrical Transients in Power System", Wiley & Sons Inc. New York, 1991.

Y. G. Paithankar, "Fundamentals of Power System Protection", Prentice Hall India Learning Private Limited, 2010.

Akihiro Ametani, Naoto Nagaoka, Yoshihiro Baba, Teruo Ohno and Koichi Yamabuki, "Power System Transients: Theory and Applications", CRC Press, 2016.

Prabha Kundur, "Power System Stability and Control", McGraw Hill Education, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2		H	H	L		
CO 3					H	
CO 4			M	H		
CO 5						H

EEFC0065: FACTS AND CUSTOM POWER DEVICES

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

List various FACTS devices. (Remembering)

Describe fundamental principles of Passive and Active Reactive Power Compensation Schemes. (Understanding)

Identify suitable FACTS devices for specific applications. (Applying)

Experiments with various FACTS devices to improve Power quality. (Evaluating)

Objective

This course gives an introduction to the of flexible ac transmission systems to enhance controllability and power transfer capability in ac systems, involves applications of power electronics in power systems in the range of a few tens to hundred megawatts to improve reliability of power supply and opens up new opportunities for controlling power and enhancing the usable capacity of present, as well as new and upgraded lines.

Module I: Power flow control (6 hours)

Reactive power flow control in Power Systems, Control of dynamic power unbalances in Power System - Power flow control,

Constraints of maximum transmission line loading, Benefits of FACTS Transmission line compensation, Uncompensated line Shunt compensation, Series compensation Phase angle control, Reactive power

compensation Shunt and Series compensation principles, Reactive compensation at transmission and distribution level.

Module II: Shunt compensator (10 hours)

Static versus passive VAR compensator, Static shunt compensators: SVC and STATCOM, Operation and control of TSC, TCR and STATCOM -Compensator control, Comparison between SVC and STATCOM.

Module III: Series compensator and regulators (15hours)

Static series compensation: TSSC, SSSC -Static voltage and phase angle regulators, TCVR and TCPAR Operation and Control, Applications, Static series compensation, GCSC, TSSC, TCSC and Static synchronous series compensators and their Control.

Module IV: Combined compensator (8 hours)

SSR and its damping Unified Power Flow Controller, Circuit Arrangement, Operation, and control of UPFC, Basic Principle of P and Q control, Independent real and reactive power flow control-Applications, Introduction to interline power flow controller.

Module V: Power quality (6hours)

Modeling and analysis of FACTS, Controllers, Simulation of FACTS controllers, Power quality problems in distribution systems, harmonics, loads that create harmonics, modeling, harmonic propagation, series and parallel resonances mitigation of harmonics, passive filters, active filtering – shunt, series and hybrid and their control, Voltage swells, sags, flicker, unbalance and mitigation of these problems by power line conditioners, IEEE standards on power quality.

Suggested Readings

K. R. Padiyar, "FACTS Controllers in Power Transmission and Distribution", New Age International Publishers, 2007.

X. P. Zhang, C Rehtanz and B. Pal, "Flexible AC Transmission Systems- Modelling and Control", Springer, Verlag, Berlin, 2006.

N. G. Hingorani, L. Gyugyi, "Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems", IEEE Press Book, Standard Publishers and Distributors, Delhi, 2001.

K. S. Suresh Kumar and S. Ashok, "FACTS Controllers & Applications", E-book edition, Nalanda Digital Library, NIT Calicut, 2003.

G. T. Heydt, "Power Quality", McGraw-Hill Professional, 2007.

T. J. E. Miller, "Static Reactive Power Compensation", John Wiley and Sons, New York, 1982.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	L	H	H	H	
CO 3		H	H	H	M
CO 4		M	M		

EEOC0066: OPTIMAL CONTROL THEORY

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Relate the mathematical methods used in optimal control to derive the solution to variations of the problems studied in the course. (Remembering)

Explain dynamic programming and its use in control system engineering. (Understanding)

Apply principle of optimality to decision making. (Applying)

Utilize the standard algorithms for numerical solution of optimal control problems and use MATLAB to solve fairly simple but realistic problems. (Applying)

Objective

This course aims at introducing the basic and fundamental concepts of optimal control theory, controller design. The course also introduces computational aspects of optimal control.

Module I (15 hours)

Review of Matrix Computations. Maximization of functional of a single and several functions using calculus of variations, Constrained externals, Euler-Lagrange Equation, Necessary conditions for optimal control, Pontryagin's minimum principle and state inequality constraints, Minimum time problems, Minimum control effort problems.

Module II (15 hours)

Linear quadratic regulator problems, Riccati Equation, Singular intervals in optimal control problems, The principle of optimality, Application of the principle of optimality to decision making, Dynamic programming applied to routing problems.

Module III (15 hours)

Solving optimal control problems using dynamic programming, Discrete linear regulator problem, Hamilton-Jacobi-Bellman Equation, Numerical Techniques to determine optimal trajectories, Numerical Aspects of Optimization.

Suggested Readings

M. Athans and P. L. Falb, "Optimal Control: An Introduction to the Theory and Its Applications", Dover Books on Engineering, 2006.

D. S. Naidu, "Optimal Control Systems", CRC Press, 2002.

D. Liberzon, "Calculus Of Variations and Optimal Control Theory: A Concise Introduction", Princeton University Press, Dec 2011.

Frank L. Lewis, Draguna Vrabe and Vassilis L. Syrmos, "Optimal Control", 3rd Edition, Wiley, 2012.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	
CO 2		M	H
CO 3		H	
CO 4	M		H

EESF0067: STOCHASTIC FILTERING AND IDENTIFICATION

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Tell about different filtering and prediction methods for system design. (Remembering)

Take part in convergence analysis of Recursive Identification methods. (Analyzing)

Elaborate essential stochastic modeling tools including Markov chains and queuing theory. (Creating)

Design control system based on adaptive control. (Creating)

Objective

This course aims at introducing fundamental concepts of stochastic filtering, prediction, control. The course introduces nonlinear system identification.

Module I (15 hours)

Introduction to Parameter Estimation and System Identification, MMSE estimation including LMS, Gaussian case, Wiener filtering & prediction, Kalman filtering & prediction, Extended Kalman filtering and its variations, Predictors for difference equation based models including ARMA, Box Jenkins & others.

Module II (15 hours)

Statistical properties of Least Squares estimation and its relationship with Bayes estimation (ML, MAP), convergence analysis, CR bound, Recursive Least Squares, Iterative methods for nonlinear Least Squares Identification problem: Different approaches for linear dynamical system, Offline identification methods including Least Squares, Prediction error framework, Pseudo-linear regression (PLR) & Instrument variable methods. Recursive Identification of linear dynamical system: RLS, PLR, Prediction error framework & its application to ARMA & Innovations representation, Convergence Analysis of Recursive Identification methods: Associated ODE, Martingale.

Module III (15 hours)

Nonlinear system identification, Subspace based method of system identification, Applications including LQG and adaptive control.

Suggested Readings

A. Papoulis and S. Pillai, "Probability, random variable and stochastic processes", McGraw Hill, 2002.
 T. Soderstrom and P. Stoica, "System Identification", Prentice-Hall, 1989.
 Lennart Ljung, "System Identification", Prentice-Hall, 2nd edition, 1999.
 S. Thomas Alexander: "Adaptive Signal processing, Theory and applications", Springer-Verlag, 1986.
 R. Isermann and M. Munchhof, "Identification of Dynamic Systems", Springer-Verlag, 2011.
 B. D. O. Anderson and J. B. Moore, "Optimal Filtering", Dover Books on Electrical Engineering, 2005.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	H
CO 3		H	
CO 4			H

EECS0068: ADVANCE CONTROL SYSTEM

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Define different approaches for modeling of dynamic systems. (Remembering)
 Explain philosophy of optimal control system. (Understanding)
 Apply the concepts of linear algebra and their applications to control systems. (Applying)
 Design linear quadratic controller, reduced order observer, compensator (Creating)

Objective

The course provides glimpses into the advanced methods of modelling and analysis of the dynamical systems. The course is a strong step in inculcating the research aptitude in the students.

Module I (15 hours)

Math Modelling of Dynamical Systems: Newtonian and Lagrangian approaches, Concept of dynamical state of a system, Concept of equilibrium point, linearization of nonlinear model. Review of Linear Algebra concepts: Field, Vector space, linear combination, linear independence, bases of a vector space, representation of any vector on different basis, matrix representation of a linear operator, change of basis, rank, nullity, range space and null space of a matrix, Eigen value and Eigen vector of a matrix, similarity transform, Diagonalisation

Module II (15 hours)

Modern Control Analysis: Concept and computation of systems modes, controllability theorem and its proof, Observability theorem and its proof, Controllable and observable subspaces. Stability Analysis: Stability of linear systems, stability types and their definitions for any general system, Stability of an equilibrium point, Lyapunov stability theory for LTI systems, Quadratic forms and Lyapunov functions.

Module III (15 hours)

Modern Control Design: Converting the math model to controllable canonical form and its use for pole placement, Concept of linear observer and its design, Design of reduced order observer, Compensator design using separation principle, Poles of compensator, Open-loop and close-loop systems. Optimal Control Theory: Introduction to the philosophy of optimal control, formulation of optimal control problem, different performance criterion, Linear quadratic regulator (LQR) and optimum gain matrix, Riccati equations, conceptual models and statistical models for random processes, Kalman filter.

Suggested Readings

Bernard Friedland, "Control System Design: An Introduction to State-Space Methods", Dover Publications, Inc. Mineola, New York, 2012.
 Thomas Kailath, "Linear Systems", Prentice-Hall Inc., New Jersey, 1986.
 M. Gopal, "Modern Control System Theory", New Age International (P) Limited, New Delhi, 2000.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3	H		
CO4	L		H

EEAL0069: ADAPTIVE LEARNING AND CONTROL**(3 Credits - 45 hours) (L-T-P: 3-0-0)****Course Outcomes**

Recall detailed knowledge of classical system identification and the development and properties of various methods. (Remembering)

Utilize detailed knowledge of robust adaptive control, neural network based control (Applying)

Apply adaptive and learning techniques for control design for uncertain dynamical systems. (Applying)

Design control system based on predictive control. (Creating)

Objective

The course introduces adaptive and learning techniques for control design for uncertain dynamical systems. The course also introduces learning based control.

Module I (15 hours)

Introduction to adaptive control, Direct and indirect adaptive control, Model reference adaptive control, Parameter convergence, Persistence of excitation, Review of Lyapunov stability theory.

Module II (15 hours)

Adaptive backstepping, Adaptive control of nonlinear systems, Composite adaptation, Robust adaptive control, Neural Network-based control.

Module III (15 hours)

Reinforcement learning-based control, Repetitive learning control, Predictive control,

Suggested Readings

Bernard Friedland, "Control System Design: An Introduction to State-Space Methods", Dover Publications, Inc. Mineola, New York, 2012.

Thomas Kailath, "Linear Systems", Prentice-Hall Inc., New Jersey, 1986.

M. Gopal, "Modern Control System Theory", New Age International (P) Limited, New Delhi, 2000.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3		H	
CO4		M	H

EEMR0070: MODEL REDUCTION IN CONTROL**(3 Credits - 45 hours) (L-T-P: 3-0-0)****Course Outcomes**

Identify Source of Large Models. (Remembering)

Explain sliding mode control for control system design. (Understanding)

Make use of Pade approximation for control system design. (Applying)

Apply model reduction techniques for a given control design problem. (Applying)

Objective

The course introduces the concept of model reduction of large scale dynamics models from various engineering disciplines. The course also introduces model reduction in control.

Module I (15 hours)

Introduction to Model Reduction, Source of Large Models – Circuits, EM systems, Mechanical Systems. Classical Model Reduction Methods – Modal reduction.

Module II (15 hours)

Pade approximation and moment matching, Routh Approximants, Modern Methods - SVD (Grammian) based methods, Krylov based methods, SVD-Krylov based methods, MOR for Nonlinear Systems – SVD & POD Methods.

Module III (15 hours)

Model Reduction in Control, Sliding Mode Control – Review, SMC as model reducing control, Higher Order Sliding Mode.

Suggested Readings

- A. C. Antoulas, "Approximation of Large Scale Dynamical Systems", SIAM, 2005.
 Ed. Alfio Quarteroni and Gianluigi Rozza, "Reduced Order Methods for Modeling and Computational Reduction", Springer, 2014.
 M. Jamshidi, "Large-scale systems: modelling & control", North Holland, New York, 1983.
 C. Edwards and S. Spurgeon, "Sliding Mode Control: Theory and Applications", CRC Press, 1998.
 B. Bandyopadhyay, S. Janardhanan and S. Spurgeon, "Advances in Sliding Mode", Springer, 2013.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3		H	
CO4	M		H

EERC0071: ROBUST CONTROL

(3 Credits - 45 hours) (L-T-P: 3-0-0)

Course Outcomes

- Define LTI systems and its applications. (Remembering)
 Explain Passive system for frequency domain and time domain. (Understanding)
 Assess stability and performance of passive systems. (Evaluating)
 Design robust control system based on Riccati equation (Creating)

Objective

This course introduces the concept of control techniques with greater emphasis on robustness to modelling uncertainty. The course introduces how to handle parameter variations, and presence of disturbances and noise.

Module I (15 hours)

Modelling of uncertain systems, Signals and Norms, Lyapunov theory for LTI systems.

Module II (15 hours)

Passive systems- frequency domain, Passive systems- time domain, Robust Stability and performance, Stabilizing controllers - Co prime factorization.

Module III (15 hours)

LQR, LQG problems, Riccati equations and solutions, Riccati equation solution through LMI, H-infinity control and mu-synthesis, Linear matrix inequalities for robust control.

Suggested Readings

- L. Fortuna, M. Frasca (Eds.), "Optimal and Robust Control", CRC Press, 2012.
 K. Zhou, J. C. Doyle and K. Glover, "Robust and Optimal Control", Prentice Hall, 1996.
 J. C. Doyle, B. A. Francis and A. R. Tannenbaum, "Feedback Control Theory", Macmillan, 1992.
 Benefits of FACTS Transmission line compensation, Uncompensated line –

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3		H	
CO4		M	H

EEMC0087: ADVANCED MICROCONTROLLER BASED SYSTEMS**(3 Credits - 45 hours) (L-T-P: 3-0-0)****Course Outcomes**

List the various functional blocks of a basic computer. (Remembering)

Recall the architecture of PIC microcontrollers. (Remembering)

Summarize the architecture of Intel 8051 and 8086 microcontrollers and microprocessors. (Understanding)

Summarize the architecture of DSP processors and FPGA. (Understanding)

Develop Intel and PIC microcontroller based systems. (Applying)

Objective

The course will help to develop an in-depth understanding of the basic computer architecture and organizations. Students will be able to understand the architecture and application of advanced microcontrollers, DSP processors and FPGA.

Module I: Basic Computer Organization (7 hours)

Basic computer organization. Accumulator based processes, Architecture, Memory Organization, I/O organization.

Module II: Intel 8051 Microcontroller and 8086 Microprocessor (14 hours)

Intel 8051, Intel 8086- Registers, Memories. I/O Ports, Serial communication. Timers, Interrupts, Programming. Intel 8051 Assembly language programming, Addressing operations, Stack & Subroutines, Interrupts-DMA.

Module III: PIC Microcontrollers (8 hours)

PIC 16F877- Architecture Programming, Interfacing Memory/ I/O Devices, Serial I/O and data communication.

Module IV: Digital Signal Processors (8 hours)

Digital Signal Proc Processor (DSP) – Architecture, Programming, Introduction to FPGA.

Module V: Applications (8 hours)

Microcontroller development for motor control applications. Stepper motor control using microcontroller.

Suggested Readings

John. F. Wakerly, "Microcomputer Architecture and Programming", John Wiley and Sons 1981.

Ramesh S. Gaonker, "Microprocessor Architecture, Programming and Applications with the 8085", Penram International Publishing (India), 1994.

Raj Kamal, "The Concepts and Features of Microcontrollers", Wheeler Publishing, 2005.

Kenneth J. Ayala, "The 8051 microcontroller", Cengage Learning, 2004.

John Morton, "The PIC microcontroller: your personal introductory course", Elsevier, 2005.

Dogan Ibrahim, "Advanced PIC microcontroller projects in C: from USB to RTOS with the PIC18F Series", Elsevier, 2008.

Microchip datasheets for PIC16F877.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L	L	L	
CO 2			H		H
CO 3		H			H

CO 4				H	L
CO 5		L	L	L	H

EEPQ0088: POWER QUALITY**(3 Credits - 45 hours) (L-T-P: 3-0-0)****Course Outcomes**

Explain about the harmonics, harmonic introducing devices and effect of harmonics on system equipment and loads. (Understanding)

Explain the series and shunt active power filtering techniques for harmonics. (Understanding)

Classify different power quality issues. (Analyzing)

Develop analytical modeling skills needed for modeling and analysis of harmonics in networks and components. (Creating)

Improve power factor based on static VAR compensators. (Creating)

Objective

The objective of this course is to introduce the different power quality issues faced by the power system and understand the recommended practices by various standard bodies like IEEE, IEC, etc. on voltage & frequency, harmonics and understanding the concept of STATIC VAR Compensators in power systems.

Module I: Power quality issues (8 hours)

Introduction-power quality-voltage quality-overview of power, Quality phenomena classification of power quality issues, Power quality measures and standards-THD-TIF-DIN-C-message weights, Flicker factor transient phenomena-occurrence of power quality problems, Power acceptability curves-IEEE guides, Standards and recommended practices.

Module II: Harmonics (8 hours)

Harmonics-individual and total harmonic distortion, RMS value of a harmonic waveform, Triplex harmonics. Important harmonic introducing devices, SMPS, Three-phase power converters-arc devices, saturable devices, Harmonic distortion of fluorescent lamps-effect of power system harmonics on power system equipment and loads.

Module III: Modeling of systems (6 hours)

Modeling of networks and components under non-sinusoidal conditions, Transmission and distribution systems, Shunt capacitors-transformers, Electric machines, Ground systems loads that cause power quality problems, Power quality problems created by drives and its impact on drive.

Module IV: Improvement and control in power system (6 hours)

Power factor improvement- Passive Compensation, Passive Filtering, Harmonic, Resonance, Impedance Scan Analysis, Active Power Factor Corrected Single Phase Front End, Control Methods for Single Phase APFC, Three-Phase APFC and Control Techniques, PFC based on Bilateral Single Phase and Three Phase Converter.

Module V: Hamilton-Jacobi-Bellman model (8 hours)

Introduction to Hamilton-Jacobi-Bellman equation - model reference adaptive systems (MRAS) - Design hypothesis.

Module VI: Control methods (8 hours)

Introduction to design method based on the use of Liapunov function, Design and simulation of variable structure adaptive model following control.

Suggested Readings

G. T. Heydt, "Electric power quality", McGraw-Hill Professional, 2007.

Math H. Bollen, "Understanding Power Quality Problems", IEEE Press, 2000.

J. Arrillaga, "Power System Quality Assessment", John Wiley, 2000.

J. Arrillaga, B. C. Smith, N. R. Watson and A. R. Wood, "Power system Harmonic Analysis", Wiley, 1997.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1		H		L	

CO 2			H		H
CO 3		H		H	
CO 4		H			
CO 5			L	H	

EEWE0092: WASTE TO ENERGY
(3 Credits – 45 hours) (L-T-P: 3-0-0)

Course Outcomes

Select the appropriate method for Biomass pyrolysis, biomass gasification and biomass combustion for waste to energy conversion. (Remembering)

Explain waste management systems with respect to its physical properties, and associated critical considerations in view of emerging technologies. (Understanding)

Implement energy conversion system for conversion of waste to electrical energy. (Applying)

Design cooking stoves, digester, gasifier. (Creating)

Objective

The objective of this course is to introduce different sources, processes to carry on waste to energy conversion. The students will be able to design different systems and devices for converting waste materials to useful energy.

Module I: Introduction to Energy from waste (9 hours)

Classification of waste as fuel, Agro based, Forest residue, Industrial waste, MSW, Conversion devices, Incinerators, gasifiers, digestors.

Module II: Biomass Pyrolysis (9 hours)

Pyrolysis, Types, slow, fast, Manufacture of charcoal, Methods, Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Module III: Biomass Gasification (9 hours)

Fixed bed system, Downdraft and updraft gasifiers, Fluidized bed gasifiers, Design, construction and operation, Gasifier burner arrangement for thermal heating, Gasifier engine arrangement and electrical power, Equilibrium and kinetic consideration in gasifier operation.

Module IV: Biomass Combustion (9 hours)

Biomass stoves, Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation, Operation of all the above biomass combustors.

Module V: Biogas (9 hours)

Properties of biogas (Calorific value and composition), Biogas plant technology and status, Bio energy system, Design and constructional features, Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, Direct combustion, Types of biogas Plants, Applications, Alcohol production from biomass, Bio-diesel production, Urban waste to energy conversion, Biomass energy programme in India.

Suggested Readings:

Ashok V. Desai, "Non Conventional Energy", Wiley Eastern Ltd., 1990.

K. C. Khandelwal and S. S. Mahdi, "Biogas Technology - A Practical Hand Book - Vol. I & II", Tata McGraw Hill Publishing Co. Ltd., 1983.

D. S. Challal, "Food, Feed and Fuel from Biomass", IBH Publishing Co. Pvt. Ltd., 1991.

C. Y. WereKo-Brobby and E. B. Hagan, "Biomass Conversion and Technology", John Wiley & Sons, 1996.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	H	H	H	
CO 2	H	M	M	M	M

CO 3			H	H	
CO 4				H	M

LABORATORY COURSES

EESS6033: POWER SYSTEM STEADY STATE ANALYSIS LAB (2 Credits - 60 hours) (L-T-P: 0-0-4)

Course Outcomes

- Recall characteristics of IGBT and thyristor. (Remembering)
- Demonstrate the knowledge of Y-bus and Z-bus formation. (Understanding)
- Find various performance parameters of a power system by using given data. (Analyzing)
- Develop program for economic dispatch problems of electrical energy. (Creating)

List of Experiments:

- Simulation of IGBT Inverters
- Simulation of Thyristor Converters
- Transient Stability Studies
- Short Circuit Studies
- Evaluation of Z-Bus and Y-Bus
- Economic Load Dispatch
- Gauss Seidel Load Flow analysis
- Newton Raphson Load Flow analysis
- Load Forecasting and Unit Commitment

Suggested Readings

- C.L. Wadhwa, Electrical Power systems, (5th Edition) New Age International Publishers.
- D.P. Kothari, I.J. Nagrath, Power System Engineering, Second edition, Tata McGraw Hill.

Mapping of COs to Experiments

Course Outcomes	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9
CO 1	M	M							
CO 2			H	H					
CO 3					H		H	H	
CO 4						H			H

EERE6034: RENEWABLE ENERGY LAB (2 Credits - 60 hours) (L-T-P: 0-0-4)

Course Outcomes

- Identify the V-I characteristics of solar panels. (Applying)
- Utilize the concepts of Solar Energy and Wind Energy conversion techniques in practical situations. (Applying)
- Determine the power output from Solar and Wind Farms. (Evaluating)

List of Experiments:

- Power Curves
- Build a Wind Farm model.
- Test the Capabilities of Solar PV array in partial shading condition.
- Effect of Temperature on Solar Panel Output
- Variables Affecting Solar Panel Output
- Effect of Load on Solar Panel Output
- Wind Turbine Output: The Effect of Load
- Test the Capabilities of Solar Panels and Wind Turbines

Mapping of COs to Syllabus

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8
CO 1	H							
CO 2		H	M	H			H	H
CO 3					H	H		

EECT6035: CONTROL LAB 1**(2 Credits - 60 hours) (L-T-P: 0-0-4)****Course Outcomes**

Name the MATLAB commands associated with a robust control system. (Remembering)

Model common non-linearities used in control systems. (Applying)

Model and analyse digital control system. (Applying)

Design and simulate control system models. (Creating)

List of experiments:

Design and simulation of Linearised models using MATLAB/PSPICE.

Simulation and analysis of State space models for continuous time and discrete time systems using MATLAB/PSPICE.

Design and Simulation of LTI models of Feedback Control System using MATLAB/PSPICE.

Simulation and analysis of Digital Control System using MATLAB/PSPICE.

Simulation and Stability analysis of control systems with common nonlinearities using MATLAB/PSPICE.

Familiarization and use of the MATLAB command associated with Robust Control Systems.

Familiarization and use of PSIM software.

EECL6036: CONTROL LAB 2**(2 Credits - 60 hours) (L-T-P: 0-0-4)****Course Outcomes**

Compare position, velocity, and adaptive control. (Understanding)

Explain adaptive control system (understanding)

Explain analog and digital servo system. (Understanding)

Construct PLC based system.(Creating)

Design ladder logic for PLC. (Creating)

List of experiments:

Designing of Ladder logic for various practical applications.

Execution of the Ladders using PLC's.

Study of Analog and Digital Servo Systems.

Experiment on Position Control System.

Experiment on Velocity Control System.

Experiment on Adaptive Control System.

Experiment on Nonlinear Control Systems.

EEPL6037: POWER SYSTEM PROTECTION LAB**(2 Credits) (L-T-P: 0-0-4)****Course Outcomes**

Show the ability to propose models for radial and parallel feeder protection. (Remembering)

Demonstrate applications of practical power system protection schemes. (Understanding)

Apply the knowledge of different types of relays components in practical power system applications. (Applying)

Examine the performance characteristics of relays in equipment protection. (Analyzing)

Evaluate fault currents due to different types of faults in a network. (Evaluating)

List of experiments (any 8):

Introduction to Power System Protection

Evaluate fault currents due to different types of faults in a network

Over Current Relay (OCR) Testing System - To Plot IDMT Characteristics of OCR

Over Current Relay Testing System - To Perform Experiment on Definite/ Instantaneous Mode Setting of the relay.

Characteristics of a Differential Relay - To Plot Characteristics of % Biased Differential Relay (Merz-Price Method).

Pick-up Test for Differential Relay

Transformer Differential Protection Testing - For Transformer In-Zone Trips Fault

Transformer Differential Protection Testing - For Transformer Out-Zone or Non-Trip Faults

Principle of Reverse Power Protection

Concept of Radial Feeder Protection

Concept of Parallel Feeder Protection

Mapping of COs to Syllabus

Course Outcomes	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6	Exp.7	Exp.8	Exp.9	Exp.10	Exp.11
CO 1	H	H				M			M	H	H
CO 2	L	L	H	H			H	H			
CO 3			H	M	H	M			H	H	H
CO 4			H	M	H	H			L		
CO 5	L	H	H			H	H				

EEPA6038: POWER ELECTRONICS APPLICATION TO POWER SYSTEM LABORATORY

(2 Credits - 30 hours) (L-T-P: 0-0-4)

Course Outcomes

Identify the suitable power electronic devices for designing different power electronic converters. (Applying)

Examine the performance characteristics of different types of FACTS devices. (Analyzing)

Experiment with various power electronic circuits used in power system applications. (Evaluating)

Design different types of power electronic converters. (Creating)

List of Experiments:

Any ten experiments will be performed

Three phase fully controlled rectifier

Multi-level inverters

Active power filters

Non-isolated DC- DC converter

Characteristic of SVC

Characteristic of STATCOM

Characteristic of TCSC

Improvement of power quality using shunt compensation

Improvement of power quality using series compensation

Solar power integration to grid

Vector control of inverter

Suggested Readings

N. G. Hingorani and L. Gyugyi, "Understanding FACTS: Concepts and Technology of FACTS Systems", Wiley-IEEE Press, 1999.

M.R. Rashid, Power Electronic Circuits, Devices and Applications, Third Edition, PHI.

Mapping of COs to Experiments

Course Out-comes	Expt.1	Expt.2	Expt.3	Expt.4	Expt.5	Expt.6	Expt.7	Expt.8	Expt.9	Expt.10	Expt.11
CO 1	H	H	H	H							
CO 2					H	H	H	L	L		L
CO 3	M	M	M								
CO 4	H	H		M						L	

EEMP6041: MINI PROJECT (M.Tech)**(2 Credits - 60 hours) (L-T-P: 0-0-4)****Course Outcomes**

Apply practical knowledge within the chosen area of technology for project development. (Applying)

Demonstrate the skills to carry out research work independently. (Understanding)

Plan for executing projects with a comprehensive and systematic approach. (Applying)

Take part in development of technical projects as an individual or in a team. (Analyzing)

Develop effective communication skills for presentation of project related activities. (Creating)

Process:

Literature Review

Synopsis Presentation

Progress Presentation

Hardware/Software Project Execution

Final Presentation and Demonstration of the Project

EEDI6050: DISSERTATION PHASE-I**(10 Credits) (L-T-P : 0-0-20)****Course Outcomes**

Select a project of interest. (Remembering)

Defend the topic of interest for continuing work, by doing initial studies on it. (Understanding)

Prepare a working methodology for the project for its successful completion. (Applying)

Design and experiment on the selected project. (Analysing)

Devise tools and methods for experimenting and troubleshooting for getting expected outcomes.

(Evaluating)

Explain, justify and defend the project work by presenting the work and writing a report. (Creating)

Objective

During this Phase-I of the M.Tech dissertation, the student will start a research project, applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightage attached to them shall be published by the department/Institute at the beginning of the semester. At least one review paper is expected to be published by the student in this phase.

EEDI6051: DISSERTATION PHASE-II**(16 Credits) (L-T-P: 0-0-32)****Course Outcomes**

Define the problem encountered in Phase-I and find suitable methodology to be adopted for the project work. (Remembering)

Classify the whole project work in various modules and explain the working model of the proposed work by demonstrating the different modules. (Understanding)

Apply mathematical skills to learn how these skills are important in engineering and construct software implementation skills and design skills especially from a systems perspective. (Applying)

Analyse the advanced electrical power or control systems and different problems encountered in designing a system. (Analysing)

Evaluate the complete system and perceive future scopes of the work carried out. (Evaluating)

Elaborate the performance of the work done, contrast on limitations of the system designed. and compile a technical report on the project (Creating)

Objective

During the Phase-II of M.Tech dissertation, the student will carry forward and complete the work that they have started in Phase-I. It is required that the student will publish at least one research paper in a well-known reputed journal to augment their work during this phase. Published papers will carry extra weightage during evaluation. The mode and components of evaluation and the weightage attached to them shall be published by the department at the beginning of the semester

SCHOOL OF TECHNOLOGY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

MASTERS OF TECHNOLOGY

VISION

To cultivate nation builders, with scientific and engineering expertise and moral integrity, committed towards the upliftment of society.

MISSION

The department of Electronics and Communication Engineering of Don Bosco College of Engineering and Technology, School of Technology, Assam Don Bosco University seeks to provide young and enthusiastic minds with sound theoretical and practical knowledge in electronics and communication technologies, so that they grow up into competent individuals, capable of:

Converting ideas into reality

Standing up to challenges to lead from the front and provide progressive solutions

Contributing towards the growth and development of new technologies

Creating a positive impact on global society and contributing towards the welfare of mankind

PROGRAM EDUCATIONAL OBJECTIVES

To create highly professional graduates with sound knowledge in the field of Electronics and Communication Engineering through quality education.

To cater to global technological needs and to contribute to the industry by delivering the expertise acquired, through problem solving and working on need based projects.

To groom young minds with a strong sense of commitment towards the betterment of society and environment.

PROGRAMME OUTCOMES OF M.TECH. IN SIGNAL PROCESSING:

PO 1: Ability to apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.

PO 2: Ability to identify, formulate and solve engineering problems in the signal processing areas such as Developing robust and problem specific algorithms for acquisition, processing, analysis, synthesis of signals, to be applied in Signal Processing, Machine Vision and Communication Networks.

PO 3: Ability to understand and use different software tools in the domain of signal processing. Analysis and Verification of algorithms, Functional and timing Simulation on platforms like MATLAB, code composer studio and assembly language.

PO 4: Ability to design and conduct experiments, analyze and interpret data, imbibe programming skills for development of simulation experiments.

PO 5: Ability to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

PROGRAMME OUTCOMES OF M.TECH IN COMMUNICATIONS:

PO 1: Ability to apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.

PO 2: Ability to identify, formulate and solve engineering problems in the broad areas like Systems Design using communication and networking platforms and tools. Explore recent developments in areas like optical communication, satellite communication, wireless communication, networking, RF-micro-wave, antennas, measurements and standards in communication.

PO 3: Ability to understand and use different software tools for Design, Analysis and Verification in the domain of communication and networking. System results are obtained through progressive steps such as Design entry, Synthesis, Functional and Timing Simulation.

PO 4: Ability to design and conduct experiments, analyze and interpret data, imbibe programming skills for development of simulation experiments.

PO 5: Ability to function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

PROGRAMME OUTCOMES OF M.TECH IN VLSI AND EMBEDDED SYSTEM:

PO 1: Ability to apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.

PO 2: Identify, formulate and solve engineering problems in the broad areas like System Design using VLSI and Embedded Platforms and tools, Semiconductor Technologies, Applications in Signal Processing, Machine Vision and Communication Networks.

PO 3: Use different software tools in the domain of VLSI and Embedded Systems Design, Analysis and Verification such as Design entry, Synthesis, Functional and Timing Simulation, Floor-planning, Place and route, Layout editors, RTL schematic, Platform specific EDA sets, MATLAB.

PO 4: Design and conduct experiments, analyze and interpret data, imbibe programming skills for development of simulation experiments.

PO 5: Function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

MAPPING of COURSES to PO/PSOs (M.Tech – Signal Processing)

Sl. No.	Course Type	COURSE	PO1	PO2	PO3	PO4	PO5	Remarks
1	Core 1	ECAP0053	H	H	H			Employability
2	Core 2	ECDV0054	M	H	H	M	L	Employability
3	Core	ECRM0042	L			M	H	
4	Audit 1	EGRW0015				L	M	
5	Prog. Specific Elective I	ECAU0055		H	H	M		Skill Development
6		ECCV0056		H	H	M	L	Skill Development
7		ECAA0057		H	H	M		Employability
8	Prog. Specific Elective II	ECSI0058	M	H	M	M		
9		ECVD0059	M	H	M	M		Skill Development
10		ECVC0060	L	H	H	H		Employability
11	Lab1	ECAP6041	M	H	H	H		
12	Lab2	ECDV6042	M	H	H	H		
13	Core 3	ECPM0069	L	H	H	H	L	Skill Development
14	Core 4	ECDE0070	M	H	M	M		
15	Prog. Specific Elective III	ECIA0071	M	H	M	H	H	Entrepreneurship
16		ECDD0072	H	M	H	L		Skill Development
17	Prog. Specific Elective IV	ECBS0073	M	H	H	H	M	Skill Development
18		ECDS0074	M	H	H			Employability
19	Lab3	ECPM6045	L	H	H	H	M	
20	Lab4	ECDE6046	M	M	H	H	M	
21	Project	ECMI6051	M	M	H	H	H	
22	Audit 2 (MOOCs)	EDCI0100					M	
23	Prog. Specific Elective V	ECAI0096	M	H	H	H	L	
24		ECOT0097	M	H	H	H		
25		ECRS0098	M	H	H	H	L	

26	Open Elective	Bioinformat-ics	H	H				
27	Dissertation (Phase I & II)	ECDI6059	M	M	H	H	H	

MAPPING of COURSES to PO/PSOs (M.Tech – Communication)

Sl. No.	Course Type	COURSE	PO1	PO2	PO3	PO4	PO5	Remarks
1	Core 1	ECAP0053	H	M	H			Employability
2	Core 2	ECWM0061	M	H		M		Employability
3	Core	ECRM0042	L			M	H	
4	Audit 1	EGRW0015				L	M	
5	Prog. Specific Elective I	ECSC0062	M	H	M			Skill Development
6		ECWN0063	L	H	H	H		Employability
7		ECON0064	L	H	H			Employability
8	Prog. Specific Elective II	ECCR0065		H	M			
9		ECSI0058	M	M	H	M		Skill Development
10		ECRC0066	M	H				
11	Lab1	ECAP6041	M	M	H	H		
12	Lab2	ECWM6043	M	H	H			
13	Core 3	ECRS0075	M	H	H	M		Skill Development
14	Core 4	ECCN0076		H	M			
15	Prog. Specific Elective III	ECDS0074	M	H	M	H	H	Entrepreneurship
16		ECIA0071	H	M	H	L		Skill Development
17	Prog. Specific Elective IV	ECPM0069	L	H	H	H		Skill Development
18		ECMS0077	M	H	H			Employability
19	Lab3	ECRS6047	M	M	H	H	M	
20	Lab4	ECCN6048	M	M	H	H	M	
21	Project	ECMI6051	M	M	H	H	H	
22	Audit 2 (MOOCs)	EDCI0100					M	
23	Prog. Specific Elective V	ECAI0096	M	M	H	H	L	
24		ECOT0097	M	H	H	H		
25		ECRS0098	M	H	H	H		
26	Open Elective	Bioinformatics	H	H				
27	Dissertation (Phase I & II)	ECDI6059	M	M	H	H	H	

MAPPING of COURSES to PO/PSOs (M.Tech – VLSI and Embedded System)

Sl. No.	Course Type	COURSE	PO1	PO2	PO3	PO4	PO5	Remarks
1	Core 1	ECAP0053	H	H	H	L		Employability
2	Core 2	ECMA0067	M	M	H	M		Employability
3	Core	ECRM0042	L			M	H	
4	Audit 1	EGRW0015				L	M	
5		ECPP0068	M	H	H			

6	Prog. Specific Elective I	ECAA0057		H	H	M		Employability
7	Prog. Specific Elective II	ECWM0061	M	H		M		Employability
8		ECDV0054	M	H	H	M	L	Employability
9	Lab1	ECAP6041	M	H	H	H	M	
10	Lab2	ECMA6044	M	H	H	H	M	
11	Core 3	ECDS0074	M	H	H			Employability
12	Core 4	ECSA0078	M	M	H	M	L	Employability
13	Prog. Specific Elective III	ECDD0072	H	M	H	L		Skill Development
14		ECIA0071	M	H	M	H	H	Entrepreneurship
15	Prog. Specific Elective IV	ECMT0079	M	H	M			Employability
16		ECBS0080	M	H	H			
17	Lab3	ECDS6049	M	H	H	H	M	
18	Lab4	ECSA6050	M	H	H	H	M	
19	Project	ECMI6051	M	M	H	H	H	
20	Audit 2 (MOOCs)	EDCI0100					M	
21	Prog. Specific Elective V	ECAI0096	M	H	H	H	L	
22		ECNN0099	M	H		H		
23		ECSD0100	M	H	H	H		
24	Open Elective	Bioinformatics	H	H				
25	Dissertation (Phase I & II)	ECDI6059	M	M	H	H	H	

DETAILED SYLLABUS

THEORY COURSES

ECRM0042 RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHT (L-T-P: 2-0-0) (2 credits-30 hours)

Objective:

This course is designed to help students to identify research problems in various fields. It aims at giving potential researchers the knowledge of effectively analysing and interpreting results and presenting the findings to the scientific and technological community of the world. This course also aims at motivating students to bring about their creative ideas for innovation and establishing research impact in the global for a through intellectual ownership.

Course Outcomes

Find research problems in various fields (Remembering).

Illustrate the concepts related to patents, trademark and copyright (Understanding).

Apply scientific investigations to find solutions for research problems of interest (Applying).

Develop technical writing and presentation skills (Applying).

Analyze the available literature and compile literature review for knowing the state of the art in the areas of interest (Analyzing/ Creating).

Formulate a research problem for a given engineering domain (Creating)

Module I (12 Hours)

Meaning, sources, scope and objective of a research problem; Good research problem criteria and characteristics, errors in selecting a research problem; Research problem solutions– approaches for investigation; Approaches to effective literature studies; Data collection, analysis, interpretation and instrumentation; Plagiarism and ethical practices.

Module II (10 Hours)

Effective writing; Research proposal development and its format; Different report types.

Module III (8 Hours)

Nature of intellectual property: Patent, design, trade and copyright; Patenting and development process; Patent grant under PCT and procedure; Geographical indications.

Patent rights: Administration of patent systems, scope, information and databases, technology licensing. New developments and case studies.

Suggested Readings

Goddard Wayne, Melville Stuart, Research Methodology: An Introduction For Science And Technology Students, Juta & Co. Ltd.

Kumar Ranjit, Research Methodology A Step By Step Guide For Beginners, SAGE publications Inc.

Halbert J. Debora, Resisting Intellectual Property, CRC press.

Menell S. Peter, Lemley A. Mark, Merges P. Robert, Intellectual Property In New Technological Age, Clause 8 Publishing.

C.R. Kothari, Research Methodology Methods and Techniques, New Age International

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		L
CO 2	M		H
CO 3	H	L	
CO 4	L	H	M
CO 5	H	M	L
CO6	H	M	L

ECAP0053 ADVANCED DIGITAL SIGNAL PROCESSING (L-T-P: 3-0-0)

(3 Credit-45 hours)

Objective:

This course is intended to make the students learn the essential advanced topics in digital signal processing that are necessary for successful post graduate-level research. The course includes a review of the linear constant-coefficient system properties covered in an undergraduate DSP course, and then examines a variety of filter structures, time-varying and adaptive systems, fast algorithms, and other topics relevant to the research areas of the students.

Course Outcomes

Recall and illustrate theory of different filters and algorithms. (Remembering, Understanding)

Choose the best algorithm for adaptive filter design. (Applying)

Understand theory of multirate DSP, solve numerical problems and write algorithms. (Understanding, Applying)

Analyse theory of prediction and solution of normal equations. (Analysing)

Examine applications of DSP at block level. (Analysing)

Interpret the utilization of advanced algorithms like LMS, MMSE etc., for designing adaptive filters. (Evaluating)

Design the various types of digital filters. (Creating)

Module I (10 Hours)

Overview of DSP: Discrete time signals and Systems. Characterization in time and frequency, LTI System, the Z-transform, DFT, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design & structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, and Parallel all pass realization of IIR, FIR differentiators.

Module II (7 Hours)

Multi rate DSP: Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, polyphase filters, QMF, digital filter banks, Applications in sub-band coding.

Module III (8 Hours) inear prediction & optimum linear filters: Stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Module IV (8 Hours)

Introduction to adaptive signal processing: Adaptive Filters, FIR adaptive filters: steepest descent adaptive filter, LMS algorithm, Gradient Adaptive Lattice, Minimum mean square criterion, Recursive Least Square algorithm, Applications: noise cancellation, channel equalization, adaptive recursive filters, recursive least squares, Kalman Filter.

Module V (7 Hours)

Estimation of Spectra from Finite-Duration Observations of Signals: Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum Variance Spectral Estimation, Eigen analysis, Algorithms for Spectrum Estimation.

Module VI (5 Hours)

Application of DSP & Multi rate DSP: Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications.

Suggested Readings

J. G. Proakis and D. G. Manolakis "Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.

N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems-Filter Banks- Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.

Bruce W. Suter, "Multirate and Wavelet Signal Processing", 1st Edition, Academic Press, 1997.

M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.

S. Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.

D. G. Manolakis, V.K. Inglean and S. M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		M	L		
CO 2			M	H	L	
CO 3		H			M	L
CO 4			H	M	L	
CO 5	M		L			H
CO 6			M	L	H	

ECDV0054 DIGITAL IMAGE AND VIDEO PROCESSING (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective:

This course is intended to give the students an overview of important topics of image and video processing. The course starts with an introduction to the basics of image and video processing such as sampling, aliasing etc. and image transforms like DFT, DCT etc. and then moves on to advanced topics such as image and video restoration, segmentation, compression etc. It also introduces the students to concepts of colour image processing.

Course Outcomes

Define key stages of image processing (Remembering)

Explain key stages of image processing (Understanding)

Implement image enhancement, restoration, data compression techniques (Applying)

Compare object recognition tools (Analyzing)

Choose image enhancement technique and object recognition tool for specific applications (5, Evaluating)

Module I (10 Hours)

Digital Image and Video Fundamentals: Digital image and video fundamentals and formats, 2-D and 3-D sampling and aliasing, 2-D/3-D filtering, image decimation/interpolation, video sampling and interpolation, Basic image processing operations, Image Transforms. Need for image transforms, DFT, DCT, Walsh, Hadamard transform, Haar transform, Wavelet transform.

Module II (8 Hours)

Image and Video Enhancement and Restoration: Histogram, Point processing, filtering, image restoration, algorithms for 2-D motion estimation, change detection, motion-compensated filtering, frame rate conversion, deinterlacing, video resolution enhancement, Image and Video restoration (recovery).

Module III (10 Hours)

Image and Video Segmentation: Discontinuity based segmentation- Line detection, edge detection, thresholding, Region based segmentation, Scene Change Detection, Spatiotemporal Change Detection, Motion Segmentation, Simultaneous Motion Estimation and Segmentation Semantic Video Object Segmentation, Morphological image processing.

Module IV (7 Hours)

Colour image Processing: Colour fundamentals, Colour models, Conversion of colour models, Pseudo colour image processing, Full Colour processing.

Module V (5 Hours)

Image and Video Compression: Lossless image compression including entropy coding, lossy image compression, video compression techniques, and international standards for image and video compression (JPEG, JPEG 2000, MPEG-2/4, H.264, SVC), Video Quality Assessment.

Module VI (5 Hours)

Object recognition: Image Feature representation and description-boundary representation, boundary descriptors, regional descriptors, feature selection techniques, introduction to classification, supervised and unsupervised learning, Template matching, Bayes classifier.

Suggested Readings

Ed. Al Bovik, "Handbook of Image and Video Processing", 2nd Edition, Academic Press, 2000.

J. W. Woods, "Multidimensional Signal, Image and Video Processing and Coding", 2nd Edition, Academic Press, 2011.

Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Prentice Hall, 2008.

M. Tekalp, "Digital Video Processing", 2nd Edition, Prentice Hall, 2015.

S. Shridhar, "Digital Image Processing", 2nd Edition, Oxford University Press, 2016.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	M	M	M	M	M	M
CO 2	M	M	M	M	M	M
CO 3	H	H	H	L	H	L
CO 4	L	L	L	L	L	H
CO 5	H	H	L	L	L	H

ECAU0055 AUDIO PROCESSING (L-T-P: 3-0-0)

(3 credits – 45 hours)

Objective:

This course is intended to introduce the students to the fundamentals of audio processing and then move on to more advanced topics such as LPC, speech coding etc. The course also delves into applications of audio processing such as speech recognition and speaker recognition.

Course Outcomes

Define principal characteristics of speech, various speech analysis and synthesis systems (Remembering)
Explain principal characteristics of speech, various speech analysis and synthesis systems (Understanding)

Implement speech analysis and synthesis systems, speech coding, speech and speaker recognition (Applying)

Compare various techniques for speech analysis and synthesis, speech coding, speech and speaker recognition (Analyzing)

Choose suitable one amongst various techniques for speech analysis and synthesis, speech coding, speech and speaker recognition (Evaluating)

Module I (8 Hours)

Principle Characteristics of Speech: Linguistic information, Speech and Hearing, Speech production mechanism, Acoustic characteristic of speech Statistical Characteristics of speech. Speech production models, Linear Separable equivalent circuit model, Vocal Tract and Vocal Cord Model.

Module II (10 Hours)

Speech Analysis and Synthesis Systems: Digitization, Sampling, Quantization and coding, Spectral Analysis, Spectral structure of speech, Autocorrelation and Short Time Fourier transform, Window function, Sound Spectrogram, Mel frequency Cepstral Coefficients, Filter bank and Zero Crossing Analysis, Analysis –by-Synthesis, Pitch Extraction.

Module III (7 Hours)

Linear Predictive Coding Analysis: Principle of LPC analysis, Maximum likelihood spectral estimation, Source parameter estimation from residual signals, LPC Encoder and Decoder, PARCOR analysis and Synthesis, Line Spectral Pairs, LSP analysis and Synthesis.

Module IV (10 Hours)

Speech Coding: Reversible coding, Irreversible coding and Information rate distortion theory, coding in time domain: PCM, ADPCM, Adaptive Predictive coding, coding in Frequency domain: Sub band coding, Adaptive transform coding, Vector Quantization, Code Excited Linear Predictive Coding (CELP).

Module V (5 Hours)

Speech Recognition: Principles of speech recognition, Speech period detection, Spectral distance measure, Structure of word recognition system, Dynamic Time Warping (DTW), Theory and implementation of Hidden Markov Model (HMM).

Module VI (5 Hours)

Speaker recognition: Human and Computer speaker recognition Principles Text dependent and Text Independent speaker recognition systems. Applications of speech Processing.

Suggested Readings

Sadaoki Furui, "Digital Speech Processing, Synthesis and Recognition" 2nd Edition, Taylor & Francis, 2000.

Rabiner and Schafer, "Digital Processing of Speech Signals", Pearson Education, 1979.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H	M	L	L	L
CO 2	H	H	M	L	L	L
CO 3	L	H	M	H	H	H
CO 4	L	H	M	H	H	H
CO 5	L	H	M	H	H	H

ECCV0056 COMPUTER VISION (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective:

The course is intended to make an insight into different aspects of Computer Vision and Machine learning, working principles, systems associated and applications.

Course Outcomes

Recall the working of camera and explain behavior of various sources, surfaces, shadows, human visual systems etc. (Remembering/ Understanding)

Illustrate the image formation models and feature extraction for computer vision. (Understanding)

Apply various image analysis operations on the images and videos such as segmentation, counting objects, shape determination, feature extraction etc. (Applying)

Analyze algorithms for high level vision analysis such as object detection and classifications using input features and classifiers. (Analyzing)

Evaluate the segmentation and motion detection and estimation techniques. (Evaluating)

Develop small applications and detect the objects in various applications. (Creating)

Module I (10 Hours)

Image Formation Models: Colour- Generation, Human Perception, Representation, Model for an Image Colour; Camera: Pinhole and Lens Types, geometric Camera model and Camera calibration; Monocular imaging system, Orthographic & Perspective Projection, Binocular imaging systems, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Radiometry, Projections, Transforms- Fourier, Hough and Radon; Rectification, DLT, RANSAC, 3-D reconstruction framework; Autocalibration.

Module II (8 Hours)

Feature Extraction: Image representations (continuous and discrete), Scene Segmentation and Labeling; Counting Objects; Edge detection, Edge linking, corner detection, texture, binary shape analysis, boundary pattern analysis, circle and ellipse detection,

Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges;

Module III (10 Hours)

Shape Representation and Segmentation: Statistical Decision Theory; Pattern Recognition Principles; Clustering Approach- K-

Means Clustering; Parametric Approach- Bayes' Classifier; Relaxation Approach; Shape Similarity Based Recognition; Expert System; Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier and wavelet descriptors, B-Splines, Least Squares and Eigen Vector Line Fitting, Medial representations, Multi-resolution analysis, Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation

Module IV (5 Hours)

Motion Detection and Estimation: Regularization theory, Optical computation, Stereo Vision, Motion estimation, Background Subtraction and Modeling, Optical Flow, KLT, Spatio Temporal Analysis, Dynamic Stereo; Motion parameter estimation, Structure from motion, Motion Tracking in Video.

Module V (7 Hours)

Object recognition: Hough transforms and other simple object recognition methods, Shape correspondence and shape matching, Principal component analysis, Shape priors for recognition, Geometric templates from spatial relations, Probabilistic and inferential methods- neural networks, support vector machines; Recognition by relations between templates.

Module VI (5 Hours)

Applications of Computer Vision: Automated Visual Inspection, Inspection of Cereal Grains, Surveillance, In-Vehicle Vision Systems, CBIR, CBVR, Activity Recognition, computational photography, Biometrics, stitching and document processing.

Suggested Readings

D. Forsyth and J. Ponce, "Computer Vision - A modern approach", 2nd Edition, Pearson Prentice Hall, 2012

Szeliski, Richard, "Computer Vision: Algorithms and Applications", 1st Edition, Springer Verlag London Limited, 2011.

Richard Hartley and Andrew Zisserman, "Multiple View Geometry in Computer Vision", 2nd Edition, Cambridge University Press, 2004.

K. Fukunaga, "Introduction to Statistical Pattern Recognition", 2nd Edition, Morgan Kaufmann, 1990.

Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", 3rd Edition, Prentice Hall, 2008.

B. K. P. Horn, "Robot Vision", 1st Edition, McGraw-Hill, 1986.

E. R. Davies "Computer and Machine Vision: Theory, Algorithms, Practicalities", 4th Edition, Elsevier Inc, 2012.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H			L	M	M
CO 2		H	L			M
CO 3		M	H		L	L
CO 4	L			M	H	M
CO 5				H	M	L
CO 6	M	L	M	M	M	H

ECAA0057 ADVANCED COMPUTER ARCHITECTURE (L-T-P: 3-0-0)
(3 credits- 45 hours)
Objective:

The main objective of this course is to introduce the students with the concept of parallelism and pipelining, the design aspects and challenges. After this course students will be able to evaluate the issues in vector and array processors. They will also learn about high performance scalable multithreaded and multiprocessor systems.

Course Outcomes

Define the concept of pipelining and parallelism in various computer architectures. (Remembering)

Explain pipelining in software and hardware and hazards associated with it. (Understanding)

Identify various issues associated with vector and array processors. (Applying)

Analyse different types of multiprocessor architectures. (Analysing)

Compare the performance of multiprocessors and multithreaded architectures. (Evaluating)

Discuss parallel algorithms for multiprocessors. (Creating)

Module I (5 Hours)

Parallel Processing and Pipelining Processing- Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture.

Module II (10 Hours)

Pipeline Architecture-Principles and implementation of Pipelining, Classification of pipelining processors, Design aspect of Arithmetic and Instruction pipelining, Pipelining hazards and resolving techniques, Data buffering techniques, Advanced pipelining techniques, Software pipelining, VLIW (Very Long Instruction Word) processor.

Module III (8 Hours)

Vector and Array Processor- Issues in Vector Processing, Vector performance modeling, SIMD Computer Organization, Static Vs Dynamic network, Parallel Algorithms for Array Processors: Matrix Multiplication.

Module IV (7 Hours)

Multiprocessor Architecture - Loosely and Tightly coupled multiprocessors, Inter Processor communication network, Time shared bus, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency and bus snooping, Massively Parallel Processors (MPP).

Module V (5 Hours)

Multithreaded Architecture- Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions, Parallel Programming Techniques: Message passing program development.

Module VI (10 Hours)

Parallel algorithms for multiprocessors- Classification and performance of parallel algorithms, operating systems for multiprocessors systems, Message passing libraries for parallel programming interface, PVM (in distributed memory system), Message Passing Interfaces (MPI).

Suggested Readings

Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw Hill Education, 2012.

Kai Hwang, "Advanced Computer Architecture", McGraw Hill Education, 1993.

William Stallings, "Computer Organization and Architecture, Designing for Performance" Prentice Hall, 6th edition, 2006.

Kai Hwang, "Scalable Parallel Computing", McGraw Hill Education, 1998.

Harold S. Stone "High-Performance Computer Architecture", Addison-Wesley, 1993.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	H			
CO 3	M		H		
CO 4				H	
CO 5				M	H
CO 6	L		M	L	H

ECSI0058 STATISTICAL INFORMATION PROCESSING (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

This course is intended to introduce the students to the concepts of information processing. The course starts with the fundamental concepts of random variables and then moves on to random processes, random signal modelling, spectral analysis etc. It also covers concepts of information theory and source coding.

Course Outcomes

Define the statistical parameters associated with random variables and random processes. (Remembering)

Explain concept of various random signal models like MA, AR, ARMA etc. (Understanding)

Identify various hypothesis and methods to estimates parameters in statistical model. (Applying)

Inspect concepts of spectral analysis using functions like autocorrelation, periodogram etc.(Analyzing)

Evaluate information content, entropy, channel capacity etc. using various source and channel coding techniques (Evaluating)

Discuss application of information theory in the area of discrete mathematics (Creating)

Module I (10 Hours)

Review of random variables: Probability Concepts, distribution and density functions, moments, independent, uncorrelated and orthogonal random variables; Vector-space representation of Random variables, Vector quantization, Tchebycheff inequality theorem, Central Limit theorem, Discrete & Continuous Random Variables. Random process: Expectations, Moments, Ergodicity, Discrete-Time Random Processes

Stationary process, autocorrelation and autocovariance functions, Spectral representation of random signals, Properties of power spectral density, Gaussian Process and White noise process.

Module II (5 Hours)

Random signal modeling: MA(q), AR(p), ARMA(p,q) models, Hidden Markov Model & its applications, Linear System with random input, Forward and Backward Predictions, Levinson Durbin Algorithm.

Module III (10 Hours)

Statistical Decision Theory: Bayes' Criterion, Binary Hypothesis Testing, M-ary Hypothesis Testing, Minimax Criterion, Neyman-Pearson Criterion, Composite Hypothesis Testing. Parameter Estimation Theory: Maximum Likelihood Estimation, Generalized Likelihood Ratio Test, Some Criteria for Good Estimators, Bayes' Estimation Minimum Mean-Square Error Estimate, Minimum Mean Absolute Value of Error Estimate Maximum A Posteriori Estimate, Multiple Parameter Estimation Best Linear Unbiased Estimator, Least-Square Estimation Recursive Least-Square Estimator.

Module IV (5 Hours)

Spectral analysis: Estimated autocorrelation function, Periodogram, Averaging the periodogram (Bartlett Method), Welch modification, Parametric method, AR(p) spectral estimation and detection of Harmonic Signals.

Module V (8 Hours)

Information Theory and Source Coding: Introduction, Uncertainty, Information and Entropy, Source coding theorem, Huffman, Shannon-Fano, Arithmetic, Adaptive coding, RLE, LZW Data compaction, LZ-77, LZ-78. Discrete Memory less channels, Mutual information, channel capacity, Channel coding theorem, Differential entropy and mutual information for continuous ensembles.

Module VI (7 Hours)

Application of Information Theory: Group, Ring & Field, Vector, GF addition, multiplication rules. Introduction to BCH codes, Primitive elements, Minimal polynomials, Generator polynomials in terms of Minimal polynomials, Some examples of BCH codes, & Decoder, Reed-Solomon codes & Decoder, Implementation of Reed Solomon encoders and decoders.

Suggested Readings

Papoulis and S.U. Pillai, "Probability, Random Variables and Stochastic Processes", 4th Edition, McGraw-Hill, 2002.

D.G. Manolakis, V.K. Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing", McGraw Hill, 2000.

Mourad Barkat, "Signal Detection and Estimation", Artech House, 2nd Edition, 2005.

R.G. Gallager, "Information theory and reliable communication", Wiley, 1st edition, 1968.

F. J. MacWilliams and N. J. A. Sloane, "The Theory of Error-Correcting Codes", New York, North-Holland, 1977.

Rosen K.H., "Elementary Number Theory", Addison-Wesley, 6th edition, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	H			
CO 3	M		H		
CO 4		M		H	
CO 5	L				H
CO 6	L			M	H

ECVD0059: VOICE AND DATA NETWORKS (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective:

This course is intended to give the students an exposure to the design criteria of voice and data networks. The course starts with network design and performance issues in general, moves on to introducing the students to issues in design of voice and data networks and then gives an extensive idea on voice networks and data networks.

Course Outcomes

Define the fundamental concepts of network design and network performance issues, network terminology etc. (Remembering)

Explain concepts of voice and data networks. (Understanding)

Apply designs of voice and data networks such as link layer design etc. (Applying)

Inspect concepts of inter-networking, IP protocol and addressing CIDR, TCP, UDP etc. (Analyzing)

Evaluate Queuing models, traffic models, Markov systems etc. (Evaluating)

Discuss congestion avoidance, quality of service in packet networks etc. (Creating)

Module I (8 Hours)

Network Design Issues, Network Performance Issues, Network Terminology, centralized and distributed approaches for networks design, Issues in design of voice and data networks.

Module II (7 Hours)

Layered and Layer less Communication, Cross layer design of Networks, Voice Networks (wired and wireless) and Switching, Circuit Switching and Packet Switching, Statistical Multiplexing.

Module III (8 Hours)

Data Networks and their Design, Link layer design- Link adaptation, Link Layer Protocols, Retransmission. Mechanisms (ARQ), Hybrid ARQ (HARQ), Go Back N, Selective Repeat protocols and their analysis.

Module IV (7 Hours)

Queuing Models of Networks, Traffic Models, Little's Theorem, Markov chains, M/M/1 and other Markov systems, Multiple

Access Protocols, Aloha System, Carrier Sensing, Examples of Local area networks,

Module V (10 Hours)

Inter-networking, Bridging, Global Internet, IP protocol and addressing, Subnetting, Classless Inter domain Routing (CIDR), IP address lookup, Routing in Internet. End to End Protocols, TCP and UDP, Additive Increase/Multiplicative Decrease, Slow Start, Fast Retransmit/ Fast Recovery.

Module VI (5 Hours)

Congestion avoidance, RED TCP Throughput Analysis, Quality of Service in Packet Networks. Network Calculus, Packet Scheduling Algorithms.

Suggested Readings

D. Bertsekas and R. Gallager, "Data Networks", 2nd Edition, Prentice Hall, 1992.

L. Peterson and B. S. Davie, "Computer Networks: A Systems Approach", 5th Edition, Morgan Kaufman, 2011.

Kumar, D. Manjunath and J. Kuri, "Communication Networking: An analytical approach", 1st Edition, Morgan Kaufman, 2004.

Walrand, "Communications Network: A First Course", 2nd Edition, McGraw Hill, 2002.

Leonard Kleinrock, "Queueing Systems, Volume I: Theory", 1st Edition, John Wiley and Sons, 1975.

Aaron Kershenbaum, "Telecommunication Network Design Algorithms", McGraw Hill, 1993.

Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill, 1987

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H	H			
CO 3			H	M		
CO 4				H	H	
CO 5				H	H	

CO 6						H

ECVC0060: AUDIO, VIDEO CODING AND COMPRESSION (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective

This course is designed to give the students an idea about multimedia systems and processing. The course starts with basic coding techniques such as Huffman coding etc. and transforms such as DCT etc. and then gives an extensive idea on video and audio coding along with their compression systems.

Course Outcomes

Define the fundamental concepts of multimedia systems and processing. (Remembering)

Outline concepts of lossy and lossless image compression systems, still image compression standards etc. (Understanding)

Make use of standards of audio and video coding. (Applying)

Analyse motion estimation algorithms. (Analyzing)

Evaluate multimedia synchronization, audio-video interleaving video indexing and retrieval etc. (Evaluating)

Discuss applications of audio coding, video coding and various compression systems. (Creating)

Module I (5 Hours)

Introduction to Multimedia Systems and Processing, Lossless Image Compression Systems, Huffman Coding, Arithmetic and Lempel-Ziv Coding, Other Coding Techniques.

Module II (10 Hours)

Lossy Image Compression Systems, Theory of Quantization, Delta Modulation and DPCM, Transform Coding & K-L Transforms, Discrete Cosine Transforms, Multi-Resolution Analysis, Theory of Wavelets, Discrete Wavelet Transforms, Still Image Compression Standards: JBIG and JPEG.

Module III (8 Hours)

Video Coding and Motion Estimation: Basic Building Blocks & Temporal Redundancy, Block based motion estimation algorithms, other fast search motion estimation algorithms.

Module IV (5 Hours)

Video Coding Standards: MPEG-1 standards, MPEG-2 Standard, MPEG-4 Standard, H.261, H.263 Standards, H.264 standard.

Module V (7 Hours)

Audio Coding: Basic of Audio Coding, Audio Coding, Transform and Filter banks, Polyphase filter implementation, Format and encoding, Psychoacoustic Models.

Module VI (10 Hours)

Multimedia Synchronization: Basic definitions and requirements, References Model and Specification, Time stamping and pack architecture, Packet architectures and audio-video interleaving, Multimedia Synchronization, Playback continuity. Video Indexing and Retrieval: Basics of content based image retrieval, Video Content Representation, Video Sequence Query Processing.

Suggested Readings

Iain E.G. Richardson, "H.264 and MPEG-4 Video Compression", Wiley, 2003.

Khalid Sayood, "Introduction to Data Compression", 4th Edition, Morgan Kaufmann, 2012

Mohammed Ghanbari, "Standard Codecs: Image Compression to Advanced Video Coding", 3rd Edition, The Institution of Engineering and Technology, 2011.

Julius O. Smith III, "Spectral Audio Signal Processing", W3K Publishing, 2011.

Nicolas Moreau, "Tools for Signal Compression: Applications to Speech and Audio Coding", Wiley, 2011.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H				
CO 2	L	H				

CO 3			H	H	H	
CO 4			H	H	M	
CO 5					H	H
CO 6					H	H

ECWM0061 WIRELESS AND MOBILE COMMUNICATION (L-T-P: 3-0-0)**(3 credits- 45 hours)****Objective**

This course is intended to make the students learn the essential advanced topics in wireless communication. The course starts with an introduction to basics of wireless communication such as cellular concepts and then moves on to important advanced topics related to multiple access techniques, equalizers, fading etc. It also introduces the students to 4G and 5G standards that are relevant topics for today's times.

Course Outcomes

Define the fundamental concepts of cellular communication, multiple access techniques etc. (Remembering)

Outline concepts of GSM, GPRS etc. (Understanding)

Utilize GSM, CDMA etc. (Applying)

Analyse spectral efficiency based on multiple access techniques, equalizers in communication receivers etc. (Analysing)

Evaluate path loss, fading, diversity etc. (Evaluating)

Discuss 3G, 4G and 5G standards. (Creating)

Module I (10 Hours)

Cellular Communication Fundamentals: Cellular system design, Frequency reuse, cell splitting, handover concepts, Co channel and adjacent channel interference, interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment. GSM architecture and interfaces, GSM architecture details, GSM subsystems, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM. 2.5G Standards: High speed Circuit Switched Data (HSCSD), General Packet Radio Service (GPRS), 2.75 G Standards: EDGE.

Module II (8 Hours)

Spectral efficiency analysis based on multiple access technologies: TDMA, FDMA and CDMA, Comparison of these technologies based on their signal separation techniques, advantages, disadvantages and application areas, Wireless network planning (Link budget and power spectrum calculations).

Module III (10 Hours)

Mobile Radio Propagation: Large Scale Path Loss, Free Space Propagation Model, Reflection, Ground Reflection (Two-Ray) Model, Diffraction, Scattering, Practical Link Budget Design using Path Loss Models, Outdoor Propagation Models, Indoor

Propagation Models, Signal Penetration into Buildings. Small Scale Fading and Multipath Propagation, Impulse Response Model, Multipath Measurements, Parameters of Multipath channels, Types of Small Scale Fading: Time Delay Spread; Flat, Frequency selective, Doppler Spread; Fast and Slow fading.

Module IV (5 Hours)

Equalization, Diversity: Equalizers in a communications receiver, Algorithms for adaptive equalization, diversity techniques, space, polarization, frequency diversity, Interleaving.

Module V (7 Hours)

Code Division Multiple Accesses: Introduction to CDMA technology, IS 95 system Architecture, Air Interface, Physical and logical channels of IS 95, Forward Link and Reverse link operation, Physical and Logical channels of IS 95 CDMA, IS 95 CDMA Call Processing, soft Handoff, Evolution of IS 95 (CDMA One) to CDMA 2000, CDMA 2000 layering structure and channels.

Module VI (5 Hours)

Higher Generation Cellular Standards: 3G Standards, evolved EDGE, enhancements in 4G standard, Architecture and representative protocols, call flow for LTE, VoLTE, UMTS, introduction to 5G.

Suggested Readings

V. K. Garg, J. E. Wilkes, "Principle and Application of GSM", Pearson Education, 5th edition, 2008.

V. K. Garg, "IS-95 CDMA & CDMA 2000", Pearson Education, 4th edition, 2009.

T. S. Rappaport, "Wireless Communications Principles and Practice", 2nd edition, PHI, 2002.

William C. Y. Lee, "Mobile Cellular Telecommunications Analog and Digital Systems", 2nd edition, TMH, 1995.

Asha Mehrotra, "A GSM system Engineering" Artech House Publishers Boston, London, 1997.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L			
CO 2	H		M		L	
CO 3	L			M	H	
CO 4		H	M		L	
CO 5		M	H	H	L	
CO 6				M	M	H

ECSC0062 SATELLITE COMMUNICATION (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

This course is intended to give the students an exposure to the important concepts of satellite communication. The course starts with fundamental principles of satellite communication and architecture of satellites. It then introduces the students to more advanced topics such as orbital analysis, satellite subsystems, link budget etc.

Course Outcomes

Define the brief history of satellite systems and fundamental concepts of satellite communication. (Remembering)

Outline concepts of satellite subsystems, modulation and multiple access schemes used in satellite communication etc. (Understanding)

Make use of orbital analysis, satellite link budget etc. (Applying)

Analyse phenomena in satellite communication such as effect of solar eclipse on satellite, Doppler shift etc. (Analysing)

Evaluate subsystems such as AOCS, communication subsystem etc. (Evaluating)

Discuss VSAT, DBS-TV etc. (Creating)

Module I (8 Hours)

Architecture of Satellite Communication System: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications, and frequency bands used for satellite communication and their advantages/drawbacks.

Module II (10 Hours)

Orbital Analysis: Orbital equations, Kepler's laws of planetary motion, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity etc of a satellite, concepts of Solar day and Sidereal Day.

Module III (10 Hours)

Satellite subsystems: Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication subsystem, power subsystems, antenna sub-system.

Module IV (7 Hours)

Typical Phenomena in Satellite Communication: Effect of Solar Eclipse on satellite, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.

Module V (5 Hours)

Satellite link budget: Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget and C/N ratio calculations in clear air and rainy conditions, Case study of Personal Communication system (satellite telephony) using LEO.

Module VI (5 Hours)

Modulation and Multiple Access Schemes used in satellite communication, Typical case studies of VSAT, DBS-TV satellites and few recent communication satellites launched by NASA/ ISRO, GPS.

Suggested Readings

Timothy Pratt and Others, "Satellite Communications", Wiley India, 2nd edition, 2010.

S. K. Raman, "Fundamentals of Satellite Communication", Pearson Education India, 2011.

Tri T. Ha, "Digital Satellite Communications", Tata McGraw Hill, 2009.

Dennis Roddy, "Satellite Communication", McGraw Hill, 4th Edition, 2008.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	L		M		
CO 2			H	M	L	
CO 3	L	H	M			
CO4		L		H	M	
CO 5					H	
CO 6				L	M	H

ECWN0063 WIRELESS SENSOR NETWORKS (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

The objective of this course is to make the students to understand the basic WSN technology and supporting protocols, with emphasis placed on standardization basic sensor systems and provide a survey of sensor technology, medium access control protocols and address physical layer issues, sensor management, sensor network middleware, operating systems. Also to learn key routing protocols for sensor networks and main design issues, transport layer protocols for sensor networks, and design requirements

Course Outcomes

Recall and illustrate the Concepts, Network Architecture and Applications of Ad-hoc and Wireless Sensor Networks. (Remembering, Understanding)

Illustrate the Concepts, Architecture of ad-hoc and sensor networks and MAC layer protocols. (Understanding)

Identify the design of routing protocols for ad-hoc and wireless networks. (Applying)

Analyse the protocol design issues of Ad-hoc Networks. (Analysing)

Elaborate and Evaluate the QOS related performance measurements of ad-hoc and sensor networks. (Evaluating, Creating)

Module I (5 Hours)

Introduction: Introduction and overview of sensor network architecture and its applications, sensor network comparison with Ad Hoc Networks, Sensor node architecture with hardware and software details.

Module II (8 Hours)

Hardware: Examples like mica2, micaZ, telosB, cricket, Imote2, tmote, btnode, and Sun SPOT, Software (Operating Systems): tinyOS, MANTIS, Contiki, and RetOS.

Module III (7 Hours)

Programming tools: C, nesC. Performance comparison of wireless sensor networks simulation and experimental platforms like open source (ns-2) and commercial (QualNet, Opnet)

Module IV (10 Hours)

Overview of sensor network protocols: Sensor network protocols (details of at least 2 important protocol per layer): Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Module V (5 Hours)

Data dissemination and processing: Data dissemination and processing; differences compared with other database management systems, data storage; query processing.

Module VI (10 Hours)

Specialized features: Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

Suggested Readings

H. Karl and A. Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley & Sons, India, 2012.

C. S. Raghavendra, K. M. Sivalingam, and T. Znati, Editors, "Wireless Sensor Networks", Springer Verlag, 1st Indian reprint, 2010.

F. Zhao and L. Guibas, "Wireless Sensor Networks: An Information Processing Approach", Morgan Kaufmann, 1st Indian reprint, 2013.

Yingshu Li, MyT. Thai, Weili Wu, "Wireless sensor Network and Applications", Springer series on signals and communication technology, 2008.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				L
CO 2		L	M	M	H	H
CO 3		H	L	M	M	M
CO4	L		H	M		M
CO 5			M	L	M	H

ECON0064 OPTICAL NETWORKS (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

This course is intended to give the students an exposure to the design criteria of optical networks. The course starts with fundamentals such as SONET etc. and then deals with practical optical network design issues such as network performance, fault management, optical layer protection schemes etc.

Course Outcomes

Define the fundamental concepts of optical networks. (Remembering)

Outline concepts of SONET, SDH etc. (Understanding)

Utilize WDM network elements, OADM architectures etc. (Applying)

Analyse network survivability, WDM network design etc. (Analysing)

Evaluate network management functions, optical layer services, interfacing etc. (Evaluating)

Discuss concepts of OTDM, PON, AON etc. (Creating)

Module I (5 Hours)

SONET/SDH: Optical transport network, IP, routing and forwarding, multiprotocol label switching.

Module II (8 Hours)

WDM network elements: Optical line terminals and amplifiers, optical add/drop multiplexers, OADM architectures, reconfigurable OADM, optical cross connects.

Module III (7 Hours)

Control and management: Network management functions, optical layer services and interfacing, performance and fault management, configuration management, optical safety.

Module IV (5 Hours)

Network Survivability: Protection in SONET/SDH & client layer, optical layer protection schemes

Module V (10 Hours)

WDM network design: LTD and RWA problems, dimensioning wavelength routing networks, statistical dimensioning models.

Module VI (10 Hours)

Access networks: Optical time division multiplexing, synchronization, header processing, buffering, burst switching, test beds, Introduction to PON, GPON, AON.

Suggested Readings

Rajiv Ramaswami, Sivarajan, Sasaki, "Optical Networks: A Practical Perspective", MK, Elsevier, 3rd edition, 2010.

C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts Design, and Algorithms", PHI, EEE, 2001.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		M	L		
CO 2	H	M	L	M		
CO 3		H	L		M	L
CO 4		H	H		H	
CO 5			H		M	
CO 6			M		L	H

ECCR0065 COGNITIVE RADIO (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

This course will help the students to understand the spectrum scarcity problem and how cognitive radio deals with this problem. It will also deal with the contribution of cognitive radio systems in wireless networks and its architectures that enable the development of the cognitive radio network (both centralized and distributed). After this course students will be able to learn the technologies to allow an efficient use of TVWS for radio communications. It also discusses various cognitive radio standards along with various research challenges for deployment of cognitive radio networks.

Course Outcomes

Recall and illustrate the fundamental concepts of cognitive radio networks. (Remembering, Understanding)
Develop the cognitive radio, as well as techniques for spectrum holes detection that cognitive radio takes advantages in order to exploit it. (Applying)

Examine technologies to allow an efficient use of TVWS for radio communications based on two spectrum sharing business models/policies. (Analysing)

Elaborate and evaluate the fundamental issues regarding dynamic spectrum access, the radio-resource management and trading, as well as a number of optimization techniques for better spectrum exploitation. (Evaluating, Creating)

Module I (10 Hours)

Introduction: Introduction to Cognitive Radios: Digital dividend, cognitive radio (CR) architecture, functions of cognitive radio, dynamic spectrum access (DSA), components of cognitive radio, spectrum sensing, spectrum analysis and decision, potential applications of cognitive radio.

Module II (10 Hours)

Spectrum Sensing: Spectrum sensing, detection of spectrum holes (TVWS), collaborative sensing, geo-location database and spectrum sharing business models (spectrum of commons, real time secondary spectrum market).

Module III (8 Hours)

Optimization Techniques of Dynamic Spectrum Allocation: Linear programming, convex programming, nonlinear programming, integer programming, dynamic programming, stochastic programming.

Module IV (7 Hours)

Dynamic Spectrum Access and Management: Spectrum broker, cognitive radio architectures, centralized dynamic spectrum access, distributed dynamic spectrum access, learning algorithms and protocols.

Module V (5 Hours)

Spectrum Trading: Introduction to spectrum trading, classification to spectrum trading, radio resource pricing, brief discussion on economics theories in DSA (utility, auction theory), classification of auctions (single auctions, double auctions, concurrent, sequential).

Module VI (5 Hours)

Research Challenges in Cognitive Radio: Network layer and transport layer issues, cross layer design for cognitive radio networks.

Suggested Readings

Ekram Hossain, Dusit Niyato, Zhu Han, "Dynamic Spectrum Access and Management in Cognitive Radio Networks", Cambridge University Press, 2009.

Kwang-Cheng Chen, Ramjee Prasad, "Cognitive radio networks", John Wiley & Sons Ltd., 2009.

Bruce Fette, "Cognitive radio technology", Elsevier, 2nd edition, 2009.

Huseyin Arslan, "Cognitive Radio, Software Defined Radio, and Adaptive Wireless Systems", Springer, 2007.

Francisco Rodrigo Porto Cavalcanti, Soren Andersson, "Optimizing Wireless Communication Systems" Springer, 2009.

Linda Doyle, "Essentials of Cognitive Radio", Cambridge University Press, 2009.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	M	L	L	
CO 2		H	H	M		L
CO 3		H		H	M	L
CO 4	L	M	H	L	H	H

ECRC0066 RF AND MICROWAVE CIRCUIT DESIGN (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

The objectives of this course are to provide students with RF circuit fundamentals for designing various circuit building blocks in a typical RF transceiver. At the completion of the course, students should appreciate the workings of RF transceivers. They are expected to be able to design key building blocks of RF transceivers, including low-noise amplifiers, standard matching circuits, RF amplifiers, mixers, power amplifiers and RF oscillators.

Course Outcomes

Explain the behavior of RF passive components and model active components. (Understanding)

Perform transmission line analysis. (Applying, Analysing)

Demonstrate use of Smith Chart for high frequency circuit design. (Understanding)

Justify the choice/selection of components from the design aspects. (Evaluating)

Contribute in the areas of RF circuit design. (Creating)

Module I (8 Hours)

Transmission Line Theory: Lumped element circuit model for transmission line, field analysis, Smith chart, quarter wave transformer, generator and load mismatch, impedance matching and tuning.

Module II (7 Hours)

Microwave Network Analysis: Impedance and equivalent voltage and current, Impedance and admittance matrix, the scattering matrix, transmission matrix, Signal flow graph.

Module III (10 Hours)

Microwave Components: Microwave resonators, Microwave filters, power dividers and directional couplers, Ferromagnetic devices and components.

Module IV (5 Hours)

Nonlinearity And Time Variance in Microwave Circuits: Inter-symbol interference, random process & noise, definition of sensitivity and dynamic range, conversion gain and distortion.

Module V (10 Hours)

Microwave Semiconductor Devices And Modeling: PIN diode, Tunnel diodes, Varactor diode, Schottky diode, IMPATT and TRAPATT devices, transferred electron devices, Microwave BJTs, GaAs FETs, low noise and power GaAs FETs, MESFET, MOSFET, HEMT.

Module VI (5 Hours)

Amplifiers Design: Power gain equations, stability, impedance matching, constant gain and noise figure circles, small signal, low noise, high power and broadband amplifier, oscillators, Mixers design.

Suggested Readings

Matthew M. Radmanesh, "Advanced RF & Microwave Circuit Design: The Ultimate Guide to Superior Design", AuthorHouse, 2009.

D.M.Pozar, "Microwave engineering", Wiley, 4th edition, 2011.

R.Ludwig and P.Bretchko, "R. F. Circuit Design", Pearson Education Inc, 2009.

G.D. Vendelin, A.M. Pavoi, U. L. Rohde, "Microwave Circuit Design Using Linear And Non Linear Techniques", John Wiley 1990.

S.Y. Liao, "Microwave circuit Analysis and Amplifier Design", Prentice Hall 1987.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	H	L		L
CO 2	H	M	L			
CO 3	H	H	M	M		L
CO4		M	H	H	L	M
CO 5	L	L	M	M	H	H

ECMA0067 MICROCONTROLLERS AND APPLICATIONS (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

The course helps to develop an in-depth understanding of the operation of microcontrollers, assembly language programming and microcontroller interfacing techniques. The students will be able to design and implement microcontroller based systems in both hardware and software and can apply this knowledge to more advanced structures.

Course Outcomes

Define various terminologies related to microprocessor and microcontrollers. (Remembering)

Compare between microprocessor and microcontroller and to explain the internal organization of 8051 microcontroller and PIC16C61 microcontroller. (Understanding)

Apply 8051 microcontroller to solve real life problems. (Applying)

Analyze the performance of 8051 microcontroller and to design and develop 8051 based system. (Analyzing)

Explain the fundamentals of PIC microcontroller. (Understanding)

Module I (7 hours)

Introduction: History of Microcontrollers and Microprocessors. Differences between Microcontrollers and Microprocessors, Introduction to MPU of different categories- such as Microcontroller-8051, AVR, PIC, etc., their specific features, advantages.

Module II (10 hours)

Microcontroller 8051: Introduction; MCS-51 Architecture; Registers, I/O Ports, Memory organization.

Module III (12 hours)

Assembly Language Microcontroller 8051: Instructions, Addressing modes, Arithmetical, Logical, Jumps, Loops and Call etc., Interrupts Timers/ Counters and Serial Communications.

Module IV (8 hours)

Application of MCS-51: Interfacing 7-segment display, LCD, Key board, ADC etc. Development of instrumentation system such as temperature, pressure, flow, frequency, pulse width, voltage, rpm, pH etc. monitoring. Generation of PWM wave, Data- logger, alarm enunciators, PID controller, programmable controller and interlock control.

Module V (8 hours)

Introduction to PIC microcontrollers: Architecture, Mid-Range instruction Set, Power Input and Decoupling, Reset, Watchdog Timer, System Clock/Oscillators.

Suggested Readings

M. A. Mazidi and J. G. Mazidi, the 8051 Microcontroller and Embedded Systems

A V Deshmukh, Microcontrollers: Theory and Applications

Subrata Ghoshal, 8051 Microcontroller-Internals, Instructions, Programming and Interfacing, Pearson

Md Ali Mazidi, Rolin D. Mc-Kindly and Janice Gillistie, the 8051 Microcontroller and Embedded System Using Assembly and C

Lyla B. Das, Embedded Systems-An Integrated Approach, Pearson

Relevant Data Sheets

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M	L		
CO 2		H	M	M	
CO 3			H	M	
CO 4		L	M	H	
CO 5					H

ECPP0068 PARALLEL PROCESSING (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

The objective of this course is to expose the students to the concept of parallel processing and pipelining. In this course students are introduced to the limitations of different architectures of computer. After this course students will be able to Analyse the performance parameters for different architectures.

Course Outcomes

Define parallel processing and pipelining, multiprocessor architecture, multithreaded architectures and multithreaded processors (Remembering)

Explain parallel processing and pipelining, multiprocessor architecture, multithreaded architectures and multithreaded processors (Understanding)

Implement parallel programming techniques (Applying)

Compare various parallel processing and pipelining techniques, multiprocessor architecture, multithreaded architectures and multithreaded processors and various operating systems for multiprocessors. (Analyzing)

Choose suitable one amongst various parallel processing and pipelining techniques, multiprocessor architecture, multithreaded architectures and multithreaded processors and various operating systems for multiprocessors (Evaluating)

Module I (5 hours)

Overview of Parallel Processing and Pipelining, Performance analysis, Scalability

Module II (10 hours)

Principles and implementation of Pipelining, Classification of pipelining processors, Advanced pipelining techniques, Software pipelining

Module III (10 hours)

VLIW processors, Case study: Superscalar Architecture- Pentium, Intel Itanium Processor, Ultra SPARC, MIPS on FPGA, Vector and Array Processor, FFT Multiprocessor Architecture

Module IV (5 hours)

Multithreaded Architecture, Multithreaded processors, Latency hiding techniques, Principles of multi-threading, Issues and solutions

Module V (10 hours)

Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing,

Shared Memory Programming, Data Parallel Programming, Parallel Software Issues

Module VI (5 hours)

Operating systems for multiprocessors systems, Customizing applications on parallel processing platforms

Suggested Readings

Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing", MGH International Edition

Kai Hwang, "Advanced Computer Architecture", TMH

V. Rajaraman, L. Sivaram Murthy, "Parallel Computers", PHI.

William Stallings, "Computer Organization and Architecture, Designing for performance" Prentice Hall, Sixth edition

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	L	H	H	M	L
CO 2	H	L	H	H	M	L
CO 3	M	M	L	L	H	L
CO 4	H	L	H	H	M	H
CO 5	H	L	H	H	M	H

ECPM0069 PATTERN RECOGNITION AND MACHINE LEARNING (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

The course is intended to make an insight into different statistical models for pattern recognition problems. This course includes different statistical models, linear regression models, different machine learning tools like Neural Network, Fuzzy Logic and different clustering techniques.

Course Outcomes

Define various terminologies used in probability theory and statistics, Linear models, neural networks, linear discriminant functions (Remembering)

Explain various terminologies used in probability theory and statistics, Linear models, neural networks, linear discriminant functions, unsupervised learning methods (Understanding)

Implement various Linear models, neural networks, linear discriminant functions, unsupervised learning methods (Applying)

Compare various Linear models, neural networks, linear discriminant functions, unsupervised learning methods (Analyzing)

Choose suitable one amongst various neural networks, linear discriminant functions, unsupervised learning methods for specific application (Evaluating)

Module I (10 Hours)

Introduction to Pattern Recognition: Problems, applications, design cycle, learning and adaptation, examples, Probability distributions, Parametric Learning - Maximum likelihood and Bayesian Decision Theory- Bayes rule, discriminant functions, loss functions and Bayesian error analysis

Module II (5 Hours)

Linear models: Linear Models for Regression, linear regression, logistic regression Linear Models for classification

Module III (10 Hours)

Neural Network: Perceptron, multi-layer perceptron, back propagation algorithm, error surfaces, practical techniques for improving back propagation, additional networks and training methods, Adaboost, Deep Learning

Module IV (8 Hours)

Linear discriminant functions: Decision surfaces, two-category, multi-category, minimum squared error procedures, the Ho-Kashyap procedures, linear programming algorithms, Support vector machine

Module V (7 Hours)

Algorithm independent machine learning: Lack of inherent superiority of any classifier, bias and variance, re-sampling for classifier design, combining classifiers.

Module VI (5 Hours)

Unsupervised learning and clustering: k-means clustering, fuzzy k-means clustering, hierarchical clustering.

Suggested Readings

Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", 2nd Edition John Wiley & Sons, 2001.

Trevor Hastie, Robert Tibshirani, Jerome H. Friedman, "The Elements of Statistical Learning", 2nd Edition, Springer, 2009.

C. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H	H	H	L	L
CO 2	H	H	H	H	L	H
CO 3	L	H	H	H	M	H
CO 4	L	H	H	H	M	H
CO 5	M	L	H	H	M	H

ECDE0070 DETECTION AND ESTIMATION THEORY (L-T-P: 3-0-0)

(3 Credits- 45 Hours)

Objective

The objective of the course is to familiarize the students with mathematical understanding of signal detection and estimation. This course also intends to use various approaches to formulate and solve problems for signal detection and parameter estimation from noisy signals.

Course Outcomes

Explain of data computing algorithms like PCA, SVD etc. (Understanding)

Identify various measures of random processes associated with LTI system. (Applying)

Analyse the concepts of random processes in detection and estimation theory. (Analysing)

Discuss the design of different types of filters like Kalman and Weiner. (Creating)

Module I (5 Hours)

Review of Vector Spaces: Vectors and matrices: notation and properties, orthogonality and linear independence, bases, distance properties, matrix operations, Eigenvalues and eigenvectors.

Module II (7 Hours)

Properties of Symmetric Matrices: Diagonalization of symmetric matrices, symmetric positive definite and semi definite matrices, principal component analysis (PCA), singular value decomposition.

Module III (10 Hours)

Stochastic Processes: Time average and moments, ergodicity, power spectral density, covariance matrices, response of LTI system to random process, cyclostationary process, and spectral factorization.

Module IV (10 Hours)

Detection Theory: Detection in white Gaussian noise, correlator and matched filter interpretation, Bayes' criterion of signal detection, MAP, LMS, entropy detectors, detection in colored Gaussian noise, Karhunen-Loeve expansions and whitening filters.

Module V (5 Hours)

Estimation Theory: Minimum variance estimators, Cramer-Rao lower bound, examples of linear models, system identification, Markov classification, clustering algorithms.

Module VI (8 Hours)

Topics in Kalman and Weiner Filtering: Discrete time Wiener-Hopf equation, error variance computation, causal discrete time Wiener filter, discrete Kalman filter, extended Kalman filter. Specialized Topics in Estimation: Spectral estimation methods like MUSIC, ESPRIT, DOA Estimation.

Suggested Readings

Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume I: Estimation Theory", Prentice Hall, 1993

Steven M. Kay, "Fundamentals of Statistical Signal Processing, Volume II: Detection Theory", 1st Edition, Prentice Hall, 1998

Thomas Kailath, Babak Hassibi, Ali H. Sayed, "Linear Estimation", Prentice Hall, 2000.

H. Vincent Poor, "An Introduction to Signal Detection and Estimation", 2nd Edition, Springer, 1998.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H				
CO 2		L	H			
CO 3	M			H	H	
CO 4				L	M	H

ECIA0071 IOT AND APPLICATIONS (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

The main objective of this course is to introduce the students with the concept of IOT and M2M. In this course they will study IOT architecture and applications in various fields along with the security and privacy issues in IOT.

Course Outcomes

Choose recent technologies related to IOT and Web technologies. (Understanding)

Illustrate the concept of IOT, M2M Security and privacy issues in IOT. (Understanding)

Apply the concept of IOT architecture and Web technologies. (Applying)

Analyze IOT architecture and applications in various fields. (Analyzing)

Module I (10 Hours)

IoT & Web Technology The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Module II (8 Hours)

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT ValueChains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Module III (7 Hours)

IoT Architecture -State of the Art – Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Module IV (10 Hours)

IoT Applications for Value Creations Introduction, IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Module V (5 Hours)

Internet of Things Privacy, Security and Governance Introduction, Overview of Governance, Privacy and Security Issues

Module VI (5 Hours)

Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

Suggested Readings

Vijay Madiseti and ArshdeepBahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014
Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013
CunoPfister, "Getting Started with the Internet of Things", O'Reilly Media, 2011

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	M	L		M
CO 2		M			M	M
CO 3			L	L		L
CO4	M		M	H	L	

ECDD0072 DIGITAL DESIGN AND VERIFICATION (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

The objective of the course is to familiarize the students with Front end design and verification techniques and create reusable test environments. This course also intends to perform verification of increasingly complex designs more efficiently and effectively.

Course Outcomes

Define combinational, sequential logic design and PLDs. (Remembering)
Explain the design methodology of HDL (VHDL/Verilog). (Understanding)
Explain the architecture of PLDs. (Understanding)
Apply HDL coding techniques for various combinational and sequential circuit design. (Applying)
Compare different circuit designs for speed, power and noise optimization. (Analysing)
Verify increasingly complex designs more efficiently and effectively. (Evaluating)
Use EDA tools like Xilinx, Cadence, Mentor Graphics for various electronic design. (Creating)

Module I (10 Hours)

Revision of basic Digital systems: Combinational Circuits, Sequential Circuits, Logic families. Synchronous FSM and asynchronous design, Metastability, Clock distribution and issues, basic building blocks like PWM module, prefetch unit, programmable counter, FIFO, Booth's multiplier, ALU, Barrel shifter etc.

Module II (8 Hours)

Verilog/VHDL Comparisons and Guidelines, Verilog: HDL fundamentals, simulation, and testbench design, Examples of Verilog codes for combinational and sequential logic, Verilog AMS

Module III (7 Hours)

System Verilog and Verification: Verification guidelines, Data types, procedural statements and routines, connecting the test bench and design, Assertions, Basic OOP concepts, Randomization, Introduction to basic scripting language: Perl, Tcl/Tk

Module IV (8 Hours)

Current challenges in physical design: Roots of challenges, Delays: Wire load models Generic PD flow, Challenges in PD flow at different steps, SI Challenge - Noise & Crosstalk, IR Drop, Process effects: Process Antenna Effect & Electromigration.

Module V (7 Hours)

Programmable Logic Devices: Introduction, Evolution: PROM, PLA, PAL, Architecture of PAL's, Applications, Programming PLD's,

FPGA with technology: Antifuse, SRAM, EPROM, MUX, FPGA structures, and ASIC Design Flows, Programmable Interconnections, Coarse grained reconfigurable devices.

Module VI (5 Hours)

IP and Prototyping: IP in various forms: RTL Source code, Encrypted Source code, Soft IP, Netlist, Physical IP, and Use of external hard IP during prototyping, Case studies, and Speed issues. Testing of logic circuits: Fault models, BIST, JTAG interface.

Suggested Readings

Douglas Smith, "HDL Chip Design: A Practical Guide for Designing, Synthesizing & Simulating ASICs & FPGAs Using VHDL or Verilog", Doone publications, 1998.

Samir Palnitkar, "Verilog HDL: A guide to Digital Design and Synthesis", Prentice Hall, 2nd Edition, 2003.

Doug Amos, Austin Lesea, Rene Richter, "FPGA based Prototyping Methodology Manual", Synopsys Press, 2011.

Christophe Bobda, "Introduction to Reconfigurable Computing, Architectures, Algorithms and Applications", Springer, 2007.

Janick Bergeron, "Writing Testbenches: Functional Verification of HDL Models", Second Edition, Springer, 2003.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L		H	
CO 2	M	H		L		
CO 3	M	M		L	H	
CO4	M	H	H	M	L	
CO 5	L	M	M	H		L
CO 6			M	H	H	
CO 7			L	L	M	H

ECBS0073 BIOMEDICAL SIGNAL PROCESSING (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

The course will help to develop an in-depth understanding of different types of biomedical signals. The students will be able to identify and Analyse different biomedical signals.

Course Outcomes

Define the fundamentals of biomedical signals. (Remembering)

Interpret the various types of biomedical signals. (Understanding)

Experiment with various types of biomedical signals using various technological tool. (Applying)

Analyze and assess biomedical signals using various technological tool. (Analyzing)

Module I (5 hours)

Acquisition, Generation of Bio-signals, Origin of bio-signals, Types of bio-signals, Study of diagnostically significant biosignal parameters

Module II (5 hours)

Electrodes for bio-physiological sensing and conditioning, Electrode-electrolyte interface, polarization, electrode skin interface and motion artefact, biomaterial used for electrode, Types of electrodes (body surface, internal, array of electrodes, microelectrodes), Practical aspects of using electrodes, Acquisition of bio-signals (signal conditioning) and Signal conversion (ADC's DAC's) Processing, Digital filtering

Module III (7 hours)

Biomedical signal processing by Fourier analysis, Biomedical signal processing by wavelet (time-frequency) analysis, Analysis (Computation of signal parameters that are diagnostically significant)

Module IV (9 hours)

Classification of signals and noise, Spectral analysis of deterministic, stationary random signals and non-stationary signals, Coherent treatment of various biomedical signal processing methods and applications.

Module V (8 hours)

Principal component analysis, Correlation and regression, Analysis of chaotic signals Application areas of Bio-Signals analysis

Multiresolution analysis (MRA) and wavelets, Principal component analysis(PCA), Independent component analysis(ICA)

Module VI (6 hours)

Pattern classification—supervised and unsupervised classification, Neural networks, Support vector Machines, Hidden Markov models. Examples of biomedical signal classification examples

Suggested Readings

W. J. Tompkins, "Biomedical Digital Signal Processing", Prentice Hall, 1993.

Eugene N Bruce, "Biomedical Signal Processing and Signal Modeling", John Wiley & Son's publication, 2001.

Myer Kutz, "Biomedical Engineering and Design Handbook, Volume I", McGraw Hill, 2009.

D C Reddy, "Biomedical Signal Processing", McGraw Hill, 2005.

Katarzyn J. Blinowska, JaroslawZygarewicz, "Practical Biomedical Signal Analysis Using MATLAB", 1st Edition, CRC Press, 2011.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M				
CO 2		H	M	L		
CO 3			H	M	M	M
CO 4				H	H	M

ECDS0074 DSP ARCHITECTURE (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

The objective of the course is to familiarize the students with architecture of various DSP hardware. It aims to equip the students with ability to design, programming (assembly and C), and testing code using Code Composer Studio environment and other tools at an intermediate to advanced level that will serve them well towards tackling various problems in this discipline.

Course Outcomes

Recall, illustrate and summarize the DSP Architecture. (Remembering, Understanding)

Make use of TMS320C6X family DSP processor. (Applying)

Explain and solve signal processing problems with the help of FPGA based DSP system. (Understanding, Applying)

Develop DSP based Assembly Language Programming. (Creating)

Examine and explain complete design of DSP system. (Analyzing, Evaluating)

Module I (10 Hours)

Programmable DSP Hardware: Processing Architectures (von Neumann, Harvard), DSP core Algorithms (FIR, IIR, Convolution, Correlation, FFT), IEEE standard for Fixed and Floating Point Computations, Special Architectures Modules used in Digital Signal Processors (like MAC unit, Barrel shifters), On-Chip peripherals, DSP benchmarking.

Module II (15 Hours)

Structural and Architectural Considerations: Parallelism in DSP processing, Texas Instruments TMS320 Digital Signal Processor Families, Fixed Point TI DSP Processors: TMS320C1X and TMS320C2X Family, TMS320C25 –Internal Architecture, Arithmetic and Logic Unit, Auxiliary Registers, Addressing Modes (Immediate, Direct and Indirect, Bit-reverse Addressing), Basics of TMS320C54x and C55x Families in respect of Architecture improvements and new applications fields, TMS320C5416 DSP Architecture, Memory Map, Interrupt System, Peripheral Devices, Illustrative Examples for assembly coding.

Module III (10 Hours)

VLIW Architecture: Current DSP Architectures, GPUs as an alternative to DSP Processors, TMS320C6X Family, Addressing

Modes, Replacement of MAC Module by ILP, Detailed study of ISA, Assembly Language Programming, Code Composer Studio, Mixed C and Assembly Language programming, On-chip peripherals, Simple applications developments as an embedded environment.

Module IV (5 Hours)

Application of DSPs for signal processing, communication and multimedia. Multi-core DSPs: Introduction to Multi-core computing and applicability for DSP hardware.

Module V (5 Hours)

FPGA based DSP Systems: Limitations of P-DSPs, Requirements of Signal processing for Cognitive Radio (SDR), FPGA based signal processing design-case study of a complete design of DSP processor.

Suggested Readings

M. Sasikumar, D. Shikhare, Ravi Prakash, "Introduction to Parallel Processing", 1st Edition, PHI, 2006.

Fayez Gebali, "Algorithms and Parallel Computing", 1st Edition, John Wiley & Sons, 2011

Rohit Chandra, Ramesh Menon, Leo Dagum, David Kohr, Dror Maydan, Jeff McDonald, "Parallel Programming in OpenMP", 1st Edition, Morgan Kaufman, 2000.

Ann Melnichuk, Long Talk, "Multicore Embedded systems", 1st Edition, CRC Press, 2010.

Wayne Wolf, "High Performance Embedded Computing: Architectures, Applications and Methodologies", 1st Edition, Morgan Kaufman, 2006.

E.S.Gopi, "Algorithmic Collections for Digital Signal Processing Applications Using MATLAB", 1st Edition, Springer Netherlands, 2007.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M	M		L
CO 2		H	M	L	
CO 3			L	M	H
CO 4			H	M	L
CO 5	M	M	L	H	H

ECRS0075: ANTENNAS AND RADIATING SYSTEMS (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

The objective of this course is to introduce students with the concept of antennas, their principle of operation, analysis and their applications. It will also cover the theory of wave propagation over ground, through the troposphere and ionosphere; diversity principles; propagation effects in microwave systems, satellite, space, and radar links.

Course Outcomes

Compute the far field distance, radiation pattern and gain of an antenna for given current distribution. (Applying)

Compute the array factor for an array of identical antennas. (Applying)

Estimate the input impedance, efficiency and ease of match for antennas. (Evaluating)

Design antennas and antenna arrays for various desired radiation pattern characteristics. (Creating)

Module I (10 Hours)

Types of Antennas: Wire antennas, Aperture antennas, Micro strip antennas, Array antennas Reflector antennas, Lens antennas, Radiation Mechanism, Current distribution on thin wire antenna. Fundamental Parameters of Antennas: Radiation Pattern, Radiation Power Density, Radiation Intensity, Directivity, Gain, Antenna efficiency, Beam efficiency, Bandwidth, Polarization, Input Impedance, radiation efficiency, Antenna Vector effective length, Friis Transmission equation, Antenna Temperature.

Module II (8 Hours)

Linear Wire Antennas: Infinitesimal dipole, Small dipole, Region separation, Finite length dipole, half wave dipole, Ground effects. Loop Antennas: Small Circular loop, Circular Loop of constant current, Circular loop with non-uniform current.

Module III (7 Hours)

Linear Arrays: Two element array, N Element array: Uniform Amplitude and spacing, Broadside and End fire array, Super directivity, Planar array, Design consideration.

Module IV (8 Hours)

Aperture Antennas: Huygen's Field Equivalence principle, radiation equations, Rectangular Aperture, Circular Aperture. Horn Antennas: E-Plane, H-plane Sectoral horns, Pyramidal and Conical horns.

Module V (7 Hours)

Micro strip Antennas: Basic Characteristics, Feeding mechanisms, Method of analysis, Rectangular Patch, Circular Patch.

Module VI (5 Hours)

Reflector Antennas: Plane reflector, parabolic reflector, Cassegrain reflectors, Introduction to MIMO.

Suggested Readings

Constantine A. Balanis, "Antenna Theory Analysis and Design", John Wiley & Sons, 4th edition, 2016.

John D Kraus, Ronald J Marhefka, Ahmad S Khan, "Antennas for All Applications", Tata McGraw-Hill, 2002.

R.C.Johnson and H.Jasik, "Antenna Engineering handbook", Mc-Graw Hill, 1984.

I.J.Bhal and P.Bhartia, "Micro-strip antennas", Artech house, 1980.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	L	L		
CO 2		M	H	L	L	
CO 3	M	H	H	M		L
CO 4	M	L		H	H	

ECCN0076 ADVANCED COMMUNICATION NETWORK (L-T-P: 3-0-0)

(3 Credits- 45 hours)

Objective

The main objective of the course is to familiarize the students with concepts in communication networking. This course is intended to teach the students about various protocols in communication networking. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in this discipline.

Course Outcomes

Definition of basic taxonomy and terminology of the computer networking area. (Remembering)
 Understand advanced concepts in Communication Networking. (Understanding)
 Understand the mechanisms in Quality of Service in networking. (Understanding)
 Apply the basic concepts to build efficient networks. (Applying)
 Analyse the network from layers of OSI and TCP/IP model perspective. (Analysing)
 Evaluate and measure the performance issues in different networks. (Evaluating)
 Design and develop protocols for Communication Networks. (Creating)

Module I (8 Hours)

Overview of Internet-Concepts, challenges and history. Overview of -ATM. TCP/IP Congestion and Flow Control in Internet Throughput analysis of TCP congestion control. TCP for high bandwidth delay networks. Fairness issues in TCP.

Module II (10 Hours)

Real Time Communications over Internet. Adaptive applications. Latency and throughput issues. Integrated Services Model (IntServ). Resource reservation in Internet. RSVP; Characterization of Traffic by Linearly Bounded Arrival Processes (LBAP). Leaky bucket algorithm and its properties.

Module III (10 Hours)

Packet Scheduling Algorithms-requirements and choices. Scheduling guaranteed service connections. GPS, WFQ and Rate proportional algorithms. High speed scheduler design. Theory of Latency Rate servers and delay bounds in packet switched networks for LBAP traffic.; Active Queue Management - RED, WRED and Virtual clock. Control theoretic analysis of active queue management.

Module IV (7 Hours)

IP address lookup-challenges. Packet classification algorithms and Flow Identification- Grid of Tries, Cross producting and controlled prefix expansion algorithms.

Module V (5 Hours)

Admission control in Internet. Concept of Effective bandwidth. Measurement based admission control. Differentiated Services in Internet (DiffServ). DiffServ architecture and framework.

Module VI (5 Hours)

IPV4, IPV6, IP tunnelling, IP switching and MPLS, Overview of IP over ATM and its evolution to IP switching. MPLS architecture and framework. MPLS Protocols. Traffic engineering issues in MPLS.

Suggested Readings

Jean Wairand and Pravin Varaiya, "High Performance Communications Networks", 2nd edition, 2000.
 Jean Le Boudec and Patrick Thiran, "Network Calculus A Theory of Deterministic Queueing Systems for the Internet", Springer Verlag, 2001.
 Zhang Wang, "Internet QoS", Morgan Kaufman, 2001.
 Anurag Kumar, D. Manjunath and Joy Kuri, "Communication Networking: An Analytical Approach", Morgan Kaufman Publishers, 2004.
 George Kesidis, "ATM Network Performance", Kluwer Academic, Research Papers, 2005.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H					
CO 2			H	M	M	M
CO 3		H				
CO 4						H
CO 5	H					M
CO 6					H	M
CO 7						H

ECMS0077 MIMO SYSTEM (L-T-P: 3-0-0)
(3 Credits- 45 hours)

Objective

This course covers the fundamentals of Multiple input multiple output (MIMO) antenna based wireless communication systems. This course covers important concepts of MIMO communication such as capacity computation, error probability analysis, transmitter and receiver design, multi-user communication, etc. After completion of the course the participants will be able to apply the methods for performance analysis and design of advanced wireless communication systems.

Course Outcomes

Explain channel modelling and propagation, MIMO Capacity, space-time coding, MIMO receivers, MIMO for multi-carrier systems (e.g. MIMO-OFDM), multi-user communications, multi-user MIMO. (Understanding)

Illustrate, Analyse and interpret the cooperative and coordinated multi-cell MIMO and MIMO in 4G (LTE, LTE-Advanced, WiMAX). (Understanding, Analysing, Evaluating)

Perform Mathematical modelling and analysis of MIMO systems. (Creating)

Module I (5 Hours)

Introduction to Multi-antenna Systems, Motivation, Types of multi-antenna systems, MIMO vs. multi-antenna systems.

Module II (10 Hours)

Diversity, exploiting multipath diversity, transmit diversity, Space-time codes, The Alamouti scheme, Delay diversity, Cyclic delay diversity, Space-frequency codes, Receive diversity, The rake receiver, Combining techniques, Spatial Multiplexing, Spectral efficiency and capacity, Transmitting independent streams in parallel, Mathematical notation

Module III (10 Hours)

The generic MIMO problem, Singular Value Decomposition, Eigenvalues and eigenvectors, Equalising MIMO systems,

Disadvantages of equalising MIMO systems, Predistortion in MIMO systems, Disadvantages of pre-distortion in MIMO systems, Pre-coding and combining in MIMO systems, Advantages of pre-coding and combining, Disadvantages of precoding and combining, Channel state information.

Module IV (8 Hours)

Codebooks for MIMO, Beam forming, Beam forming principles, increased spectrum efficiency, Interference cancellation,

Switched beam former, Adaptive beam former, Narrowband beam former, Wideband beam former

Module V (7 Hours)

Case study: MIMO in LTE, Codewords to layers mapping, Pre-coding for spatial multiplexing, Pre-coding for transmit diversity, Beamforming in LTE, Cyclic delay diversity based pre-coding, Pre-coding codebooks, Propagation Channels, Time & frequency channel dispersion, AWGN and multipath propagation channels, Delay spread values and time variations, Fast and slow fading environments, Complex baseband multipath channels, Narrowband and wideband channels, MIMO channel models

Module VI (5 Hours)

Channel Estimation, Channel estimation techniques, Estimation and tracking, Training based channel estimation, Blind channel estimation, Channel estimation architectures, Iterative channel estimation, MMSE channel estimation, Correlative channel sounding, Channel estimation in single carrier systems, Channel estimation for CDMA, Channel estimation for OFDM.

Suggested Readings

Claude Oestges, Bruno Clerckx, "MIMO Wireless Communications : From Real-world Propagation to Space-time Code Design", Academic Press, 1st edition, 2010.

Mohinder Janakiraman, "Space - Time Codes and MIMO Systems", Artech House Publishers, 2004.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	H	H	M	M	
CO 2		L	M	H	H	L
CO 3	L	M	M	M	L	H

ECSA0078 EMBEDDED SYSTEMS AND APPLICATIONS (L-T-P: 3-0-0)**(3 Credits- 45 hours)****Objective**

The objective of this course is to expose the students to the features of advanced microcontrollers such as PIC and AVR. In this course students are introduced to the architecture, programming and interfacing of all these microcontrollers. Industrial applications of these microcontrollers are also introduced in this course.

Course Outcomes

Define various terminologies related to PIC and AVR microcontroller. (Remembering)

Explain the internal organization of PIC and AVR microcontroller. (Understanding)

Apply and analyze PIC and AVR microcontroller based system. (Applying)

Design and develop PIC and AVR microcontroller based system. (Creating)

Module I (10 Hours)

PIC Microcontroller: Overview of PIC Microcontrollers, PIC16CXX Series: Architecture, Memory Organization, Registers,

Oscillator Connections, Reset Actions, I/O ports, Interrupt, Timers, ADC, Watch Dog timer, Instruction Set

Module II (10 Hours)

PIC16F8XX Series:

Architecture, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, ADC, Instruction Set, Capture/Compare/PWM Module, MSSP Module, USART, Watch Dog Timer.

Assembly Language Programming using PIC16CXX and PIC16F8XX

Module III (10 Hours)

PIC24FXX Family Microcontroller: Architecture, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, Watch Dog timer, ADC, PWM, Serial Communications, Programming using Embedded C.

Module IV (15 Hours)

AVR Microcontroller:

Introduction, History, Importance of AVR, Naming Convention of AVR, Mega AVR Series.

ATMega8 Microcontroller: Architecture, Pin Diagram, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, ADC, Watch Dog timer.

ATMega16 Microcontroller: Architecture, Pin Diagram, Memory Organization, Registers, Oscillator Connections, I/O ports, Interrupt, Timers, ADC, Watch Dog timer.

Programming using ATMega8 and ATMega16.

Suggested Readings

V. Deshmukh, Microcontroller: Theory and Applications, TMG, 1st Edition

Md. Ali Mazidi, Rolin D. Mckinlay, Danny Causey, PIC Microcontroller and Embedded Systems: Using Assembly and C, Pearson, 1st Edition

Md. Ali Mazidi, SarmadNaimi, SepehrNaimi, The AVR Microcontroller and Embedded Systems: Using Assembly and C, Pearson, 1st Edition

Relevant Data Sheets

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2		H	M	L
CO 3		M	H	L
CO 4			M	H

ECMT0079 MEMORY TECHNOLOGIES (L-T-P: 3-0-0)
(3 Credits- 45 hours)
Objective

The course helps to develop an in-depth understanding of the various memory types. The students will be able to learn. After this course students will be able to design semiconductor memory circuits and subsystems. They can also identify various fault models, modes and mechanisms in semiconductor memories and their testing procedures.

Course Outcomes

Define various memory architecture. (Remembering)

Explain memory circuits and subsystems. (Understanding)

Apply various fault models, modes and mechanisms in semiconductor memories and their testing procedures. (Applying)

Analyse advanced memory technologies. (Analysing)

Assess various high density memory packing technologies. (Evaluating)

Discuss memory testing and reliability issues and start of the art memory chip design. (Creating)

Module I (10 hours)

Random Access Memory Technologies, Static Random Access Memories (SRAMs), SRAM Cell Structures, MOS SRAM Architecture, MOS SRAM Cell and Peripheral Circuit, Bipolar SRAM, Advanced SRAM Architectures, Application Specific SRAMs.

Module II (5 hours)

DRAMs, MOS DRAM Cell, BiCMOS DRAM, Error Failures in DRAM, Advanced DRAM Design and Architecture, Application Specific DRAMs. SRAM and DRAM Memory controllers.

Module III (5 hours)

Non-Volatile Memories, Masked ROMs, PROMs, Bipolar & CMOS PROM, EEPROMs, Floating Gate EPROM Cell, OTP EPROM, EEPROMs, Non-volatile SRAM, Flash Memories

Module IV (10 hours)

Semiconductor Memory Reliability and Radiation Effects, General Reliability Issues, RAM Failure Modes and Mechanism, Nonvolatile Memory, Radiation Effects, SEP, Radiation Hardening Techniques. Process and Design Issues, Radiation Hardened Memory Characteristics, Radiation Hardness Assurance and Testing

Module V (10 hours)

Advanced Memory Technologies and High-density Memory Packing Technologies, Ferroelectric Random Access Memories (FRAMs), Gallium Arsenide (GaAs) FRAMs, Analog Memories, MagnetoResistive Random Access Memories (MRAMs), Experimental Memory Devices

Module VI (5 hours)

Memory Hybrids (2D & 3D), Memory Stacks, Memory Testing and Reliability Issues, Memory Cards, High Density Memory Packaging

Suggested Readings

Ashok K Sharma, "Advanced Semiconductor Memories: Architectures, Designs and Applications", Wiley Interscience

Kiyooltoh, "VLSI memory chip design", Springer International Edition

Ashok K Sharma, "Semiconductor Memories: Technology, Testing and Reliability, PHI

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M	M			
CO 2	L	H	H	L		
CO 3		M	H	L		

CO 4			M	H		
CO 5				L	H	
CO 6				L	M	H

ECBS0080 COMMUNICATION BUSES AND INTERFACES (L-T-P: 3-0-0)
(3 Credits- 45 hours)

Objective

This main objective of this course is to introduce the students with the concept of various communication buses. After this course students will be able to develop APIs for configuration, reading and writing data onto serial bus and can also design and develop peripherals that can be interfaced to desired serial bus

Course Outcomes

Define various terminologies related to communication buses. (Remembering)

Compare various communication buses. (Understanding)

Explain the architecture of various communication buses. (Understanding)

Apply and analyze the concept of various communication buses. (Applying/ Analyzing)

Module I (8 hours)

Serial Busses, Physical interface, Data and Control signals, features

Module II (8 hours)

Limitations and applications of RS232, RS485, I2C, SPI

Module III (8 hours)

CAN - Architecture, Data transmission, Layers, Frame formats, applications

Module IV (8 hours)

PCI - Revisions, Configuration space, Hardware protocols, applications

Module V (8 hours)

USB - Transfer types, enumeration, Descriptor types and contents, Device driver

Module VI (5 hours)

Data Streaming Serial Communication Protocol, Serial Front Panel Data Port (SFPDP) using fiber optic and copper cable

Suggested Readings

Jan Axelson, "Serial Port Complete - COM Ports, USB Virtual Com Ports, and Ports for Embedded Systems", Lakeview Research, 2nd Edition

Jan Axelson, "USB Complete", Penram Publications

Mike Jackson, Ravi Budruk, "PCI Express Technology", Mindshare Press

Wilfried Voss, "A Comprehensive Guide to Controller Area Network", Copperhill Media Corporation, 2nd Edition, 2005.

Serial Front Panel Draft Standard VITA 17.1 – 200x

Technical references on www.can-cia.org; www.pcisig.com; www.usb.org

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	L				
CO 2		H	M	M	M	
CO 3			H	H	H	
CO 4			L	L	L	H

ECAI0096 ARTIFICIAL INTELLIGENCE (L-T-P: 3-0-0)
(3 credits- 45 hours)

Objective

The main objective of the course is to familiarize the students with concepts of Artificial Intelligence, search techniques and knowledge representation issues. This course also aims to equip the students with knowledge of fuzzy logic and its uses for artificial intelligence, game playing and natural language processing.

Course Outcomes

Define Artificial Intelligence and different techniques of Artificial Intelligence. (Remembering)

Relate components of a Planning system, AI in solutions that require problem solving, inference, perception, knowledge representation, learning ANN and Fuzzy logic. (Understanding)

Apply basic principles of AI in solutions that require problem solving, inference, perception, knowledge representation, learning, ANN and Fuzzy logic (Applying)

Analyze the different approaches to AI in solutions that require problem solving, inference, perception, knowledge representation, learning, game playing, ANN and Fuzzy logic (Analyzing)

Module I (10 Hours)

What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are AI Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate- And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

Module II (10 Hours)

Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate

Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

Module III (8 Hours)

Symbolic Reasoning Under Uncertainty: Introduction To Non-monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bayes' Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory

Module IV (5 Hours)

Fuzzy Logic, Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and- Filler Structures: Conceptual Dependency, Scripts, CYC.

Module V (7 Hours)

Game Playing: Overview, And Example Domain: Overview, MiniMax, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction.

Module VI (5 Hours)

Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.

Suggested Readings

Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.

Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rd Edition, Prentice Hall, 2009.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	M	M	L	L	L	L
CO 2	L	H	H	L	L	L
CO 3		M	H	H	L	L
CO 4	L	M	L	L	M	M

ECOT0097 OPTIMIZATION TECHNIQUES (L-T-P: 3-0-0)**(3 credits – 45 hours)****Objective**

The objective of the course is to familiarize the students about various optimization methods and algorithms necessary for solving various optimization problems.

Course Outcomes

Define single variable, multivariable and constrained and intelligent optimization techniques and also principles of genetic programming. (Remembering)

Illustrate the importance of optimization. (Understanding)

Apply basic concepts of mathematics to formulate an optimization problem. (Applying)

Analyze and appreciate a variety of performance measures for various optimization problems. (Analysing)

Evaluate and measure the performance of an optimization algorithm. (Evaluating)

Design algorithms, the repetitive use of which will lead reliably to finding an approximate solution. (Creating)

Module I (7 Hours)

Introduction to Classical Methods & Linear Programming Problems Terminology, Design Variables, Constraints, Objective Function, Problem Formulation. Calculus method, Kuhn Tucker conditions, Method of Multipliers.

Module II (5 Hours)

Linear Programming Problem, Simplex method, Two-phase method, Big-M method, duality, Integer linear Programming, Dynamic Programming, Sensitivity analysis.

Module III (8 Hours)

Single Variable Optimization Problems: Optimality Criterion, Bracketing Methods, Region Elimination Methods, Interval Halving Method, Fibonacci Search Method, Golden Section Method. Gradient Based Methods: Newton-Raphson Method, Bisection Method, Secant Method, Cubic search method.

Module IV (10 Hours)

Multi Variable and Constrained Optimization Technique: Optimality criteria, Direct search Method, Simplex search methods, Hooke-Jeeve's pattern search method, Powell's conjugate direction method, Gradient based method, Cauchy's Steepest descent method, Newton's method, Conjugate gradient method. Kuhn - Tucker conditions, Penalty Function, Concept of Lagrangian multiplier, Complex search method, Random search method.

Module V (8 Hours)

Intelligent Optimization Techniques: Introduction to Intelligent Optimization, Soft Computing, Genetic Algorithm: Types of reproduction operators, crossover & mutation, Simulated Annealing Algorithm, Particle Swarm Optimization (PSO) - Graph Grammar Approach – Example Problems

Module VI (7 Hours)

Genetic Programming (GP): Principles of genetic programming, terminal sets, functional sets, differences between GA & GP, random population generation, solving differential equations using GP.

Suggested Readings

S. S. Rao, "Engineering Optimisation: Theory and Practice", Wiley, 2008.

K. Deb, "Optimization for Engineering design algorithms and Examples", Prentice Hall, 2005.

C.J. Ray, "Optimum Design of Mechanical Elements", Wiley, 2007.

R. Saravanan, "Manufacturing Optimization through Intelligent Techniques, Taylor & Francis Publications, 2006.

D. E. Goldberg, "Genetic algorithms in Search, Optimization, and Machine learning", Addison-Wesley Longman Publishing, 1989.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		H	L		
CO 2		L	H	H	M	
CO 3	H		L	M	M	L
CO 4	L		H	M		M
CO 5		M		M	H	H
CO 6		L		H	M	H

ECRS0098: REMOTE SENSING (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

This course is intended to introduce the students to the concepts of remote sensing. The course starts with the physics used in remote sensing and then gives an idea about the types of platforms and satellites. It also deals with advanced topics such as microwave scatterometry, thermal and hyper spectral remote sensing etc.

Course Outcomes

Define the concepts behind the physics of remote sensing. (Remembering)

Outline concepts of data acquisition and different platforms such as LANDSAT, SPOT etc. (Understanding)

Make use of optical sensors and different types of scanners. (Applying)

Analyse different types of RADAR, characteristics of microwave images etc. (Analyzing)

Evaluate thermal and hyper spectral remote sensing etc. (Evaluating)

Discuss data analysis and data processing techniques. (Creating)

Module I (10 Hours)

Physics Of Remote Sensing: Electro Magnetic Spectrum, Physics of Remote Sensing, Effects of Atmosphere Scattering, Different types, Absorption, Atmospheric window, Energy interaction with surface features, Spectral reflectance of vegetation, soil and water atmospheric influence on spectral response patterns-multi concept in Remote sensing.

Module II (5 Hours)

Data Acquisition: Types of Platforms, Different types of aircrafts, Manned and Unmanned space crafts, sun synchronous and geosynchronous satellites.

Types and characteristics of different platforms: LANDSAT, SPOT, IRS, INSAT, IKONOS, QUICKBIRD etc.

Module III (10 Hours)

Photographic products, B/W color, color IR film and their characteristics, resolving power of lens and film, Optomechanical electro optical sensors, across track and along track scanners, multispectral scanners and thermal scanners, geometric characteristics of scanner imagery, calibration of thermal scanners.

Module IV (10 Hours)

Scattering System: Microwave scatterometry, types of RADAR, SLAR, resolution, range and azimuth, real aperture and synthetic aperture RADAR. Characteristics of Microwave images: topographic effect, different types of Remote Sensing platforms, airborne and space borne sensors, ERS, JERS, RADARSAT, RISAT, Scatterometer, Altimeter, LiDAR remote sensing, principles, applications.

Module V (5 Hours)

Thermal and Hyper Spectral Remote Sensing: Sensors characteristics, principle of spectroscopy, imaging spectroscopy, field conditions, compound spectral curve, Spectral library, radiative models, processing

procedures, derivative spectrometry, thermal remote sensing, thermal sensors, principles, thermal data processing, applications.

Module VI (5 Hours)

Data Analysis: Resolution, Spatial, Spectral, Radiometric and temporal resolution, signal to noise ratio, data products and their characteristics, visual and digital interpretation, Basic principles of data processing, Radiometric correction, Image enhancement, Image classification, Aerial Laser Terrain Mapping.

Suggested Readings

Lillesand.T.M. and Kiefer.R.W ,“Remote Sensing and Image interpretation”, 6th Edition, John Wiley & Sons, 2000.

John R. Jensen, “Introductory Digital Image Processing: A Remote Sensing Perspective”, 2nd Edition, PrenticeHall,1995.

Richards, John A., Jia, Xiuping, “Remote Sensing Digital Image Analysis”,5th Edition, Springer-Verlag Berlin Heidelberg, 2013.

Paul Curran P.J. Principles of Remote Sensing, 1st Edition, Longman Publishing Group, 1984.

Charles Elachi, Jakob J. van Zyl, “Introduction to ThePhysicsand Techniques of Remote Sensing”, 2nd Edition, Wiley Serie,2006.

Sabins, F.F.Jr, “Remote Sensing Principles and Image Interpretation”, 3rd Edition, W. H. Freeman & Co,1978.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	L				
CO 2		H	M			
CO 3			H	H		
CO 4			M	H	H	
CO 5					H	H
CO 6						H

ECNN0099: NANOTECHNOLOGY AND NANOELECTRONICS (L-T-P: 3-0-0)

(3 credits – 45 hours)

Objective

This course will introduce the students to Nanotechnology. The course is designed to build up a basic understanding of the nano concepts. It will provide the students the knowledge of synthesis of nanomaterials, their characterization techniques as well as touch upon some applications of nanotechnology. This course will also introduce the students to nano and molecular

Course Outcomes

Recognize the concepts underlying this disruptive field of new technology (Remembering)

Illustrate the processes involved in making nano components and material. (Understanding)

Apply this knowledge for fabrication of new materials and devices in the nanoscale (Application)

Analyze new materials and devices in the nanoscale using various characterization tools (Analysis)

Evaluate materials for their various properties (Evaluating)

Creating solutions for practical problems with appropriate use of nano-materials. (Creating)

Module I (8 Hours)

Basics of Nanotechnology: History, Properties of Nanomaterials, Difference between Bulk and Nano-material, Molecular building blocks for nanostructure systems, Forces between atoms and molecules - Particles and grain boundaries – strong Intermolecular forces – Electrostatic and Vander Waals forces between surfaces, Properties of nanomaterials.

Module II (8 Hours)

Physics of nanomaterials: Atomic scale structure of nanoparticles, nanotubes, nanowires, nanodots etc.; electronic and optical characteristic properties of quantum dots, quantum wires and quantum wells; concept of quantum confinement: 0D, 1D and 2D nanostructures; Size effects – Fraction of Surface Atoms –

specific Surface Energy and Surface Stress. Nanophotonics, Nanofluidics, Nanothermodynamics, Plasmonics – plasmons and surface plasmons, SPR, Core-shell quantum dots and quantum-dot-quantum wells.

Module III (10 Hours)

Synthesis and Characterization of nanomaterials: Top down approach, Lithography – electron beam and ion beam techniques, Etching – wet and dry etching, Bottom up approach - Solvent based and template based synthesis, other important synthesis methods like CVD, PVD etc.; Doping, Nucleation, Growth and Stability of colloidal nanoparticles, concept of self-assembly. Characterization methods: Transmission electron microscopy (TEM), Scanning electron microscopy (SEM), Atomic force microscopy (AFM), X-ray diffraction spectroscopy (XRD), Optical characterization.

Module IV (12 Hours)

Fundamentals of Nanoelectronics: Quantum particles, Quantum mechanics of electrons, Free and confined electrons, Band theory of solids, Single electron/few electron devices, Coulomb blockade, Semiconductor quantum wells, quantum wires and quantum dots, Nanosensors, Micro and Nano electromechanical systems, Photonic crystals, Nanopiezotronics.

Module V (7 Hours)

Molecular Electronics: Electronic and optoelectronic properties of molecular materials - Electrodes and contacts – functions – molecular electronic devices - elementary circuits using organic molecules- Organic materials based rectifying diode switches – TFTs- OLEDs- OTFTs – logic switches.

Suggested Readings

G. L. Hornyak, J. Dutta, H. F. Tibbals, A. Rao Introduction to nanoscience, CRC Press
 G. L. Hornyak, J. Dutta, H. F. Tibbals, A. Rao Introduction to nanotechnology CRC Press
 T. Pradeep, Nano: The Essentials McGraw Hill
 G. W. Hanson, Fundamentals of Nanoelectronics, Pearson
 D. Maclurcan and N. Radywyl (Eds.) Nanotechnology and Global Sustainability CRC Press
 E. Lichtfouse, J. Shwarzbauer, D. Robert, Environmental Chemistry for a Sustainable World, Vol.2 Springer Verlag

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M	M	L	L
CO 2		M	H		
CO 3		L	M	H	
CO 4		M	H	M	
CO 5	L	M	H		H
CO 6			M	M	H

ECSD0100 SOC DESIGN (L-T-P: 3-0-0)

(3 credits- 45 hours)

Objective

This course will cover the basics of system-on-chip (SoC) design, hardware-software co-specification, co-synthesis, network-onchip (NoC) systems and system-on-programmable-chip technologies. It provides the advanced knowledge required for system-on-chip design and development, multi-core architectures and embedded systems on a chip. It also involves projects based on FPGA prototyping platform using state-of-the-art synthesis and verification tools and design flows.

Course Outcomes

Define System on Chip (SoC) and SoC design methodologies. Also Relate the algorithms used for ASIC construction. (Remembering)

Explain the issues involved in ASIC design, including technology choice, design management, tool-flow, verification, debug and test, as well as the impact of technology scaling on ASIC design. (Understanding)

Model and specify embedded systems at high levels of abstraction. (Applying)

Develop HDL coding techniques for minimization of power consumption, Fault tolerant designs. (Applying)

Examine high performance algorithms available for ASICs. (Analysing)

Develop examples of applications and systems developed using a co-design approach. (Creating)

Module I (7 Hours)

ASIC: Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP) concepts.

Module II (8 Hours)

NISC: NISC Control Words methodology, NISC Applications and Advantages, Architecture Description Languages (ADL) for design and verification of Application Specific Instruction set Processors (ASIP), No-Instruction-Set-computer (NISC)- design flow, modeling NISC architectures and systems, use of Generic Netlist Representation - A formal language for specification, compilation and synthesis of embedded processors.

Module III (8 Hours)

Simulation: Different simulation modes, behavioural, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors, Low power FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

Module IV (7 Hours)

Low power SoC design / Digital system: Design synergy, Low power system perspective- power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling (DCFS), building block optimization, building block memory, power down techniques, power consumption verification.

Module V (10 Hours)

Synthesis: Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report analysis Single core and Multi core systems, dark silicon issues, HDL coding techniques for minimization of power consumption, Fault tolerant designs

Module VI (5 Hours)

Case study for overview of cellular phone design with emphasis on area optimization, speed improvement and power minimization.

Suggested Readings

Hubert Kaeslin, "Digital Integrated Circuit Design: From VLSI Architectures to CMOS Fabrication", Cambridge University Press, 2008.

B. Al Hashimi, "System on chip-Next generation electronics", The IET, 2006

Rochit Rajsuman, "System-on- a-chip: Design and test", Advantest America R & D Center, 2000

P Mishra and N Dutt, "Processor Description Languages", Morgan Kaufmann, 2008

Michael J. Flynn and Wayne Luk, "Computer System Design: System-on-Chip", Wiley, 2011

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H		H	M	L	
CO 2	H	M		L		
CO 3		M		H	L	H
CO 4		H	M		H	
CO 5	H		M	L		H

ECBI0129 BIOINFORMATICS

(L:T:P: 3:0:0) (3 credit – 45 hours)

Objective

The objective of the course is to introduce students to the rapidly evolving field of bioinformatics. It will help the students to gain knowledge about various biological databases that provides information about biomolecules. It will also give in depth understanding of various techniques used in bioinformatics.

Course Outcomes

Recall the biological concepts. (Remembering)

Explain the fundamentals of bioinformatics. (Understanding)

Apply various techniques used in bioinformatics. (Applying)

Analyse and compare various aspects of bioinformatics. (Analysing)

Predict protein structure that helps in drug discovery. (Creating)

Module I (10 hours)

Introduction to bioinformatics and computational biology, Scope of bioinformatics, relation of bioinformatics with molecular biology, Fundamental concepts of biology such as nucleotide, amino acids, proteins, different structure of proteins, DNA, DNA Sequences, Cell, Chromosomes, Gene, Mutation, Genetic Polymorphism

Module II (15 hours)

The form of biological information, Introduction to Biological Databases: Nucleic Acid Databases (NCBI, EMBL, DDBJ), Protein databases (Primary, Composite and Secondary), Specialized Genome Databases (SGD, TIGR), Structure Databases (CATH, SCOPE and PDBsum), Tools: FASTA, BLAST, BLAT, RASMOL

Module III (10 hours)

DNA sequence analysis, Sequence Based Parameters, DNA sequencing as a diagnostic tool

Module IV (10 hours)

Protein Structure and Function, Sequence Alignment, Protein Sequence Analysis, Protein Secondary Structure Prediction,

Recent advancement in bioinformatics

Introduction to various bioinformatics Softwares: Acua, INCA, Anaconda, PAST3, CodonW c. DNA Computing

Suggested Readings

Arthur M. Lesk, Introduction to Bioinformatics, Fifth Edition, Oxford

Jin Xiong, Essential Bioinformatics, First Edition, Cambridge University Press

David W. Mount, Bioinformatics: Sequence and Genome Analysis, First Edition, CBS

Relevant e resources

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L		
CO 2		H		
CO 3		M	H	
CO 4			M	H
CO 5			L	H

LABORATORY COURSES

ECAP6041: ADVANCED DIGITAL SIGNAL PROCESSING LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

Find and demonstrate the particular methodology to be adopted for writing the various programs in MATLAB. (Remembering - Understanding)

Apply important mathematical skills in writing MATLAB programs for DSP. (Applying)

Examine the advance topics of digital signal processing in MATLAB. (Analyzing)

List of Experiments:

Basic Signal Representation
Different operations on discrete time signals
Linear and Circular convolution
Correlation Auto And Cross
Stability Using Hurwitz Routh Criteria
Sampling FFT Of Input Sequence
Butterworth Low pass And High pass Filter Design
Chebychev Type I, II Filter
State Space Matrix from Differential Equation
Normal Equation Using Levinson Durbin
Decimation And Interpolation Using Rational Factors
Maximally Decimated Analysis DFT Filter
Cascade Digital IIR Filter Realization
Convolution And M Fold Decimation & PSD Estimator
Estimation Of PSD
Inverse Z Transform
Group Delay Calculation
Separation Of T/F
Parallel Realization of IIR filter

ECDV6042: DIGITAL IMAGE AND VIDEO PROCESSING LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

Perform basic gray and colour image processing operations as well as various image procession algorithms. (Applying)
Perform basic video processing algorithm and to calculate various features of image. (Applying)

List of Experiments:

Perform basic operations on images like addition, subtraction etc.
Plot the histogram of an image and perform histogram equalization
Implement segmentation algorithms
Perform video enhancement
Perform video segmentation
Perform image compression using lossy technique
Perform image compression using lossless technique
Perform image restoration
Convert a colour model into another
Calculate boundary features of an image
Calculate regional features of an image
Detect an object in an image/video using template matching/Bayes classifier

ECWM6043: WIRELESS AND MOBILE COMMUNICATION LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

Define the fundamental concepts of cellular communication like frequency reuse, cell splitting etc. (Remembering)
Outline concepts of GSM and CDMA architecture, network concepts etc. (Understanding)
Utilize GSM handset for various signalling techniques. (Applying)
Analyse transmitter and receiver sections in mobile handset, different modulation techniques etc. (Analysing)
Evaluate AT commands in 3G network. (Evaluating)

Discuss features of 3G communication systems such as transmission of voice and video calls, SMS etc. (Creating)

List of Experiments:

Understanding Cellular Fundamentals like Frequency Reuse, Interference, cell splitting, multipath environment, Coverage and Capacity issues using communication software.

Knowing GSM and CDMA architecture, network concepts, call management, call setup, call release, Security and Power Control, Handoff Process and types, Rake Receiver etc.

Study of GSM handset for various signaling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).

To study transmitters and receiver sections in mobile handsets and measure frequency band signal and GMSK modulating signal.

To study various GSM AT Commands their use and developing new applications using it.

Understanding of 3G Communication System with features like; transmission of voice and video calls, SMS, MMS, TCP/IP, HTTP, GPS and File system by AT Commands in 3G network.

Study of DSSS technique for CDMA, observe effect of variation of types of PN codes, chip rate, spreading factor, processing gain on performance.

To learn and develop concepts of Software Radio in a real time environment by studying the building blocks like Baseband and RF section, convolution encoder, Interleaver and De- Interleaver.

To study and Analyse different modulation techniques in time and frequency domain using SDR kit.

ECMA6044: MICROCONTROLLER AND APPLICATIONS LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

Apply the concept of 8051 microcontroller to write program using assembly language and embedded C language. (Applying)

Design systems using 8051 microcontroller. (Creating)

List of Experiments:

Introduction to various simulators used for 8051 microcontroller

Assembly language programming of 8051 microcontroller for arithmetic operations

Assembly language programming of 8051 microcontroller for logical operations

Introduction to development board of 8051 microcontroller

Interfacing of LED with 8051 microcontroller

Interfacing of Seven segment display with 8051 microcontroller

Interfacing of LCD interfacing with 8051 microcontroller

Interfacing of Keyboard with 8051 microcontroller

Interfacing of ADC with 8051 microcontroller

Assignment based on above mentioned experiments.

ECPM6045: PATTERN RECOGNITION & MACHINE LEARNING LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcome

Implement various tools such as maximum likelihood algorithm, Bayes classifier, linear regression, deep learning algorithm, linear discriminant algorithm, unsupervised learning. (Applying)

Design classifier using perceptron rule, feed forward back-propagation and delta rule, SVM. (Creating)

List of Experiments:

Implement maximum likelihood algorithm

Implement Bayes classifier

Implement linear regression

Design a classifier using perceptron rule

Design a classifier using feed-forward back-propagation and delta rule algorithms

Implement deep learning algorithm

Implement linear discriminant algorithm

Design a two class classifier using SVM
Design a multiclass classifier using SVM
Perform unsupervised learning

ECDE6046: DETECTION AND ESTIMATION THEORY LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

Identify methods for detection and estimation of signals in white and non-white Gaussian noise. (Applying)
Analyse Signals and noise models. (Analysing)
Design optimal and suboptimal detection and estimation algorithms under realistic conditions. (Creating)

List of Experiments:

Simulate signal and noise models models.
Simulate spatially separated target Signal in the presence of Additive Correlated White Noise
Simulate spatially separated target Signal in the presence of Additive Uncorrelated White Noise
Simulate spatially separated target Signal in the presence of Additive Correlated Colored Noise
Detect Constant amplitude Signal in AWGN
Detect Time varying Known Signals in AWGN
Detect Unknown Signals in AWGN
Compare performance comparison of the Estimation techniques - MLE, MMSE, Bayes Estimator, MAP Estimator, Expectation Maximization (EM) algorithm
Performance comparison of conventional Energy Detectors and Coherent Matched Filter Techniques

ECRS6047: ANTENNAS AND RADIATING SYSTEMS LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcome

Definition of basic taxonomy and terminology of the computer networking area. (Remembering)
Understand and build the skills of subnetting and routing mechanisms. (Understanding)
Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation. (Understanding)
Apply mathematical foundations to solve computational problems in computer networking. (Applying)
Analyse performance of various communication protocols. (Analysing)
Compare routing algorithms. (Evaluating)
Design and develop protocols for Communication Networks and practice packet/file transmission between nodes. (Creating)

List of Experiments:

Simulation of half wave dipole antenna.
Simulation of change of the radius and length of dipole wire on frequency of resonance of antenna.
Simulation of quarter wave, full wave antenna and comparison of their parameters.
Simulation of monopole antenna with and without ground plane.
Study the effect of the height of the monopole antenna on the radiation characteristics of the antenna.
Simulation of a half wave dipole antenna array.
Study the effect of change in distance between elements of array on radiation pattern of dipole array.
Study the effect of the variation of phase difference 'beta' between the elements of the array on the radiation pattern of the dipole array.
Case study.

ECCN6048: ADVANCED COMMUNICATION NETWORKS LAB

(L-T-P: 0-0-4) (2 credits)

Course Outcomes

Definition of basic taxonomy and terminology of the computer networking area. (Remembering)
Understand and build the skills of subnetting and routing mechanisms. (Understanding)

Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation. (Understanding)

Apply mathematical foundations to solve computational problems in computer networking. (Applying)

Analyse performance of various communication protocols. (Analysing)

Compare routing algorithms. (Evaluating)

Design and develop protocols for Communication Networks and practice packet/file transmission between nodes. (Creating)

List of Experiments:

Study of Networking Commands (Ping, Tracert, TELNET, nslookup, netstat, ARP, RARP) and Network Configuration Files.

Linux Network Configuration.

Configuring NIC's IP Address.

Determining IP Address and MAC Address using if-config command.

Changing IP Address using if-config.

Static IP Address and Configuration by Editing.

Determining IP Address using DHCP.

Configuring Hostname in /etc/hosts file.

Design TCP iterative Client and Server application to reverse the given input sentence.

Design a TCP concurrent Server to convert a given text into upper case using a multiplexing system called "select".

Design UDP Client Server to transfer a file.

Configure a DHCP Server to serve contiguous IP addresses to a pool of four IP devices with a default gateway and a default DNS address. Integrate the DHCP server with a BOOTP demon to automatically serve Windows and Linux OS Binaries based on client MAC address.

Configure DNS: Make a caching DNS client, and a DNS Proxy; implement reverse DNS and forward DNS, using TCP dump/Wireshark characterise traffic when the DNS server is up and when it is down.

Configure a mail server for IMAP/POP protocols and write a simple SMTP client in C/C++/Java client to send and receive mails.

Configure FTP Server on a Linux/Windows machine using a FTP client/SFTP client characterise file transfer rate for a cluster of small files 100k each and a video file of 700mb. Use a TFTP client and repeat the experiment.

Signaling and QoS of labeled paths using RSVP in MPLS.

Find shortest paths through the provider network for RSVP and BGP.

Understand configuration, forwarding tables, and debugging of MPLS.

ECDS6049: DSP ARCHITECTURE LAB

(L-T-P:0-0-4) (2 credits)

Course Outcomes

Recall and demonstrate the Code Composer Studio. (1-Remembering, 2-Understanding)

Develop the interfacing between MATLAB and Code Composer Studio (3-Applying, 6-Creating)

Simplify and explain the real time DSP problems with the help of DSP processor. (4-Analyzing, 5-Evaluating)

List of Experiments:

Introduction to Code Composer Studio-I

Introduction to Code Composer Studio-II

Introduction to the Addressing Modes

FFT and Bit Reversal Operation

FFT and its Applications

Audio Codec and its Applications

Real Time Data Exchange

FIR filtering by interfacing Matlab with Code Composer Studio

Introduction to Interrupts

Digital communication using Binary Phase Shift Keying

ECSA6050: EMBEDDED SYSTEMS AND APPLICATIONS LAB
(L-T-P: 0-0-4) (2 credits)

Course Outcomes

Perform various experiments using PIC and AVR microcontroller. (Applying)
Relate different peripheral devices with PIC and AVR microcontroller. (Analysing)
Evaluate the performance of various microcontroller based embedded systems (Evaluating)

List of Experiments:

Introduction to MPLAB and Embedded C.
LED interfacing with PIC Microcontroller
7 Segment display interfacing with PIC Microcontroller
LCD interfacing with PIC Microcontroller
Keyboard interfacing with PIC Microcontroller
ADC and DAC interfacing with PIC Microcontroller
Serial Communication using PIC Microcontroller
Timer using PIC Microcontroller
Interrupt using PIC Microcontroller
Basic programming using AVR Microcontroller
Data Acquisition using LabView
Interfacing of Microcontroller with LabVIEW

ECMI6051: MINI PROJECT
(L-T-P: 0-0-4) (2 credits)

Objective

The Mini Project work will start in semester III and should preferably be a problem with research potential and should involve scientific research, design, generation/collection and analysis of data, determining solution and must preferably bring out the individual contribution. Seminars should be based on the area in which the candidate has undertaken the dissertation work as per the common instructions for all branches of M. Tech. The examination shall consist of the preparation of a report consisting of a detailed problem statement and a literature review. The preliminary results (if available) of the problem may also be discussed in the report. The work has to be presented in front of the examiners panel set by the Head and PG coordinator. The candidate has to be in regular contact with his guide and the topic of dissertation must be mutually decided by the guide and student.

Course Outcomes

Choose various topics for self-learning (Remembering)
Explain different problems and recent trends related to the topic (Understanding)
Apply the knowledge to find out the solution of the problems related to the topic (Applying)
Compare various real life problems related to the topic (Analysing)
Evaluate various design problems related to the topic (Evaluating)
Develop oral and written communication skills to present and defend their work in front of technically qualified audience
(Creating)

ECDI6059: DISSERTATION PHASE-I
(L-T-P: 0-0-20) (10 credits)

Objectives

During this phase the student will start a research project applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester

Course Outcomes

Select a project of interest. (Remembering)
Defend the topic of interest for continuing work, by doing initial studies on it. (Understanding)
Prepare a working methodology for the project for its successful completion. (Applying)
Design and experiment on the selected project. (Analysing)
Devise tools and methods for experimenting and troubleshooting for getting expected outcomes. (Evaluating)
Explain, justify and defend the project work by presenting the work and writing a report. (Creating)

ECDI6060: DISSERTATION PHASE-II (L-T-P: 0-0-32) (16 credits)

Objective

During this phase the student will carry forward and complete the work that they have started in Phase I. It is expected that the student will publish at least one research paper in a well-known journal to augment their work during this phase. Published papers will carry extra weightage during evaluation. The mode and components of evaluation and the weightages attached to them shall be published by the Department at the beginning of the semester.

Course Outcomes

Define the problem encountered in Phase-I. (Remembering)
Explain the working model of the proposed work. (Understanding)
Apply mathematical skills and how these skills are important in engineering. (Applying)
Contrast different problems encountered in designing a system. (Analysing)
Interpret knowhow on the topic selected for the project. (Evaluating)
Contrast on limitations of the system designed. (Creating)

VALUE ADDED COURSES

ECES6064: ELECTRONIC DISPLAY SYSTEM (L-T-P: 2-0-0) (2 credits – 30 hours)

Objective

The objective of this course is to introduce the students to opto-electronic devices that are used to make advance display units. This course will also provide an exposure to interfacing of these display devices based on LED.

Course Outcomes

Explain and experiment with LED based display system. (Understanding - Applying)
Make use of Embedded Systems and its related applications. (Applying)
Design electronic displays. (Creating)

Module I (10 hours)

Fundamentals of LED: Introduction to PN Junction Diode, Construction and working of LED, Types of LED, Advantage, Disadvantage and Applications, 7 segment display, LED Dot Matrix Display, Tricolor LED – Construction and Working, LCD. Fundamentals of Microcontroller: 8051 Microcontroller, Basic and Advanced Microcontroller Boards.

Module II (20 hours)

Glowing of various patterns in LED using microcontroller, Microcontroller based up counter and down counter design using LED and 7 segment displays, Displaying of Names in different format using LCD, designing of rolling display using LED and LCD. Implementation of display devices in projects.

Suggested Readings

Electronic Devices and Circuits Theory, Boylestead and Nashelsky, 9th Edition, Prentice Hall India, 2007.
Electronic Devices and Circuits, Salivahanan et al., 2nd Edition, Tata McGraw Hill, New Delhi, 2008.
The 8051 Microcontroller And Embedded Systems Using Assembly And C, Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, Pearson
Microcontrollers : Theory and Applications, A V Deshmukh, Tata McGraw-Hill Education

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	M
CO 2	H	H
CO 3	H	H

ECNA6065: NANOTECHNOLOGY and APPLICATIONS
(L-T-P: 2-0-0) (2 credits – 30 hours)
Objective

This course will introduce the students to Nanotechnology. The course is designed to build up a basic understanding of the nano concepts. It will provide the students the knowledge of synthesis of nanomaterials, their characterization techniques as well as touch upon some applications of nanotechnology.

Course Outcomes

Define various terms such as nanotechnology, nanoelectronics, nanoscience etc. (Remembering)

Explain the operations of various characterization tools. (Understanding)

Apply the synthesis process to fabricate various nanostructures. (Applying)

Analyze various nanostructures. (Analysing)

Evaluate nanomaterials using characterization techniques. (Evaluating)

Module I (17 hours)

Introduction to Nanotechnology, Basics of Material science and Nanoscience, Poor Man's Nanotechnology, Introduction to Characterization Techniques-I, Synthesis of nanomaterials, ImageJ, Origin and Lab Rules, Nano electronics: Novel device fabrication and characterization.

Module II (13 hours)

Introduction to Characterization Techniques – II, Optical properties of nanomaterials, Nano Bioscience, Issues of Nanotechnology, Characterization results, Applications of Nanotechnology.

Suggested Readings

G. L. Hornyak, J. Dutta, H. F. Tibbals, A. Rao Introduction to nanoscience, CRC Press

G. L. Hornyak, J. Dutta, H. F. Tibbals, A. Rao Introduction to nanotechnology CRC Press

T. Pradeep, Nano: The Essentials McGraw Hill

G. W. Hanson, Fundamentals of Nanoelectronics, Pearson

D. Maclurcan and N. Radywyl (Eds.) Nanotechnology and Global Sustainability CRC Press

E. Lichtfouse, J. Shwarzbauer, D. Robert, Environmental Chemistry for a Sustainable World, Vol.2 Springer Verlag

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	M
CO 2	H	M
CO 3	H	M
CO 4	M	H
CO 5	M	H

SCHOOL OF TECHNOLOGY
DEPARTMENT OF COMPUTER APPLICATIONS
MASTER OF COMPUTER APPLICATIONS (MCA)

VISION OF THE DEPARTMENT

Imparting knowledge of Computer Applications, to mould individuals into IT professionals, researchers and entrepreneurs who are innovative, versatile and committed to society.

MISSION OF THE DEPARTMENT

1. To prepare students for professional career and higher studies by providing conducive teaching, learning and research environment.
2. To produce skilled individuals and entrepreneurs in emerging areas of technologies by academia-industry collaboration.
3. To instill in individuals a sense of commitment to work for the betterment of society using technology.

PROGRAMME – MASTER OF COMPUTER APPLICATIONS (MCA)

PROGRAM OUTCOMES – MCA

- PO 1: Computational Knowledge:** Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models from defined problems and requirements.
- PO 2: Problem Analysis:** Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
- PO 3: Design/Development of Solutions:** Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
- PO 4: Conduct investigations of complex Computing problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
- PO 5: Modern Tool Usage:** Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
- PO 6: Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.
- PO 7: Life-long Learning:** Recognise the need, and have the ability, to engage in independent learning for continual development as a computing professional.
- PO 8: Project management and finance:** Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
- PO 9: Communication Efficacy:** Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
- PO 10: Societal and Environmental Concern:** Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.
- PO 11: Individual and Team Work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
- PO 12: Innovation and Entrepreneurship:** Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

PROGRAM SPECIFIC OUTCOMES – MCA

PSO 1: Develop a comprehensive understanding and proficiency in advanced programming, computer networks, database management, distributed applications, software engineering, and entrepreneurship, enabling the effective design, development, and management of software systems.

PSO 2: Ability to work with latest tools and technologies in the field of computer applications, such as Cybersecurity, data science, machine learning and artificial intelligence and pursue careers in IT industry, research and development, teaching and allied areas.

SEMESTER I					
Type	Course Code	Course Name	Credits	Category	Page No
Theory	CAMF0043	Mathematical Foundation for Computer Science	4	DC	1620
Theory	CATC0048	Theory of Computation	4	DC	1621
Theory	CAOS0016	Operating Systems	4	DC	1623
Theory	CADA0044	Data Structures and Algorithms	4	DC	1624
Lab	CAPJ0018	Programming Through Java	2	DE	1626
Lab	CAOS6012	Operating Systems Lab	2	DC	1652
Lab	CADA6033	Data Structures and Algorithms Lab	2	DC	1653
Lab	CAPJ6014	Programming Through Java Lab	2	DE	1654
Total Credits			26		
SEMESTER II					
Theory	CASE0019	Software Engineering	4	DC	1628
Theory	CACC0045	Data Communication and Computer Networks	4	DC	1630
Theory	CADM0046	Advanced Database Management Systems	4	DC	1635
Theory	CAIT0022	Internet Technology and Applications	4	DC	1631
Theory	CASI0058	Sensor Networks and Internet of Things	3	DE	1633
Lab	CACC6034	Data Communication and Computer Networks Lab	2	DC	1654
Lab	CAIT6017	Internet Technology and Applications Lab	2	DC	1656
Lab	CADM6035	Advanced Database Management Systems Lab	2	DC	1657
Mandatory	CASL0200	Service Learning Theory / Community Engagement	NC	IE	
Mandatory		Indian Polity and Constitution	NC	IE	
Total Credits			25		
SEMESTER III					
Theory	CACL0033	Cyber Law and IT Security	4	DC	1636
Theory	CAML0049	Machine Learning	4	DC	1638
Theory	CAEP0024	Enterprise Resource Planning	4	DC	1639
Theory	ECRM0042	Research Methodology and IPR	2	DE	1640

Elective-I	—	Specialization I: Artificial Intelligence OR Data Science	4	DE	1647
Elective-II	—	Specialization II: Artificial Intelligence OR Data Science	4	DE	1647
Lab	CAML6036	Machine Learning Lab	2	DC	1658
Project	CAMI6038	Minor Project – MCA	5	DC	1659
Audit Course	EGCS0110	Communication Skills	NC	IE	1660
Audit Course	CMES0023	Entrepreneurship	NC	IE	1660
Mandatory		Service Learning Practice / Community Engagement	NC	IE	
Total Credits			29		
SEMESTER IV					
Project	CAMP6039	Major Project – MCA	18	DC	1659
Elective-III	—	Specialization III (Artificial Intelligence/Data Science)	2	DE	1647
Total Credits			20		

Specialization I (Artificial Intelligence)		
Course Code	Course Name	Page No
CAPA0030	Principles of Artificial Intelligence	1641
CAHC0050	Human Computer Interaction	1643
CABI0051	Bioinformatics	1644
CADL0052	Deep Learning	1645
CASC0053	Soft Computing	1646
Specialization II (Data Science)		
CADS0054	Data Science	1647
CAVS0055	Data Visualization for Data Science	1649
CABD0056	Big Data Management	1650
CAWA0057	Web Analytics and Development	1651
Specialization III (Artificial Intelligence/Data Science)		
	NPTEL Course of 8-12 Weeks List of Courses to be provided by the Department	

LIST OF COURSES - MCA

Mapping Code	Course Name
1.1	Mathematical Foundation for Computer Science
1.2	Theory of Computation
1.3	Operating Systems
1.4	Data Structures and Algorithms
1.5	Programming Through Java
1.6	Operating Systems Lab
1.7	Data Structures and Algorithms Lab
1.8	Programming Through Java Lab
2.1	Software Engineering
2.2	Data Communication and Computer Networks

2.3	Advanced Database Management Systems
2.4	Internet Technology and Applications
2.5	Sensor Networks and Internet of Things
2.6	Data Communication and Computer Networks Lab
2.7	Internet Technology and Applications Lab
2.8	Advanced Database Management Systems Lab
2.9	Constitution of India
3.1	Cyber Law and IT Security
3.2	Machine Learning
3.3	Enterprise Resource Planning
3.4	Research Methodology and IPR
3.5	Elective I <i>Specialization I: Artificial Intelligence</i> OR <i>Specialization II: Data Science</i>
3.6	Elective II <i>Specialization I: Artificial Intelligence</i> OR <i>Specialization II: Data Science</i>
3.7	Machine Learning Lab
3.8	Minor Project - MCA
3.9	Communication Skills
3.10	Entrepreneurship
4.1	Major Project - MCA
4.2	Elective III [NPTEL Course of 8-12 Weeks]

MAPPING of COURSES to PO/PSOs – MCA

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
1.1	H	M		L									M	L
1.2	H	M		L									M	M
1.3	M	L	H	M	M								H	M
1.4	H	H	M	L									H	M
1.5	H	M	H		M				L				M	M
1.6	M	L	H		H								H	M
1.7	H	M	H		M								H	M
1.8	H	M	H		M				L				M	M
2.1	M	M	H	M	L	M		M	M	L	M	M	M	L
2.2	M	M	M	L	M					M	M		M	M
2.3	H	M	H	L	M								H	M
2.4	M	M	H		H						M		M	M
2.5	M	M	H		H					M	M		H	M
2.6	L	M	M		H					L	M		M	M
2.7	L	M	H		H				L		M		M	M
2.8	M	L	H		M								H	M
2.9						H	M		M	H				
3.1				M	M	H			L	H			M	H

3.2	M	H	M	M	H								H	H
3.3		M	M		M			L	M	L	M	M	M	M
3.4	M	M		H		M	M		M				L	L
3.5	M	M	H	M	H								H	H
3.6	M	M	H	M	H								H	H
3.7	M	M	H	L	H				L				H	H
3.8	M	M	H	M	H	M	M	M	H	M	M	M	H	H
3.9									H		M			
3.1 0						M	M	M	M	L	M	H	L	L
4.1	H	H	H	H	H	M	M	H	H	M	H	H	H	H
4.2	M	M	H	M	H								H	H

DETAILED SYLLABUS

CAMF0043: MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

(4 Credits – 60 Hours)

Objective

To introduce the concepts of mathematical logic.

To introduce the concepts of sets, relations, and functions and relate practical examples to the appropriate set, function, or relation model, and interpret the associated operations and terminology in context.

To perform the operations associated with sets, functions, and relations.

To understand combinatorics and apply in solving problems.

To use Graph Theory for solving problems

COURSE/LEARNING OUTCOMES

CO1: Ability to apply mathematical logic to solve problems (Remembering, Understand)

CO2: Recall some basic concept of set theory and understand the concept of graph theory and Group theory. (Remembering)

CO3: Interpret logic sentence in terms of predicates, quantifiers, and logical Connectives (Understanding)

CO4: For a given a discrete problem, classify its algebraic structure (Analyzing)

CO5: Derive the solution of a problem using deductive logic and prove the solution based on logical inference (Applying)

CO6: Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra (Evaluating)

CO7: Develop the given problem as graph networks and solve with techniques of graph theory. (Creating)

Course Content:

Module I (13 hours)

Mathematical Logic: Statements and notations, Connectives, Well-formed formulas, Truth Tables, tautology, Logical equivalence: The Laws of logic, Logical Implication, Normal forms, Quantifiers, universal quantifiers. Predicates: Predicative logic, Free & Bound variables, Rules of inference, Consistency, proof of contradiction.

Module II (20 hours)

Set theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Matrix representation of relations and partial ordered sets, representation of relations by Graphs; Lattices as Partially Ordered Sets, Boolean algebra; Functions. Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids; Groups, Congruence Relation and Quotient Structures, permutation groups, Lagrange's Theorem; Normal subgroups. Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. (Definition, basic properties and examples)

Module III (12 hours)

Elementary Combinatorics: Basics of counting, Combinations & Permutations with repetitions, Constrained repetitions, Binomial Coefficients, Binomial and Multinomial theorem, Pigeonhole Principle, principles of Inclusion – Exclusion.

Module IV (15 hours)

Graph Theory: Basic Concepts, Sub graphs, Multi graphs Representation of Graphs, Isomorphism, Paths and Circuits, Traversing a Graph, DFS, BFS, Eulerian and Hamiltonian graphs, Shortest path algorithms, Planar Graphs, Chromatic Numbers. Tree and Spanning Trees. Applications of Graph Theory.

Suggested Readings

1. Discrete Mathematical Structures with Applications to Computer Science by J. P. Tremblay and R Manohar, Tata McGraw-Hill Publications, 1997.
2. Graph Theory by Narsingh Deo, Prentice-Hall of India publications, 2004.
3. Discrete Mathematical Structures, Theory and Applications. D.S. Malik, Thomson Learning, I Edn
4. Discrete Mathematics for Computer Science, Haggard, Thomson Learning, I Edn
5. Discrete Mathematics and Its Applications by Kenneth H Rosen. Tata McGraw-Hill Publications
6. Mathematical foundation of Computer Science by Y. N Sings. New Age international Publishers
7. Bernard Kolman, Robert. C. Busby & Sharon Ross, "Discrete Mathematical structures" Prentice Hall of India, 2001.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3	H			
CO 4		H		
CO 5		H		
CO 6		H	M	
CO 7				H

CATC0048: THEORY OF COMPUTATION

(4 credits – 60 hours)

Objective

The objective of the Theory of Computation is to introduce and study abstract, mathematical models of computation (such as finite state, pushdown and Turing machines), and to use the abstract machine models to study the ability to solve computational problems. At the complete course students will be able to use regular expressions effectively and appropriately, construct derivations and parse trees, write simple programs for a Turing machine, understand the equivalence of grammars, languages and automata and translate between grammars, languages and automata.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

- CO1: Define basic terminology like Deterministic and Non deterministic automata, Pushdown Automata, Parse Tree, Regular Languages, Turing Machines etc. (Remembering)
- CO2: Make use of techniques, components and tools of a typical automated machine and apply it in designing new machines (Applying)
- CO3: Design deterministic and non-deterministic context-free grammars and understand their capabilities and limits. (Creating)
- CO4: Design deterministic and non-deterministic pushdown automata and Turing Machine. (Creating)
- CO5: Demonstrate the understanding of complexity classes and current unsolved problems in theoretical computer science. (Understanding).

Module I Theory of Automata (15 Hours)

Definition of an Automaton, Description of a Finite Automaton, Transition Systems, Properties of Transition Functions, Acceptability of a String by a Finite Automaton, Nondeterministic Finite State Machines, The Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata.

Module II Formal Languages, Regular Sets and Regular Grammars (15 Hours)

Definition of formal languages, Chomsky Classification of Languages, Languages and Their Relation, Recursive and Recursively Enumerable Sets, Operations on Languages, Languages and Automata; Regular Expressions, Finite Automata and Regular Expressions, Pumping Lemma for Regular Sets, Application of Pumping Lemma, Regular Sets and Regular Grammars.

Module III Context-free Languages (15 Hours)

Context-free Languages and Derivation tree, Ambiguity in Context-free Grammars, Simplification of Context-free Grammars, Normal Forms for Context-free Grammars, Pumping Lemma for Context-free Languages, Decision Algorithms for Context-free Languages.

Module IV Pushdown Automata Turing Machines and Linear Bounded Automata (15 Hours)

Basic Definitions, Acceptance by PDA, Pushdown Automata and Context-free Languages, Parsing and Pushdown Automata;

Turing machine Model, Representation of Turing Machine, Language Acceptability by Turing Machines, Design of Turing Machines, Universal Turing Machine and Other Modification, The Model of Linear Bounded Automaton, Turing Machines and Type 0 Grammars, Linear Bounded Automata and Languages, Halting Problem of Turing Machines, NP-Completeness.

Suggested Readings

1. K.L.P. Mishra, N. Chandrasekaran, Theory of Computer Science, BPB Publication, Prentice-Hall of India, Second Edition.
2. H.R. Lewis and C.H. Papadimitriou, Elements of the Theory of Computation, Second Edition, Prentice Hall of India.
3. H.E. Hopcraft and J.D. Ullman, Introduction to Automata Theory, Languages and Computation, Narosa Publications.
4. J.C. Martin, Introduction to Languages and the Theory of Automata, Tata McGraw-Hill.
5. C.H. Papadimitriou, Computation Complexity, Addison-Wesley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M	M	M	M
CO2	M	M	M	M
CO3			H	
CO4				H
CO5			M	H

CAOS0016: OPERATING SYSTEMS
(4 credits – 60 hours)

Course Objective

The main objective of this course is to introduce the students to a layer of software called Operating Systems, whose job is to manage all the devices of a computer system and provide user programs with a simple interface to the hardware. This course will familiarize the students with the concepts of processes, memory management, file management, Input/Output management and the potential problem of deadlocks. The students will also learn about the Linux operating system, which is a full-blown Unix clone and is fast gaining popularity worldwide.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

- CO1:Elaborate what operating systems are, what they do and how they are designed and constructed. (Creating)
- CO2:Define process concepts like process scheduling, inter-process communication, process synchronization and concurrency. (Remembering)
- CO3:Explain different memory management schemes, relate various approaches to memory management and effectiveness of a particular algorithm. (Understanding)
- CO4:Identify different page replacement algorithms to solve problems. (Applying)
- CO5:Determine the concepts learned with case studies of Linux and Windows. (Evaluating)

Module I: Concepts, Processes and Threads (14 Hours)

Operating system as an Extended Machine and as a Resource Manager, Operating system concepts (Files, Deadlocks, Memory Management, Input/Output, Processes, The Shell, Security), The evolution of Operating Systems (Serial Processing, Simple Batch Systems, Multiprogrammed Batch Systems, Mainframe Operating Systems, Server Operating Systems, Time Sharing Systems, Multiprocessor Operating Systems, Real-Time Systems, Embedded Operating Systems, Smart Card Operating System Calls (Process Management, File Management, Directory management), Introduction to Processes (The Process Model, Process Creation, Process Termination, Process Hierarchies, Process States, Implementation of Processes, Process Control Block), Threads (The Thread Model, Thread Usage, Implementing Threads(In User Space and Kernel), Scheduler Activation, Pop Up Threads, Interprocess Communication (Race conditions, Critical Sections, Mutual Exclusion with Busy Waiting, Sleep and wakeup, Semaphores, Mutexes, Monitors, Message Passing), Classical IPC problems (The Dining Philosophers Problem, The Sleeping Barber Problem), Process Scheduling (Scheduling in Batch Systems, Scheduling in Batch Systems, Scheduling in Interactive Systems, Scheduling in Real-Time Systems, Thread Scheduling)

Module II: Deadlocks and Memory Management (14 Hours)

Resources, Deadlock (Conditions for Deadlock, Deadlock modeling), Deadlock detection and recovery, Deadlock avoidance, Deadlock prevention
Memory management without swapping or paging (Monoprogramming without swapping or paging, Multiprogramming with fixed partitions, Relocation and Protection), Swapping, Virtual Memory (Paging, Page Tables), Page Replacement Algorithms (Not-recently-used, First in first out, Second Chance page replacement algorithm, The Clock Page Replacement Algorithm, Least Recently used page replacement algorithm, The Working Set Page Replacement Algorithm, Modelling
Paging Algorithms (Belady's Anomaly, Stack Algorithms, Predicting page fault rates), Design issues for Paging Systems, Implementation issues, Segmentation (Implementation of pure segmentation, Segmentation with Paging: MULTICS)

Module III: Input/output and File Systems (16 Hours)

Principles of I/O hardware (I/O devices, Device Controllers, Direct memory access), Principles of I/O software, I/O Software Layers, Disks (Disk hardware, disk formatting, disk arm scheduling algorithms, Error handling, Track-at-a-time caching, RAM disks) Clocks (Clock hardware, Clock software), Terminals (Terminal hardware, Input software, Output software)

Files (File Naming, File structure, File types, File access, File attributes, File operations, Memory mapped files), Directories, File System layout (Implementing files, Implementing directories, Shared files), Security (The security environment, Generic Security Attacks, Design Principles For Security, User Authentication), Protection mechanisms (Protection Domains, Access Control Lists, Capabilities, Multilevel Security, Covert Channels), Type of File Systems (FAT, VFAT, FAT32, NTFS)

Module IV: Introduction to Linux OS design – Case study (16 Hours)

Overview of Unix, Processes in Unix (Fundamental Concepts, Process Management System Calls in Unix, Implementation of Processes in Unix), Memory Management in Unix, Input/Output in Unix, The Unix File System, Security in Unix

Suggested Readings

1. Andrew S Tanenbaum, Modern Operating Systems , (Second Ed.), Prentice Hall of India, New Delhi,
2. William Stallings, Operating Systems, Fourth Edition, Prentice Hall of India, New Delhi.
3. Silberschatz, Galvin, Operating System Concepts, Fifth Edition, John Wiley and Sons (Asia)
4. HM Deitel, Operating Systems, Second Edition, Pearson Education.
5. Pramod Chandra P. Bhatt, An Introduction to Operating Systems Concept, Prentice Hall of India.
6. Maurice J. Bach, The Design of the Unix Operating System, Prentice Hall of India, New Delhi.
7. Kernighan and Pike, The Unix Programming Environment, Prentice Hall of India, New Delhi.

Mapping of COs with Syllabus

Course Outcomes	Module1	Module2	Module3	Module4
CO1	H	M	L	
CO2	M	H	L	
CO3	M	H	M	
CO4		M	H	
CO5		L	H	M

CADA0044: DATA STRUCTURES AND ALGORITHMS

(4 Credits – 60 Hours)

Objectives

To introduce first level topics covering basics in algorithms and data structures.

To enable students to choose appropriate data structures, understand the ADT/libraries, and use of it to design algorithms for a specific problem.

To understand the necessary mathematical abstraction to solve problems.

To apply important algorithmic design paradigms and methods of analysis.

COURSE/LEARNING OUTCOMES

At the end of the course, students would be able to:

CO1: Know the formal definition of algorithms, importance of analysis of an algorithm and get familiar with different types of problem and their solutions. (Remembering and Understanding)

CO2: Choose appropriate data structure as applied to specified problem definition. (Applying)

- CO3: Understand different design strategies such as brute force, divide-and-conquer, dynamic programming, greedy technique and backtracking used for the design of algorithms. (Understanding)
- CO4: To design and analyse algorithms for given problems. (Applying)
- CO5: Compare and analyse different design strategies and assess an algorithm in terms of correctness, computation cost and memory space used. (Analysing and Evaluating)
- CO6: Design new algorithms for given problems by using most appropriate algorithmic strategy considering the problem domain. (Creating)

Module I (14 Hours)

Introduction to Algorithms, Fundamentals Stages of Problem Solving, and Classification of Algorithms - Based on

Implementation, Based on Design, Based on Area of Specialization, Based on Tractability, Basics of Algorithms Analysis, Asymptotic Analysis, Mathematical Analysis of Iterative and Recursive Algorithms, Empirical Analysis of Algorithms, Models of Computations - RAM model, Turing Machine.

Module II (12 Hours)

Data Structures: Abstract Data Types (ADTs), Stacks, Queues, Circular Queues, Implementation of Stacks using Queues, Implementation of Queues using Stacks, Priority Queues, Heaps, Linked Lists, Search and Update Operations on Varieties of Linked Lists, Graphs, Binary Trees, Tree Traversals, Binary Search Trees (BSTs), AVL Trees, Red Black Trees, Splay Trees, B-Trees, Disjoint Sets.

Module III (12 Hours)

Analysis of Sorting and Searching Algorithms: The sorting problem, Brute Force Approach - Sequential Search, Bubble Sort, Selection Sort, Decrease-and-Conquer Approach - Insertion Sort, Binary Search, Divide-and-Conquer Approach - Quick Sort, Merge Sort, Transform-and-Conquer Approach - Heap Sort, Linear Sorting Algorithms - Counting Sort, Radix Sort, Bucket Sort, Hashing - Hash Function, Collisions in Hashing, Separate Chaining, Open Addressing, Analysis of Search Operations.

Module IV (14 Hours)

Graph Algorithms: Graphs and their Representations, Graph Traversal Techniques - Breadth First Search (BFS) and Depth First Search (DFS), Minimum Spanning Trees (MST), Greedy Techniques - Prim's and Kruskal's algorithms for MST, Dijkstra's Algorithm for Single Source Shortest Paths, Dynamic Programming - Warshall's Algorithm for finding Transitive Closure of a Graph, Floyd's Algorithm for All-Pairs Shortest Paths Problem.

Algorithmic Design Techniques: Greedy Algorithms - Coin Change Problem, Scheduling Problem, Knapsack Problem, Huffman Trees, Divide-and-Conquer Approach - Strassen Matrix Multiplication, Closest-pair Problem, Tiling Problem, Dynamic Programming – Longest Common Subsequence (LCS) problem, Optimal Binary Search Trees, Travelling Salesperson Problem, Chain matrix multiplication.

Module V (8 Hours)

Tractable and Intractable Problems: Computability of Algorithms, Computability Classes – P, NP, NP-Complete, NP-Hard. Basics of Backtracking, Branch-and-bound methodologies for Algorithm design, Approximation algorithms, Randomized algorithms.

Suggested Readings

1. Mark Allen Weiss, Data Structure and Algorithm Analysis in C++, Fourth Edition, Pearson, 2014.
2. S. Sridhar, Design and Analysis of Algorithms, Oxford University Press, 2014.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, Third Edition, The MIT Press, 2009.
4. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, Fundamentals of Computer Algorithms, Universities Press, 2008.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4			H	H	
CO 5		M	M	H	
CO 6					H

CAPJ0018: PROGRAMMING THROUGH JAVA
(4 credits–60 hours)
Objective

The course is designed to impart the knowledge and skill required to solve real world problems using an object-oriented approach utilizing Java language constructs. This course covers the two main parts of Java i.e. Java Language and Java Library (JDK 5). After completion of the course, a student is expected to be able to Do Object Oriented Programming using Java, Implement Exception handling and Multithreading in Java, Create Java I/O Applications and Applets., Set up a GUI using Swing components, Do Network Programming in Java, Access relational databases from the Java program and use Java Beans and Servlets.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

- CO1: Recall the various features of Object-Oriented programming by utilizing the JAVA language construct. (Remembering)
- CO2: Explain the standard library, scope and lifetime of a variable and various control statements used in JAVA programs. (Understanding)
- CO3: Interpret the concept of classes and object in JAVA and apply exception handling to solve various exceptions (Applying)
- CO4: Contrast the different types of inheritance and polymorphism and analyse it in resolving various problems (Analysing)
- CO5: Select the appropriate GUI and justify the decision to use a particular GUI by evaluating the required parameters depending on the domain and requirement. (Evaluating)
- CO6: Develop algorithms based on the knowledge they have gained to design cost effective and user-friendly applications. (Creating)

Module I: Core Java Programming (14 Hours)

Java Overview: Genesis, Java Philosophy, Java and Internet, Object-Oriented Programming features, Java Applet and Application, Java Environment and Java Development Kit (JDK) and Java Standard Library (JSL), Java language fundamentals: The scope and lifetime of variable, Type conversion and casting, Control statements, Arrays

Classes and objects: The this keyword, Garbage collection, Overloading constructor, Using object as parameters, Argument passing, Returning objects, Recursion, Introducing Access control (public, private and protected), static, final, nested classes, String class, Command- line argument

Module II: Inheritance, Exception handling, Multithread and Applets (12 Hours)

Inheritance: Member access and inheritance, method overriding, dynamic method dispatch, using abstract classes, using final with inheritance, the Object class; Packages, Interface, classpath

Exception handling: Fundamentals, Exception types, Java's built-in exceptions, user defined exceptions.

Multithreaded Programming: The Java thread model (thread priorities, synchronization and inter-thread communication);

Deadlock, Thread Group

I/O Basics: Streams, the stream classes, the predefined streams, Reading console input, writing console output, the transient and volatile modifiers, using instance of native methods

Module III String handling, Utility classes, java.lang and java.io (12 Hours)

String handling: String constructors, methods for character extraction, string searching and comparison, data conversion using valueOf (), String Buffer.

Exploring java. lang: Simple type wrappers, System class, class Class, Math functions

The utility classes: Vector, Stack, Hash Table, String Tokenizer, Bit set, Date, Calendar, Gregorian Calendar,

Random, Observable

Input/Output - Exploring java.io: The java.io classes and interface, File class and methods for creating, renaming, listing and deleting files and directories, I/O stream classes (File Input Stream, File Output Stream, Buffered Input Stream, Buffered Output Stream, Push Back Input Stream, Input Stream Reader, Buffered Reader, Buffered Writer, Print Stream, Random Access File)

Module IV: Networking, Images, Applet class and Swing (12 Hours)

Networking: Socket overview, Stream Sockets, Datagram sockets, Manipulating URLs, Establishing a simple Server/Client using Stream Sockets, Connectionless Client/Server Interaction with Datagrams

Images: File formats, image fundamentals, creating, loading and displaying images, ImageObserver, MediaTracker

The Applet class: applet architecture, passing parameters to applets, getDocumentBase, getCodeBase, and showDocument, AppletContext and AudioClip interfaces, Graphics class and methods for drawing lines, rectangles, polygons and ovals

Swing: Component and Container classes, Layout managers (Flow Layout, Grid Layout, Border Layout), Handling events, Adapter classes, Anonymous inner classes

Swing GUI components: JLabel, JTextField, JTextArea, JButton, JCheckBox, JRadioButton, JList, JComboBox, JScrollbar, JScrollPane, JToolTip, JPanel, JFrame

Menus: JMenuBar, JMenu, JMenuItem, JSeparator

Module V: Java Beans, JDBC, Java Servlets (10 Hours)

Java Beans: Introducing JavaBeans Concepts and Bean Development Kit (BDK), Using the Bean Box, Writing a simple Bean,

Bean Properties (simple properties), Manipulating events in the Bean Box

Java database connectivity (JDBC): Introduction to JDBC, type of JDBC connectivity, Establishing database connections, Accessing relational database from Java programs

Suggested Readings

1. Deitel, H. M.; P. J. Deitel, Java : How To Program (Sixth Edition), New Delhi: Prentice-Hall India, 2005
2. Schildt, H., The Complete Reference Java 2 (Fifth Edition), New Delhi: Tata McGraw-Hill, 2005
3. Moss, K., Java Servlets (Second Edition), New Delhi: Tata McGraw-Hill
4. Russel, Java Programming for the absolute Beginner , New Delhi: Prentice-Hall India
5. Hanagan D., Java Examples in a Nutshell (Third Edition), New Delhi: O' Reilly, 2001

Mapping of COs with Syllabus

Course Outcome	Module I	Module II	Module III	Module IV	Module V
CO1	H	H	M		
CO2	H	H	M		
CO3	H				
CO4		H			

CO5				H	H
CO6			M	M	M

CASE0019: SOFTWARE ENGINEERING**(4 credits–60 hours)****Objective**

The field of software engineering aims to find answers to the many problems that software development projects are likely to meet when constructing large software systems. The objective of this paper is to make students aware of the problems incurred by large-scale software development and the solutions proposed. It covers a framework for studying and evaluating software tools, and stresses the importance of theory in the development of software.

COURSE / LEARNING OUTCOMES

- CO1: Demonstrate understanding of fundamental software engineering principles and methodologies by explaining core concepts such as software development life cycle, agile methodologies, and software project management. (Understanding)
- CO2: Apply software engineering techniques and tools to design and develop software solutions by implementing design patterns, writing test cases, and using version control systems. (Applying)
- CO3: Analyze software requirements and specifications to identify potential risks, resource needs by conducting requirement analysis, feasibility studies, and risk assessments. (Analysing)
- CO4: Create comprehensive software project plans and design documentation that address software requirements and constraints by developing detailed project plans, system architectures, and design documents. (Creating)

Module I (10 Hours)

The Product and The Process: The Product - Evolving Role of Software, Software (Characteristics, Components and Applications);

The Process – Software Engineering A Layered Technology, The Software Process, Software Process Models, The Linear Sequential Model, The Prototyping Model, The RAD Model, Evolutionary Process Models (The Incremental Model, The Spiral Model, The Component Assembly Model, The Concurrent Development Model), The Formal Methods Model,

Fourth Generation Techniques;

Project Management Concepts – The Management Spectrum (People, the Problem, the Process and the Project)

Software Process and Project Metrics – Measures, Metrics and Indicators, Metrics in the Process and Project Domains, Software Measurement, Reconciling Different Metrics Approaches, Metrics for Software Quality

Software Project Planning – Observation on Estimating, Project Planning Objectives, Software Scope, Resources, Project Estimation Technique – Empirical estimation techniques (Expert Judgement Technique, Delphi Cost Estimation), Heuristic estimation techniques (COCOMO Model), Halstead Software Science (An Analytical Technique), The Make-Buy Decision

Module II (10 Hours)

Project Scheduling and Tracking - Basic Concepts, The Relationship between People and Effort, Defining a Task set for the Software Project, Selecting Software Engineering Tasks, Defining a Task Network, Scheduling, The Project Plan

Software Projects Risks, Quality Assurance and Configuration Management: Risk Management- Reactive Vs. Proactive Risk Strategies, Software Risk, Risk Identification, Risk Projection, Risk (Mitigation, Monitoring and Management), Safety Risks and Hazards, The RMMM Plan

Software Quality Assurance - Quality Concepts, The Quality Movement, Software Quality Assurance, Software Reviews, Formal Technical Reviews, Statistical Quality Assurance, Software Reliability, The SQA Plan, The ISO 9000 Quality Standards

Software Configuration Management - Software Configuration Management, The SCM Process, Identification of Objects in the Software Configuration, Version Control, Change Control, Configuration Audit, Status Reporting; System Engineering - Computer Based Systems, Product Engineering

Module III (20 Hours)

Analysis and Design: Analysis Concepts and Principles - Requirements Analysis, Communication Techniques, Analysis Principles, Software Prototyping, Specification, Specification Review

Analysis Modeling- The Elements of the Analysis Model, Data Modeling, Functional Modeling and Information Flow, Behavioral Modeling, the Mechanics of Structured Analysis, the Data Dictionary

Design Concepts and Principles - Software Design and Software Engineering, the Design Process, Design Principles, Design Concepts, Effective Modular Design, Design Heuristic for Effective Modularity, the Design Model, Design Documentation

Design Methods - Data Design, Architectural Design, the Architectural Design Process, Architectural Design Optimization, Interface Design, Human-Computer Interface Design, Interface Design Guidelines, Procedural Design;

Design For Real Time systems - Real Time Systems; Case studies on diagram - Use case, Class, Activity, Sequence

Module IV (10 Hours)

Software Testing: Software Testing Methods - Software Testing Fundamentals, Test Case Design, White Box Testing, Basis Path Testing, Control Structure Testing, Black Box Testing, Testing for Specialized Environments

Software Testing Strategies - A Strategic Approach to Software Testing, Strategic Issues, Unit Testing, Integration Testing, Validation Testing, System Testing, The Art of Debugging

Technical Metrics For Software - Software Quality, A Framework For Technical Software Metrics, Metrics for the Analysis Model, Metrics for the Design Model, Metrics for Source Code, Metrics for Testing, Metrics for Maintenance

Module V (10 Hours)

Object Oriented Software Engineering: Object Oriented Concepts and Principles - The Object Oriented Paradigm, Object Oriented Concepts, Identifying the Elements of an Object Model, Management of Object Oriented Software Projects

Object Oriented Analysis - Object Oriented Analysis, Domain Analysis, Generic Components of the Object Oriented Analysis Model, the OOA Process, the Object Relationship Model, the Object Behavior Model

Object Oriented Design - Design for Object Oriented Systems, The Generic Components of the OO Design Model, The Systems Design Process, The Object Design Process, Design Patterns, Object Oriented Programming

Advanced Topics in Software Engineering: Cleanroom Software Engineering- The Cleanroom Approach, Functional Specification, Design Refinement and Verification, Cleanroom Testing

Software Reuse - Management Issues, the Reuse Process, Domain Engineering, Building Reusable Components, Classifying and Retrieving Components, Economics of Software Reuse

Reengineering - Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering, Economics of Reengineering

Computer Aided Software Engineering - Case Definition, Building Blocks of Case, Taxonomy of Case Tools, Integrated Case Environments, the Integration Architecture, the Case Repository

Suggested Readings

1. Roger S. Pressman, Software Engineering A Practitioner's Approach, Fourth Edition, Tata McGraw Hill.

2. Rajib Mall, Fundamentals of Software Engineering, Second Edition, Prentice Hall of India Private Limited.
3. Ian Sommerville, Software Engineering, Sixth Edition, Addison Wesley, Pearson Education.
4. Carlo Ghezzi, Mehdi Jazayeri, Dino Mandrioli, Fundamentals Of Software Engineering, Second Edition, Prentice Hall of India Private Limited, New Delhi, 2002.
5. Jeffrey A. Hoffer, Joey F. George, Joseph S. Valacich, Modern Systems Analysis and Design, Second Edition, Pearson Education.
6. Richard E Fairley, Software Engineering Concepts, Tata McGraw Hill Publishing Company Limited, New Delhi, 1997.
7. Hans Van Vilet, Software Engineering Principles and Practice, Second Edition, John Wiley and Sons, Ltd.

Mapping of COs with Modules

Course Out-comes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H	H	M	M
CO2	L	H	H	M	M
CO3	L	M	H	H	H
CO4	L	L	H	H	H

CACC0045: DATA COMMUNICATION AND COMPUTER NETWORKS (4 Credits – 60 Hours)

Objective

This course introduces students to computer networks and concentrates on building a firm foundation for understanding Data Communications and Computer Networks. It deals with the Data link layer, the Network layer, the Transport layer and the Application Layer. This course also introduces the concepts of network security and cryptography.

COURSE/LEARNING OUTCOMES:

At the end of the course the students will be able to:

CO1: Understand and explain Data Communications System and its components (Understand, Explain)

CO2: Understand and identify different networking terminologies and network architecture. Design issues in network and network transition. (understand)

CO3: Students would be able to distinguish between IPV4 and IPV6 network together with MAC layer transmission and modulation schemes. (Analyze)

CO4: Students would be able to understand and analyze what type of network to implement and decide what protocols to configure (Analyze)

CO5: Students would be able to know why different layers are embodied with different protocols and different network architecture for different network needs. (Evaluate)

CO6: Have a basic knowledge of the use of cryptography and network security; (Apply)

Module I: Digital Communications

Signals, noise, Nyquist rate, Shannon capacity; Analog transmission: modulation techniques, FDM; Digital transmission: PCM, TDM, line coding, xDSL; Transmission media: Guided (twisted pair, coaxial, fiber optic) and unguided media; Local area networks: Ethernet, Fast Ethernet, introduction to Gigabit Ethernet and WLANs; Repeater, Hubs, Bridges, Switches, Router and Gateway.

Module II: Media Access Control and Data Link Layer

Data Link Layer Fundamentals: Framing, Error Control, Flow Control, Error Detection and Correction; Data link protocols: Stop&-Wait ARQ, Go-Back-NARQ, Selective Repeat ARQ, Piggybacking Multiple Access Protocols: Advantages of Multiple-Access Sharing of Channel Resource, Pure ALOHA, Slotted ALOHA, Carrier Sense Multiple Access (CSMA), CSMA with Collision Detection (CSMA/CD), Asynchronous Transfer Mode (ATM)

Module III: Network Layer

IPv4 Addresses: Address space, Notations, Classful addressing, classless addressing, NAT; IPv6 Addresses: advantages, structure, address space, packet format, extension header; Transition from IPv4 to IPv6; Address Mapping, Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing Protocols.

Module IV: Transport Layer and Application Layer

Process to Process Delivery: Client Server paradigm, Connectionless vs Connection Oriented Service, Services provided to upper layers, Transport Service primitives. UDP: Introduction, User Datagram, Checksum, UDP operations, use of UDP, Remote Procedure call TCP: Introduction, TCP Service Model, TCP Protocol, segment header, Connection Establishment and release, Transmission Policy, Congestion Control, Timer Management, Wireless TCP and UDP . Application Layer: Domain Name System, Simple Mail Transfer Protocol (SMTP), POP3, IMAP, File Transfer Protocol (FTP) Network Security: Cryptography, Symmetric Key Algorithms, Public Key Algorithms, Digital Signatures, Communication Security, Web Security

Suggested Readings

1. Andrew S. Tenenbaum, Computer Networks (Fourth Ed.), Prentice Hall of India, 2002
2. W Richard Stevens, UNIX Network Programming – Volume I (2nd Ed.), Prentice Hall of India, 2002
3. William Stallings, Data and Computer Communications (Sixth Ed.), Prentice Hall of India, 2000
4. Fred Halsall, Data Communication, Computer Networks and Opens Systems, (4th Ed.), Pearson Education, 2000
5. William Stallings, Cryptography and Networking Security - Principles and Practice, Pearson

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4		M	M	M
CO 5			H	M
CO 6				H

CAIT0022: INTERNET TECHNOLOGY AND APPLICATIONS

(4 credits – 60 hours)

Objective

The objective of the course is to familiarize the students with a discussion on Internet and its growth. It also provides the students a study on the basic services provided by the Internet. A familiarization on the markup languages, scripting languages and web application development is also being discussed to make the student competent to design websites. It has been taken into consideration that this paper assumes that the students must know well in advance about the various protocols of the Internet and the knowledge of HTML and databases.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

- CO1: Recall and examine the growth of Internet and identify the history behind it. (Remembering)
- CO2: Identify and differentiate the various services provided by the internet. (Understanding)
- CO3: Experiment with various mark-up languages and scripting languages. (Applying)
- CO4: Analyse and design a website of their own and can also identify the faults in the design. (Analysing)
- CO5: Develop and create a website of their own. (Creating)
- CO6: Summarize and validate a practical solution towards a web application development and also deploy a website of their own. (Evaluating)

Module I: Introduction to Internet (10 Hours)

History of the Internet; History of the World Wide Web; W3C (World Wide Web Consortium); Levels of Internet Connectivity (Dial-up, Leased Line, DSL, VSAT); Requirements for Internet connectivity; Use of Browsers; Different types of browsers (IE, Opera, Netscape, Firefox); Search engines; FTP; Electronic Mail; Instant Messaging; DHCP; DNS; HTTP; URL; Proxy Servers.

Module II: Internet Markup Languages (12 Hours)

XHTML: What is XHTML? Components of XHTML; Elements of XHTML (Headers, Paragraphs, Linking, Images, Special Characters, Lists, Tables, Forms, Framesets)

Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation Service; Use of CSS (Positioning Elements, Backgrounds, Text flow)

XML: What is XML? Structuring Data; XML Namespaces; Document Type Definitions and Schemas; XML Vocabularies; Document Object Model (DOM and its methods); Extensible Style Sheet Language (XSL)

Module III: Web servers, Databases and Scripting Languages (18 Hours)

Web servers: What is a web server; HTTP Request Types; System Architecture of a Web server; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Apache Web Server.

Databases: Introduction to each one of the following: SQL, MYSQL, DBI

Scripting Languages: Javascript: Operators, Data Types, Control Structures, Functions, Arrays, String Manipulation. JQuery, ASP.NET. Introduction to Perl and CGI (Common Gateway Interface). JSP: Introduction; JSP Overview; Scripting;

Standard Actions; Directives

Java Servlets: Servlet overview and architecture, Servlet Interface and Servlet life cycle, HttpServlet Class, HttpServletRequest Interface, HttpServletResponse Interface, Handling HTTP get Requests, deploying a web application, Handling HTTP get requests containing data, Handling HTTP post requests.

Module IV: Web Application Development Using PHP (20 Hours)

Web Site Design Considerations: Using Logical Design: Planning your website, drawing a map, using a top-down approach, flexibility, other web design metaphors. Creating templates. Creating a Compatible Design: Designing for different color depths, resolutions, different browser considerations, accommodating limited bandwidth. Validating your work.

PHP: Introduction to PHP; Data Types; Control Structures; Functions; Strings; Arrays; Querying Web Databases using PHP; Writing to Web Databases; Errors, Debugging and Deployment; Reporting in PHP; Validation Techniques in PHP.

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
2. Hugh E. Williams and David Lane, PHP and MySQL, 2nd Edition, O'Reilly, Shroff Publishers and Distributors Pvt. Ltd.
3. Moss, K., Java Servlets (Second Edition), New Delhi: Tata McGraw-Hill
4. Internet Complete, 2nd Edition, BPB Publications, New Delhi

5. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H			
CO 3			H	
CO 4		M		H
CO 5		M		H
CO 6		M		H

CASI0058: SENSOR NETWORK AND INTERNET AND INTERNET OF THINGS

(3 Credits – 45 Hours) (L-T-P: 3-0-0)

Course Objective

This course will introduce the students to the Internet of Things (IoT) and basic structure of communication protocols in sensor networks. The course is designed to build up basic understanding of how to set up an application specific IoT network with better orientation and representation of sensor nodes.

COURSE/LEARNING OUTCOMES:

- CO1:** Utilize IoT concepts, hardware knowledge, and device platforms like Arduino, Raspberry Pi, and WSNs to design and develop effective networks, addressing real-world challenges. **(Applying)**
- CO2:** Assess sensor protocols and network architectures to optimize communication efficiency and evaluate the suitability of different protocols for specific IoT applications. **(Analyzing)**
- CO3:** Critically evaluate the reliability, scalability, and security of IoT systems, and make informed decisions on protocol selection and energy preservation techniques. **(Evaluating)**
- CO4:** Integrate knowledge and skills to design, test, and deploy complete IoT systems, demonstrating proficiency in prototyping, programming, and data analysis for domain-specific applications. **(Creating)**

Module I: Introduction to IOT (10 Hours)

Definitions and Characteristics of IoT, Historical Evolution of IoT: Predecessors of IoT-Wireless Sensor Networks, Machine-toMachine Communications, IoT versus M2M; Impact of IOT in various industries, IoT Hardware Technologies - Microcontrollers, Sensors, Actuators, RFID; Types of sensors and actuators; IoT Device Platforms - Arduino, Raspberry Pi, IOT Reference Architecture: Main Design Objectives of IOT, Layers of IoT Reference Architecture, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views; IoT Data Management and Compute Stack, Edge, Fog, and Cloud computing. Emerging Trends and Technologies, IOT value chain.

Module II: IoT Communication Model and Protocols (10 hours)

Communication Models: Request-Response, Publisher-Subscriber, Push-Pull, Exclusive Pair; Key protocols Key Protocols in IoT: Physical and Data Link Layer Protocols-IEEE 802.11 (Wi-Fi), IEEE 802.15.4, ZigBee, RFID, Bluetooth and Bluetooth Low Energy (BLE), Z-Wave, LoRa and LoRaWAN; Network Layer Protocols- IPv4 and IPv6, RPL, 6LoWPAN; Transport Layer Protocols-TCP, UDP; Application Layer Protocols: MQTT, CoAP, HTTP/HTTPS, WebSockets, AMQP, DDS, XMPP

Security Challenges in IoT Communication: Encryption and Authentication Techniques- Symmetric and asymmetric protocols, authentication protocol- Digital Signatures, Secure Communication Protocols- MQTT with TLS/SSL, CoAP with DTLS, HTTPS, AMQP with SASL, AMQP with SASL.

Module III: IoT Development with Arduino and Raspberry Pi (12 Hours)

IOT with Arduino: Overview of Arduino, Hands-on Experience with Arduino (Firmware development & RTOS) Setting up Arduino IDE and development environment, General Purpose I/O (GPIO) programming with Arduino, Interfacing sensors with Arduino, Serial communication interfaces: RS-232/485, I2C, SPI

IoT with Raspberry PI: Overview of Raspberry Pi, Setting up Raspberry PI SD Card, Raspberry PI booting up & Initialization; General Purpose I/O (GPIO), Serial Communication Interfaces: RS-232/485, Synchronous Peripheral Interfaces: I2C, SPI; Sensors Interfacing with Raspberry PI Domain-specific applications of IoT: Home automation, Industry applications, Surveillance, applications, Other IoT applications.

Module IV. Wireless Sensor Networks & Protocols (13 Hours)

Key definitions of sensor networks, Advantages of sensor Networks, Wireless Sensor Networks Applications, Unique constraints and challenges, Driving Applications.

Single node architecture: hardware and software components of a sensor node, Energy Consumption of Sensor Nodes, WSN Network architecture: Design Principles for WSNs- Gateway Concepts, Need for gateway, data relaying and aggregation strategies, Classification of sensor nodes in WSN based on behaviour, network topologies in WSN, Personal area networks (PANs), hidden node and exposed node problem, Topologies of PANs, MANETs, WANETs. WSN Operating Systems-Operating System Design Issues - Examples of Operating Systems – Introduction to Tiny OS, Mate, MagnetOS, MANTIS etc.

Overview of sensor network protocols: Sensor network protocols: Physical, MAC and routing/ Network layer protocols, node discovery protocols, multi-hop and cluster based protocols, Fundamentals of 802.15.4, Bluetooth, BLE (Bluetooth low energy), UWB.

Specialized features: Energy preservation and efficiency; security challenges; fault tolerance, Issues related to Localization, connectivity and topology, Sensor deployment mechanisms; coverage issues; sensor Web; sensor Grid, Open issues for future research, and Enabling technologies in wireless sensor network.

Suggested Readings

1. Adrian McEwen and Hakim Cassimally, Designing the Internet of Things, Wiley, 2013.
2. Qusay F. Hassan, Internet of Things A to Z: Technologies and Applications, Wiley-Blackwell, 2018.
3. Peter Waher, Mastering Internet of Things: Design and Create Your Own IoT Applications Using Raspberry Pi 3, Packt Publishing, 2018.
4. Kazem Sohraby, Minoli Daniel and Znati Taieb, Wireless sensor networks: technology, protocols, and applications. John Wiley & Sons, 2007.
5. Waltenegus Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice (Wireless Communications and Mobile Computing), Wiley-Blackwell, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	H	M
CO2		M		H
CO3		H		M
CO4			H	

CADM0046: ADVANCED DATABASE MANAGEMENT SYSTEMS
(4 Credits - 60 hours)

Objective

The objective of this course is to introduce the basic conceptual background necessary to design and develop simple database systems. The course stresses on database modeling and design, physical file storage techniques and SQL query language facilities provided by database management systems. The course also presents some advanced database management concepts like query processing and optimization, transaction processing, concurrency control, recovery and security issues in database management systems.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

- CO1: Explain the core terms, concepts, and tools of relational database management systems (Understanding)
- CO2: Understand Normalization and Design ER-diagrams and corresponding schema diagrams for handling database projects (Creating)
- CO3: Recall and identify the techniques used by a DBMS to process, optimize and execute high level queries. (Remembering)
- CO4: Describe fundamentals of transaction processing system, including ACID properties of a transaction. (Understanding)
- CO5: Illustrate concurrency control & analyze several concurrency control techniques for ensuring serializability, locking, timestamping. (Analysing)
- CO6: Discuss some of the techniques that can be used for database recovery from failures and summarize the control measure for securing databases against a variety of threats. (Understanding)

Module I: Introduction (3 Hours)

Introduction: Introduction to databases, characteristics of the database approach, database users and designers, role of a DBA, advantages of using a DBMS, data models, schemas, instances, DBMS architecture (Three-Schema Architecture), Database systems- Network, Hierarchical, Relational, Data Independence

Module II: Relational Data Model and ER Models (12 Hours)

Relational Model: Domains, Attributes, Tuple and Relation; Super keys Candidate keys and Primary keys for the Relations. Relational Constraints: Domain Constraint, Key Constraint, Integrity Constraint. Relational Algebra: basic relational algebra operations-SELECT, PROJECT, UNION, INTERSECTION, SET DIFFERENCE, Cartesian PRODUCT, JOIN, Aggregate functions. Entity Relationship (ER) Model: Entities, Attributes, Relationships. More about Entities and Relationships, E-R Diagram, Conversion of E-R Diagram to Relational Database, Case Study.

Module III: Functional Dependencies and Normalization (10 Hours)

Functional Dependencies, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Multivalued Dependencies.

Module IV: Data Storage, Indexing, Query Processing and Query Optimization (11 Hours)

Overview of physical storage media, Magnetic Disks, RAID, File Organization: Fixed-length records, variable-length records. Organization of records in Files - Heap Files, Sequential File, Hashed Files. Indexing: Types of Single-level Ordered Indexes

(Primary Indexes, Clustering Indexes, Secondary Indexes), Multilevel Indexes, Multilevel indexing using B tree and B+ tree, Indexing on multiple keys. Query Processing: Overview of query processing, Algorithms for query processing, Query Optimization

Module V: Transaction Processing and Concurrency Control (14 Hours)

Transaction Processing: Transaction, ACID properties of transaction, transaction states, schedules, serializability, tests for serializability, recoverability, transaction definition in SQL. Concurrency Control: Concurrent execution of transaction, Lockbased techniques for concurrency control, Graph-based protocol, Timestamp based protocol, Deadlock, Deadlock prevention methods, Deadlock detection Deadlock recovery.

Module VI: Recovery and Security (10 Hours)

Recovery system: Types of failure, types of storage, recovery and Atomicity, Log-based recovery, shadow paging, recovery with concurrent transactions, buffer management, logical undo logging, transaction rollback, checkpoints, restart recovery, fuzzy checkpointing.

Security: Security and Integrity-security violations, authorization and views, granting of privileges, security specifications in SQL, encryption, and statistical databases.

Suggested Readings

1. Silberschatz, HF Korth, S Sudarshan, Database System Concepts, Tata- McGraw Hill, 1997.
2. R Elmasri, SB Navathe, Fundamentals of Database Systems, Addison, Wesley (Third Edition) 2000
3. DM Kroenke, Database Processing: Fundamentals, Design and Implementation, Prentice-Hall of India, (Eighth Edition) 2002.
4. GW Hansen, JV Hansen, Database Management and Design, Prentice-Hall of India, (2nd Edition) 2001.
5. Thomas M Connolly, Carolyn E Begg, Database Systems, A Practical Approach to Design, Implementation and Management, Addison Wesley Longman Ltd. 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M	M	M	M	M
CO 2		H	H			
CO 3				H		
CO 4					H	
CO 5					H	
CO 6						H

CACL0033: CYBER LAW and IT SECURITY (4-0-0) **(4 credits – 60 hours)**

COURSE/LEARNING OUTCOMES:

- CO1: Apply fundamental concepts of Information Security threats and vulnerabilities to adopt right security measures and design real time scenarios. (Applying)
- CO2: Determine and analyze software vulnerabilities and security solutions to reduce the risk of exploitation. (Analyzing)
- CO3: Analyze and evaluate the Cybersecurity needs of an individual/organization. (Analyzing, Evaluating)
- CO4: Design operational and strategic Cybersecurity strategies and policies. (Creating)

CO5: Analyze various types of cybercrime and formulate procedures for real world cybercrime Investigations. (Analyzing)

Module I: (12 hours)

Object and Scope of the IT Act - Genesis, Object, Scope of the Act. Encryption -Symmetric Cryptography, Asymmetric Cryptography, RSA Algorithm, Public Key Encryption

Module II: (14 hours)

Digital Signature- Technology behind Digital Signature, creating a Digital Signature, Verifying a Digital Signature, Digital Signature and PKI, Digital Signature and the Law. E-Governance and IT Act 2000- Legal recognition of electronic records, Legal recognition of digital signature, Use of electronic records and digital signatures in Government and its agencies, Certifying Authorities. Need of Certifying Authority and Power. Appointment, function of Controller. Who can be a Certifying Authority? Digital Signature Certifications. Generation, Suspension and Revocation of Digital Signature Certificate.

Module III: (12 hours)

Domain Name Disputes and Trademark Law: Concept of Domain Names, New Concepts in Trademark, Jurisprudence, Cybersquatting, Reverse Hijacking, Meta tags, Framing, Spamming, Jurisdiction in Trademark Dispute

Module IV: (12 hours)

Cyber Regulations Appellate Tribunal: Establishment & Composition of Appellate Tribunal, Powers of Adjudicating officer to Award Compensation, Powers of Adjudicating officer to impose Penalty.

Module V: (10 hours)

The Cyber Crimes (S-65 to S-74): Tampering with Computer Source Documents(S-65), Hacking with Computer System(S-66), Publishing of Information Which is Obscene in Electronic Form(s-67), Offences: Breach of Confidentiality & Privacy (S-72), Offences: Related to Digital Signature Certificate (S-73 & S-74)

Suggested Readings

1. Farooq Ahmad, Cyber Law in India, Pioneer Books
2. Vakul Sharma, Information Technology Law and Practice, Universal Law Publishing Co. Pvt. Ltd.
3. Suresh T Vishwanathan, The Indian Cyber Law, Bharat Law house New Delhi.
4. P.M. Bakshi and R.K.Suri, Hand book of Cyber and E-commerce Laws, Bharat Law house New Delhi.
5. Rodney D. Ryder, Guide to Cyber Laws, Wadhwa and Company Nagpur.
6. The Information Technology Act, 2000, Bare Act, Professional Book Publishers, New Delhi.

Mapping of COs to Syllabus

Course Out-comes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		M
CO 4				H	M
CO 5				M	H

CAML0049: MACHINE LEARNING
(4 Credits – 60 Hours)

COURSE/LEARNING OUTCOMES:

- CO1: Learn mathematical principles used in learning algorithms and relate them to learning principles. (Understanding)
 CO2: Construct and classify learning algorithms used in different problems. (Applying)
 CO3: Know what and how to perform pre-processing to make dataset ready for learning algorithms (Analysing)
 CO4: Create learning models and evaluate the effect of it in a given problem domain. (Evaluation)

Module I: (15 hours)

Mathematical Foundations of Machine Learning: Linear Algebra-Linear equations & vector spaces, matrix decomposition: determinant, Eigen values, singular value decomposition, matrix approximation, Calculus: Differentiation & partial differentiation, gradient of matrices, Probability & Distributions: Discrete and Continuous probabilities, Gaussian distribution, Continuous optimization: Gradient descent, Lagrange Multiplier.

Module II: (10 hours)

Learning: supervised and unsupervised learning, necessary of supervised learning, KNN, regression models, Naive Bayes' classifier, decision trees, random forest classifier, SVM: linear, non-linear.

Module III: (11 hours)

Data preprocessing & Scaling: Different kinds of preprocessing, Data transformations, Scaling: training data & testing data, Types of unsupervised learning, dimensionality reduction, clustering: k-Means, Fuzzy C-Means, DBSCAN, Comparing and evaluating clustering.

Module IV: (13 hours)

Neural Network: Biological to Artificial neurons, Logical computations with neurons, perceptron, MLP & backpropagation, Tuning neural network hyperparameters, vanishing and exploding gradient problems, momentum optimization: AdaGrad, Adam optimization, Regularization: L1 & L2, Convolutional property of neural network.

Module V: (11 hours)

Deep learning: Convolutional Neural Network: AlexNet, GoogleNet, ResNet, RNN: Training a RNN, deep RNN, LSTM cell, Auto encoders: stacked auto encoders, sparse auto encoder.

Suggested readings:

1. Hands-On Machine Learning with Scikit-Learn & TensorFlow. Second edition, Aurelien Geron, 2017, O'Reilly Media.
2. Machine Learning-An Algorithmic Perspective, second edition, Stephen Marshall, 2015, CRC Press.
3. Deep Learning, John D. Kelleher, 2019, Massachusetts Institute of Technology (MIT).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	M		
CO 3			H	M	
CO 4				H	H

CAEP0024: ENTERPRISE RESOURCE PLANNING
(4 credits–60 hours)

Objective

To help the student understand the conceptual elements of ERP and its theory and implementation. This is especially poignant in view of large number of organizations implementing ERP applications in recent years. The student will appreciate the impact that ERP brings into the daily operations of firms with respect to their productivity, integration, communication, etc.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1: Recall the conceptual elements of ERP. (Remembering)

CO2: Demonstrate the Influence of ERP in Large Organizations. (Understanding)

CO3: Identify the impact of ERP into the daily operations of firms with respect to their productivity, integration, communication etc. (Applying)

CO4: Analyse the practical side of ERP implementation with different vendors. (Analysing)

CO5: Discuss and evaluate the best practices of ERP with various case studies and real time examples. (Creating, Evaluating)

Module I: ERP Basics (15 hours)

Evolution and structure of ERP, ERP concepts, growth of the ERP market, conceptual model of ERP, 2-tier and 3-tier architecture, elements in ERP architecture, advantages/benefits of ERP, overview of an enterprise, integrated management information, business modeling, integrated data model
ERP and related technologies: Business Process Reengineering (BPR), Management Information Systems (MIS), Decision Support Systems (DSS), Data Warehousing, Data Mining, Online Analytical Processing (OLAP), Supply Chain Management.

Module II: ERP Modules (15 hours)

Item types in ERP, Manufacturing, distribution and Financial requirements, item control module in ERP, Finance module, Manufacturing and Production Planning module, Sales and Distribution module, Plant Maintenance module, Quality Management module, Materials Management module, Capital Requirement Planning module, Purchase Control module, Human Resources modules; concept of Bill of materials, concept of formula management.

Module III: Profiling ERP Vendors (10 hours)

SAP AG: R/3 –, overview of R/3 system, R/3 modules, R/3 and the internet

BAAN: Baan ERP modules, Baan ERP Tools

Oracle: Oracle modules – Financials, Human Resources, Projects, Manufacturing, Supply chain.

PeopleSoft: Accounting and control, Treasury Management, Performance Management, Sales and Logistics, Procurement.

Module IV: ERP Implementation Lifecycle (10 hours)

Elements of implementation methodology, Pre-evaluation Screening, Package evaluation, project planning phase, Gap Analysis, Business Process Re-engineering, configuration, Implementation team training, testing, product migration and support, Problems in ERP implementation, cost of ERP.

Module V Best Practices in ERP (10 hours)

Concept of Best Practices, concept of Customer Order Decoupling Point (CODP), Demand Management – Sales and Operations Planning, ERP scenario in India, future directions in ERP.

Case studies should also be introduced to highlight situations where ERP projects are implemented, and the success stories/benefits/difficulties of these implementations.

Suggested Readings

1. O'Leary, Daniel E, Enterprise Resource Planning Systems: systems, life cycle, electronic commerce and risk, Cambridge University Press.
2. Alexis Leon, Enterprise Resource Planning, 14th reprint, Tata McGraw Hill, New Delhi 2005
3. Rahul V Altekar, Enterprise Resource Planning (Theory and Practice), Prentice Hall India, New Delhi 2004
4. Alexis Leon, ERP Demystified, Tata McGraw Hill Pub. Co. Ltd, 2000
5. Kent Sandoe, Enterprise Integration, John Wiley and Sons
6. Garg and Venkitakrishnan, Enterprise Resource Planning : Concepts and Practice, 2nd edition, Prentice Hall India
7. ERP – Concepts and Cases, ICFAI University Press, 2004

Mapping of COs to Syllabus

Course Out-comes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		M	H		
CO 3		H	M		
CO 4		L		H	
CO5					H

ECRM0042 RESEARCH METHODOLOGY AND INTELLECTUAL PROPERTY RIGHTS
(2 credits-30 hours)
Objective:

This course is designed to help students to identify research problems in various fields. It aims at giving potential researchers the knowledge of effectively analysing and interpreting results and presenting the findings to the scientific and technological community of the world. This course also aims at motivating students to bring about their creative ideas for innovation and establishing research impact in the global for a through intellectual ownership.

Course Outcomes

At the end of the course, students will be able to:

CO1:Find research problems in various fields (Remembering).

CO2:Illustrate the concepts related to patents, trademark and copyright (Understanding).

CO3:Apply scientific investigations to find solutions for research problems of interest (Applying).

CO4:Develop technical writing and presentation skills (Applying).

CO5:Analyze the available literature and compile literature review for knowing the state of the art in the areas of interest (Analyzing/ Creating).

CO6:Formulate a research problem for a given engineering domain (Creating)

Module I (12 Hours)

Meaning, sources, scope and objective of a research problem; Good research problem criteria and characteristics, errors in selecting a research problem; Research problem solutions– approaches for investigation; Approaches to effective literature studies; Data collection, analysis, interpretation and instrumentation; Plagiarism and ethical practices.

Module II (10 Hours)

Effective writing; Research proposal development and its format; Different report types.

Module III (8 Hours)

Nature of intellectual property: Patent, design, trade and copyright; Patenting and development process; Patent grant under PCT and procedure; Geographical indications.

Patent rights: Administration of patent systems, scope, information and databases, technology licensing; New developments and case studies.

Suggested Readings

1. Goddard Wayne, Melville Stuart, Research Methodology: An Introduction For Science And Technology Students, Juta & Co. Ltd.
2. Kumar Ranjit, Research Methodology A Step By Step Guide For Beginners, SAGE publications Inc.
3. Halbert J. Debora, Resisting Intellectual Property, CRC press.
4. Menell S. Peter, Lemley A. Mark, Merges P. Robert, Intellectual Property In New Technological Age, Clause 8 Publishing.
5. C.R. Kothari, Research Methodology Methods and Techniques, New Age International

Mapping of COs to Syllabus

Course Out-comes	Module 1	Module 2	Module 3
CO 1	H		L
CO 2	M		H
CO 3	H	L	
CO 4	L	H	M
CO 5	H	M	L
CO6	H	M	L

CAPA0030: PRINCIPLES OF ARTIFICIAL INTELLIGENCE (4 credits – 60 hours)

Objective

Artificial Intelligence has embraced the larger scientific goal of constructing information- processing theory of intelligence. If such a science of intelligence could be developed, it could guide the design of intelligent machines as well as explicate intelligent behaviour as it occurs in humans and other animals. This paper describes the fundamental AI ideas that underlie many of the AI applications and provides a base for understanding natural intelligence.

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

- CO1: Recall and identify the need of incorporating human intelligence into machine and define the basic terms related to the concept of knowledge and representation, learning and reasoning, communication and language processing. (Remembering)
- CO2: Define problem state space, design algorithms to solve problems, generalized schema for knowledge interpretation and planning and language processing. (Understanding)
- CO3: Compute and demonstrate the problem in terms of state space and apply different AI algorithms to solve problems and construct logic to represent knowledge in the computational domain and also to interpret the natural language. (Applying)
- CO4: Compare and analyse the performance of algorithms based on problem domain. (Analysing)
- CO5: Design and create new intelligent algorithms for application development by integrating experience-based learning. (Creating)
- CO6: Judge and assess the algorithms based on completeness, optimality, and space and time complexity for solving a problem in an intelligent manner. (Evaluating)

Module I: General Issues and Overview of AI (12 Hours)

Introduction to AI: The AI problems, the underlying assumption, AI techniques, the level of the model, criteria for success, AI applications. Problem solving, search and control strategies: defining the problem as a state space search, production systems, control strategies, breadth-first search, depth-first search, problem characteristics, production system characteristics, issues in the design of search programs.

Module II: Search Strategies for AI Production Systems (16 Hours)

Heuristic search techniques: generate-and-test, hill climbing, simple hill climbing, steepest-ascent hill climbing simulated annealing, best-first search, OR-graphs, the A* algorithm, problem reduction, AND-OR graphs, the AO* algorithm, constraint satisfaction, means-end analysis. game playing: overview, the minimax search procedure, adding alpha-beta cutoffs, additional refinements, iterative deepening.

Module III: Knowledge Representation (16 Hours)

Knowledge representation issues: representations and mappings, representing simple facts in logic, knowledge representation attributes, computable functions and predicates, resolution, conversion to clause form, the basics of resolution, resolution in propositional logic, procedural vs. declarative knowledge, logic programming, forward vs. backward reasoning, matching, control knowledge. statistical reasoning: probability and Bayes' theorem, certainty factors and rule-based systems, Bayesian networks, Dempster-Shafer theory, basic notions and concepts of fuzzy sets, fuzzy set operations, information - based characterization of fuzzy sets, fuzzy relations and their calculus.

Module IV: Advanced AI (16 Hours)

Natural language processing: overview, morphological analysis, syntactic analysis, semantic analysis, discourse integration, pragmatic analysis, parsing techniques, top-down parsing, bottom-up parsing, augmented transition networks (ATN). Learning: rote learning, learning by taking advice, learning by induction, explanation-based learning. Expert system: representing and using domain knowledge, expert system shells, explanation, knowledge acquisition.

Suggested Readings

1. Rich, E.; K. Knight, Artificial Intelligence, (Second Edition), New Delhi: Tata McGraw-Hill, 1997
2. Nilson, N. J., Principles of Artificial Intelligence, New Delhi: Narosa Publishing House, 2002
3. Pedrycz, W.; F. Gomide, An Introduction to Fuzzy Sets: Analysis and Design, New Delhi: Prentice-Hall India, 2004.
4. Winston, P. H., Artificial Intelligence, New Delhi: Pearson Education Asia, 2002
5. Charniak, E.; D. McDermott, Introduction to Artificial Intelligence, New Delhi: Pearson Education, 2002
6. Russell, S.; P. Norvig, Artificial Intelligence: A Modern Approach (Second Edition), New Jersey: Prentice-Hall, 2003

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	L
CO 2	M	H	L	
CO 3	L	M	H	
CO 4		H	M	M
CO 5			H	M
CO 6		M	M	H

CAHC0050: HUMAN COMPUTER INTERACTION (HCI)
(4 Credits – 60 Hours) (L-T-P: 4-0-0)

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

- CO1: Learn the basic physiological, perceptual, and cognitive components of human learning and memory and gain theoretical knowledge of the fundamental aspects of designing and implementing user interfaces (Remembering)
- CO2: Explain the HCI implications for designing various applications such as multimedia/apps/ e-commerce/ e-learning Web sites. (Understanding)
- CO3: Design effective HCI for individuals. (Applying)
- CO4: Analyze the quality of user interface (Analyzing)
- CO5: Assess the importance of user feedback. (Evaluating)
- CO6: Develop meaningful user interface. (Creating)

Module I: Introduction to HCI And History (10 Hours)

What is HCI? Historical evolution of the field. Human brain and computer: The Human sensation and perception–Human Memory – Reasoning and problem solving; The computer and its I/O Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms- Problems and challenges.

Module II: Design and Software Process (22 Hours)

Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Design Evaluation Techniques – Experimental evaluation and Empirical Methods: Hypothesis testing, Choosing participants and sample size, Variables: independent and dependent measures, Types of experimental designs, Data analysis.

Module III: Models and Theories (9 Hours)

Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and Collaboration modelsHypertext, Multimedia and WWW. Design Case studies: Multi-Key press Hindi Text Input Method on a Mobile Phone, Employment Information System for unorganized construction workers on a Mobile Phone.

Module IV: Mobile HCI (7 Hours)

Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

Module V: Brain-Computer Interaction (BCI) and Neuroprosthetics/Sensory substitution (12 HOURS)

What is BCI? BCI and brain plasticity-Neuroergonomics and Neurocognitive Engineering-Medical applications of BCI: Neuroprosthetics, Commercial Applications of BCI, Ethical implications of these interfaces, Neuroprosthetics vs. sensory substitution, Most sensory substitution devices compensate for loss of vision: discussion of visual to tactile and visual to auditory devices, Components of sensory substitution devices, Underlying theories and why it works?

Suggested Readings:

1. “Human Computer Interaction”, 3rd Edition , Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, 2004, Pearson Education.
2. “Designing the User Interface: Strategies for Effective Human-Computer Interaction”, 5th Edition, Shneiderman, Plaisant, Cohen, and Jacobs, 2009, Addison Wesley.

3. "Introduction to Human Factors Engineering", 2nd Edition, Wickens, Lee, Liu, and Gordon-Becker, 2004, Pearson.
4. "Human Computer Interaction", Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T., 1994, Addison-Wesley.
5. "Designing the User Interface", B. Shneiderman; 2000, Addison Wesley(Indian Reprint).
6. "Mobile Design and Development", First Edition, Brian Fling, 2009, O'Reilly Media Inc.
7. "Designing Web Interfaces", First Edition, Bill Scott and Theresa Neil, 2009, O'Reilly.

Mapping of Course Outcomes to Syllabus

Course outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	L			H
CO 2	L	H	M	M	L
CO 3		H	H	M	
CO 4		H	H	L	
CO 5		M	H	H	
CO 6			H	H	M

CABI0051: BIOINFORMATICS

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes:

Upon completion of the course, the student should be able to:

CO1:Relate the different mathematical principles that are necessary in sequence analysis and searching. (Remembering).

CO2:Explain the different protein structure and use algorithm models for alignment analysis. (Understanding)

CO3:Design phylogenetic tree for discovering pattern in sequence analysis. (Creating)

CO4:Analyze, predict and model protein structure and assess the structures. (Evaluating)

Module I: (16 hours)

Introduction to bioinformatics, opportunity and challenges in bioinformatics, protein sequence, analyzing protein sequences, analyzing DNA sequences, palindromes in DNA sequences, coding DNA sequences, RNA structures and sticky strands, pubmed, Expasy, Assessment of structure prediction, protein engineering.

Module II: (15 hours)

Genome organization, picking out genes in genomes, genome of homosapiens, database indexing, nucleic acid sequence database, genome database, protein sequence database, database of protein families, structures, protein identification resource, sequence alignments and dotplots, sequence similarity quantification, scoring schemes, dynamic programming for optimal pairwise alignment, multiple sequence alignment, editing and publishing alignments.

Module III: (14 hours) phylogenetic tree, taxonomic relationships, clustering and cladistic methods, ancestral sequences and its reconstruction, evolution and varying rates of evolution, preparing data for phylogenetic tree, BLAST search, building the tree specific to a problem, phylip and open source tools for generating tree, maximum likelihood tree.

Module IV: (15 hours)

Folding and protein stability, sidechains, denaturation in relation to protein stability, coiled-coiled proteins, helical model, structural elements and superposition, mustang, dali, protein structure evolution, SCOP classification, prediction of protein structure and modeling, assessment of structure prediction,

secondary structure and prediction, homology modeling and fold recognition. Three dimensional profiles to assess quality of structures.

Suggested readings:

1. Bioinformatics for dummies, second edition, Jean-Michel, Cedric Notredame, 2007, Wiley publishing
2. Introduction to bioinformatics, fourth edition, Arthur M. Lesk, 2014, Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		M
CO 3			H	
CO 4				H

CADL0052: DEEP LEARNING

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes:

Upon completion of the course, the student should be able to:

CO1: Recall the various deep learning related terms, tools, and technologies (Remembering)

CO2: Compare and contrast the various types of neural networks (Analysing)

CO3: Test, explore and estimate all the parameters for neural networks. (Evaluating)

CO4: Illustrate the various deep unsupervised learning techniques for solving specific real-world problems. (Understanding)

CO5: Experiment how to deploy neural network algorithm to solve real-world problems. (Applying)

Module I: Basics of Deep Learning (14 Hours)

Introduction: Basics of Artificial Intelligence, Machine learning, and Deep learning; History and Capabilities of Deep Learning,

Deep Learning primitives – Soft Max Function, Sigmoid, Tanh and ReLU Neurons, Functions and Gradient Descent, Linear/Logistic regression, Vectorizing Logistic regression,

Neural Network: Basic concepts of artificial neurons, single and multi-layer perceptrons, perceptron learning algorithm, perceptron convergence theorem, gradient descent and backpropagation algorithm, the vanishing gradient problem, gradient descent, regularization, dropout

Module II: Types of Neural Networks (18 Hours)

Convolutional Neural Networks (CNN): Introduction to CNN, CNN Architectures, Convolution / pooling layers, Correlation, Filtering, CNN architectures, Detection and Segmentation, Advanced CNNs for computer vision

Advanced Deep Architectures: Recurrent Neural Networks, Long Short-Term Memory Units (LSTM), Gated Recurrent Unit (GRU), Encoder Decoder architectures, Generative Adversarial Networks (GANs)

Module III: (10 Hours)

Deep Unsupervised Learning: Autoencoders (standard, sparse, denoising, contractive, etc), Variational Autoencoders, clustering learning, Adversarial Generative Networks, Learn-from-data model, Autoencoder and DBM Attention and memory models, Maximum Entropy Distributions, Unsupervised learning of visual representations from image patches and locality, Unsupervised Learning of Visual Representations using Videos

Module IV: Deep Learning in Practice (18 Hours)

Deep Learning for Computer Vision: Introduction to convnets, training a convnet on small datasets, using a pretrained convnet,

Applying Deep Learning for Object detection, face recognition, and automatic image classification

Deep Learning for Natural Language Processing (NLP): Introduction to NLP, Vector Space Model of Semantics, Word Vector Representations: Continuous Skip-Gram Model, Continuous Bag-of-Words model (CBOW), Glove, Evaluations and Applications in word similarity, analogy reasoning, Named Entity Recognition, Opinion Mining using Recurrent Neural Networks, Parsing and Sentiment Analysis using Recursive Neural Networks, Sentence Classification using Convolutional Neural Networks

Suggested Readings

1. Nielsen, Michael A. *Neural networks and deep learning*. Vol. 25. San Francisco, CA: Determination press, 2015.
2. Goodfellow, Ian, et al. *Deep learning*. Vol. 1. No. 2. Cambridge: MIT press, 2016.
3. Deng, Li, and Yang Liu, eds. *Deep learning in natural language processing*. Springer, 2018.
4. Wani, M. Arif, et al. *Advances in deep learning*. Springer, 2020.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3	L	H		M
CO 4			H	
CO 5		M		H

CASC0053: SOFT COMPUTING

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes:

Upon completion of the course, the student should be able to:

CO1: Identify and describe soft computing techniques and their roles in the development of smart machines. (Remembering and Understanding)

CO2: Apply fuzzy logic and reasoning to deal with uncertainty and solve various problems. (Applying)

CO3: Analyze the architecture and algorithms of Neural networks to meet the challenges of soft computing problems. (Analyzing)

CO4: Analyze genetic algorithms to combinatorial optimization problems. (Analyzing)

CO5: Evaluate and compare solutions to a given problem using various soft computing approaches. (Evaluating and Creating)

CO6: Effectively use existing software tools to solve real problems using a soft computing approach. (Applying)

Module I (6 Hours)

Introduction to Soft Computing, Characteristics of Soft Computing, Soft Computing Versus Hard Computing, Soft Computing Constituents, Applications of Soft Computing techniques, Evolutionary Computing, Machine Learning Basics.

Module II (11 Hours)

Fuzzy Logic: Introduction to Fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, Rules, Propositions, Implications and Inferences, Fuzzification and Defuzzification, Fuzzy logic controller, Fuzzy Expert Systems, Fuzzy Decision Making, Applications of Fuzzy logic.

Module III (15 Hours)

Neural Networks: Biological neurons and its working, Introduction to Artificial Neural Network, Artificial Neural Networks Versus Biological Neural Networks, Activation functions, ANN architectures: McCulloch & Pitts model, Perceptron, ADALINE, MADALINE, Activation functions, Supervised Learning: Introduction, Neuron as a simple computing element, The perceptron, Backpropagation Networks: Architecture, Multilayer Perceptron, Back propagation learning-input layer, Radial Basis Function Networks. The Hopfield Network, Unsupervised Learning Neural Networks: Hebbian Learning, Self-Organizing Computational Maps: Kohonen Network, Applications of ANNs.

Module IV (13 Hours)

Genetic Algorithms: Introduction to Genetic Algorithm (GA), Working Principle, Difference between traditional algorithms and GA, Phases of Genetic Algorithm, Basic GA framework and different GA Architectures, Convergence of GA, Applications of GA case studies. Introduction to genetic programming-basic concepts.

Module V (15 Hours)

Deep Learning: Basics of Deep Learning, Convolutional Neural Network, Recurrent Neural Network. MATLAB/Python Lib: Study of Neural Network Toolbox and fuzzy logic toolbox, Simple implementation of ANN and fuzzy logic.

Suggested Readings

1. R. Rajasekaran and G. A Vijayalakshmi Pai, Neural Networks, Fuzzy Logic, and Genetic Algorithms: Synthesis and Applications, Prentice Hall of India. 2003.
2. Timothy J. Ross, Fuzzy Logic with Engineering Applications, Wiley, 2011.
3. N. P. Padhy, Artificial Intelligence and Intelligent Systems, Oxford University Press. 2005.
4. Simon O. Haykin, Neural Networks and Learning Machines, Pearson, 2009.
5. MATLAB Toolkit Manual.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	
CO 5	M		M		M
CO 6					M

CADS0054: DATA SCIENCE

(4 Credits – 60 Hours) (L-T-P: 4-0-0)

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1: Understand the basic concepts and technologies related to Data Science. (Understanding)

CO2: Obtain, clean/process, and transform data and analyze the transformed data using an ethically responsible approach (Applying and Analyzing)

CO3: Relate which tools and methodologies can be applied to solve data science tasks. (Remembering)

CO4: Integrate Data Science capabilities into the formation of a situation analysis (Evaluating)

CO5: Formulate and use appropriate models of data analysis to solve hidden solutions to business-related challenges (Creating)

CO6: Interpret data findings effectively to any audience, orally, visually, and in written formats. (Understanding)

Module I: Introduction to Data Science, Preprocessing, and Data Visualization (14 Hours)

Introduction to Data Science: Why Learn Data Science, Data Analytics Life Cycle, Types of Data Analysis, Types of Jobs in Data Analytics, Data Science Tools, Fundamentals Areas of Study in Data Science

Data Preprocessing: Introduction to Data Preprocessing, Data Types and Forms, Possible Data Error Types, Various Data Preprocessing Operations - Data Cleaning, Data Integration, Data Transformation, Data Reduction, and Data Discretization

Data Plotting and Visualization: Introduction to Data Visualization, Visual Encoding, Data Visualization Libraries, Basic Data Visualization Tools (Histograms, Bar Charts, Scatter Plots, Line Charts, Area Plots, Pie Charts, Donut Charts); Specialized Data Visualization Tools (Box Plots, Bubble Plots, Violin Plots, Heat Map, Dendrogram, Radar Chart, Venn Diagram, 3D Scatter Plots), Advanced Data Visualization Tools (Wordclouds, Chord Diagram, Waffle Charts, Choropleth Map, Bubble Map), Data Visualization Types

Module II: Statistical Data Analysis and Machine Learning (18 Hours)

Statistical Data Analysis: Role of Statistics in Data Science, Kinds of Statistics, Descriptive Statistics (Measures of Frequency, Central Tendency, Dispersion, and Position), Inferential Statistics, Parametric vs Non-Parametric Hypothesis Testing, Probability Theory, Four Perspectives on Probability, Bayesian Probability, Probability Distribution

Machine Learning for Data Science: Overview of Machine Learning, Supervised Machine Learning - Regression Methods (linear, polynomial, and logistic), Classification Methods (KNN Classification, Support Vector Machine (SVM) Classification, and Decision Tree Classification); Unsupervised Machine Learning - Clustering Methods (Fuzzy c-means Clustering and Principle Component Analysis (PCA) Clustering), Association Analysis - Apriori Algorithm and FP-Growth Analysis, Introduction to Reinforcement Learning

Module III: Time-Series Analysis and Deep Learning (12 Hours)

Time-Series Analysis: Overview of Time-Series Analysis, Components of Time-Series, Time-Series Forecasting Models using Stochastic Models (AR, MA, ARMA and ARIMA), Time-Series Forecasting using Support Vector Machines Based Models

Deep Learning for Data Science: Introduction to TensorFlow, Pytorch, Deep Learning Primitives, Convolutional Neural Network (Softmax, ReLU, Sigmoid or Logistic Activation function, and Pooling), TensorFlow and CNN, AutoEncoder (Convolutional Autoencoder and Sparse Autoencoder)

Module IV: Social Media Analytics, Business Analytics, and Big Data Analytics (16 Hours)

Social Media Analytics: Overview of Social Media Analytics, Seven Layers of Social Media Analytics, Social Network Analysis (Link

Prediction, Community Detection, and Influence Maximization), Text Analytics/Mining (Text Categorization, Document or Text Summarization, and Sentiment Analysis), Trend Analytics

Business Analytics: An Overview of Business Analytics, The Business Analytics Life Cycle, Basic Tools Used in Business Analytics,

Financial Analytics, Market Analytics, Customer Analytics, and Employee Analytics

Big Data Analytics: An Overview of Big Data, Hadoop, Hadoop Distributed File System, Interacting with HDFS from Python Applications, Introduction to Snake, Pig and Spark

Suggested Readings

1. J. Grus, Data Science from Scratch: First Principles with Python, O'Reilly, 2nd Edition, 2019
2. Silberschatz, H. F. Korth, S Sudarshan, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, 1st Edition, Dreamtech, 2016
3. C. Neil, R. Schutt, Doing Data Science: Straight Talk from the Frontline, O'Reilly, 1st Edition, 2019.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			

CO 2	H			
CO 3		H	M	M
CO 4			M	M

CAVS0055: DATA VISUALIZATION FOR DATA SCIENCE**(4 Credits – 60 Hours) (L-T-P: 4-0-0)****Course Outcomes:**

Upon completion of the course, the student should be able to:

CO1: Learn what data visualization is, how it's used, and how computers display information. Also explore different types of visualization and how humans perceive information. (Remembering)

CO2: Apply principles of design and colour to make visualizations more engaging and effective. (Applying).

CO3: Learn how to visualize graphs that depict relationships between data items. (Understanding)

CO4: Designing your own visualization system for large datasets and dashboards. (Creating)

CO5: Create and interpret the visualization from the data set, and apply techniques from user-interface design to create an effective visualization system. (Creating, Evaluating)

Module I: (12 hours)

Introduction to Data Visualization: Overview of Visualization, Defining data visualization; Visualization workflow: describing data visualization workflow, process in practice; Data representation: chart types: categorical, hierarchical, relational, temporal & spatial.

Module II: (15 hours)

Visualization Tools: 2-D: bar charts, clustered bar charts, dot plots, connected dot plots, pictograms, proportional shape charts, bubble charts, radar charts, polar charts, Range chart, Box-and-whisker plots, univariate scatter plots, histograms word cloud, pie chart, waffle chart, stacked bar chart, back-to-back bar chart, all relevant 2-D charts. 3-D: surfaces, contours, hidden surfaces, pm3d coloring, 3D mapping; multi-dimensional data visualization; manifold visualization; graph data visualization; Annotation; Word Clouds, Seaborn and Regression Plots.

Module III: (12 hours)

Visualization of Numerical Data: Data, Mapping, Charts, Glyphs, Parallel Coordinates, Stacked Graphs, Tufte's Design Rules.

Module IV: (10 hours)

Visualization of Non-Numerical Data: Graphs and Networks, Embedding Planar Graphs, Graph Visualization, Creating Maps and Visualizing Geospatial Data, Introduction to Folium, Maps with Markers, Choropleth Maps, Tree Maps, Principal Component Analysis, Multidimensional Scaling, Packing.

Module V: (11 hours)

The Visualization Dashboard: Introduction, Visualization Systems, the Information Visualization, Database Visualization, Visualization System Design.

Suggested Readings

1. Andy Kirk, Data Visualization A Handbook for Data Driven Design, Sage Publications, 2016
2. Philipp K. Janert, Gnuplot in Action, Understanding Data with Graphs, Manning Publications, 2010.

Mapping of COs to Syllabus

Course comes	Out-	Module I	Module II	Module III	Module IV	Module V
CO 1		H				

CO 2		H	M		
CO 3			M	M	
CO 4				H	
CO 5					H

CABD0056: BIG DATA MANAGEMENT**(4 Credits – 60 Hours) (L-T-P: 4-0-0)****Course Outcomes:**

Upon completion of the course, the student should be able to:

CO1:List the components of Hadoop and Hadoop Ecosystem. (Remembering)

CO2:Understanding of big data basics and problems over big data. (Understanding)

CO3:Identify Big Data and its Business Implications. (Applying)

CO4:Make use of Hadoop and MapReduce programming to tackle big data problems. (Applying)

CO5:Demonstrate Machine Learning Techniques using R/Python. (Understanding)

Module I (12 Hours)

Introduction to Big Data and Hadoop Types of Digital Data: Introduction to Big Data, Big Data Analytics, History of Hadoop, Apache Hadoop, Analysing Data with Unix tools, Analysing Data with Hadoop, Hadoop Streaming, Hadoop Ecosystem, IBM Big Data Strategy, Introduction to Infosphere Big, Insights and Big Sheets.

Module II (12 Hours)

HDFS (Hadoop Distributed File System): The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system interfaces, Data flow, Data Ingest with Flume and Scoop and Hadoop archives, Hadoop I/O: Compression, Serialization, Avro and File-Based Data structures.

Module III (10 Hours)

Map Reduce: Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Formats, Map Reduce Features.

Module IV (14 Hours)

Hadoop Ecosystem: Pig: Introduction to PIG, Execution Modes of Pig, Comparison of Pig with Databases, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, Hive Metastore, Comparison with Traditional Databases, HiveQL, Tables, Querying Data and User Defined Functions. HBase: HBasics, Concepts, Clients, Example, HBase Versus RDBMS.

Module V (12 Hours)

Machine Learning: Introduction, Supervised Learning, Unsupervised Learning, Collaborative Filtering. Introduction to Big Data Analytics with BigR.

Suggested Readings

1. Hadoop: The Definitive Guide, Third Edition, Tom White, 2012, O'reily Media.
2. Big Data Analytics, Seema Acharya, Subhasini Chellappan, 2015, Wiley.
3. Machine Learning (in Python and R), First Edition, J. P. Mueller, L. Massaron, 2016, Wiley.

Mapping of Course Outcomes:

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H			H	
CO 2	H	M			
CO 3			M	H	
CO 4			H	H	

CO 5				M	H

CAWA0057: WEB ANALYTICS AND DEVELOPMENT**(4 Credits – 60 Hours) (L-T-P: 4-0-0)****Course Outcomes:**

Upon completion of the course, the student should be able to:

CO1: Recall the various Web Analytics--related terms, tools, and technologies (Remembering)

CO2: Illustrate the various web data capturing procedures and the various important web metrics (Understanding)

CO3: Experiment how to deploy web intelligence to improve the outcomes of marketing or business plan. (Applying)

CO4: Compare and contrast the various web analytics tools (Analysing)

CO5: Analyze, test, and judge results based on search analytics, competitive intelligence analytics and Google analytics. (Analyzing, Evaluating)

Module I: Basic Concepts of web Analytics and Web Data Collection (14 Hours)

Introduction: Web Analytics – brief history, evolution, importance and need; advantages and limitations of web analytics, site references, Basic Terms - keywords and key phrases, onsite web, offsite web, visit characterization terms, content characterization terms, conversion metrics; Web analytics platform Data Collection: Clickstream Data - Web logs, Web Beacons, JavaScript tags, Packet Sniffing; Outcomes Data: E-commerce, Lead generation, Brand/Advocacy and Support; Research data: Mindset, Organizational structure, Timing; Competitive Data: Panel Based measurement, ISP-based measurement, Search Engine data.

Module II: Web Data Capturing and Web Metrics (16 Hours)

Capturing data: Web logs, data capture, Type and size of data, Innovation, Integration, selecting optimal web analytic tool, Understanding click stream data quality, identifying unique page definition, Using cookies, Link coding issues

Web Metrics: Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non-ecommerce sites): Improving bounce rates, optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI.

Module III: Search Analytics and Qualitative Analysis of Web Data (12 Hours)

Search Analytics: Performing Internal Search Site Analytics, Search engine optimization, Measuring SEO Efforts, Analyzing Pay per Click effectiveness,

Qualitative Analysis: Essence of customer eccentricity, Heuristic evaluations, Site Visits: Conducting a site visit, Benefits of site visits; Surveys - Website surveys, post-visit surveys, creating and running a survey, Benefits of surveys

Module IV: Web Analytics Tools, Competitive Intelligence and Google Analytics (18 Hours)

Web Analytics tools: Click Stream Analysis, A/B testing, Online Surveys

Competitive Intelligence (CI) analysis: CI data sources, Toolbar data, Panel data, ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities.

Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.

Suggested Readings

1. Kaushik, Avinash. Web Analytics: An Hour a Day. United States, Wiley, 2007.
2. Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc. 2nd ed

3. Kaushik A., Web Analytics 2.0, The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc.
1st ed.
4. Sterne J., Web Metrics: Proven methods for measuring web site success, John Wiley and Sons

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			L
CO 2		H		
CO 3		L	H	M
CO 4				H
CO 5			H	H

LABORATORY COURSES**CAOS6012: OPERATING SYSTEMS LAB****(2 credits)****COURSE / LEARNING OUTCOMES**

At the end of the Lab experiments students will be able to:

Recall and label the basic commands in Linux. (Remembering)

Classify system calls, library functions calls to write on standard output device. (Understanding)

Experiment with shell programs. (Applying)

Construct programs on process scheduling, page replacement algorithms. (Creating)

Evaluate free space management using programs. (Evaluating)

Module1

Introduction to Linux

File System (Types of file, Filename, parent-child relationship, absolute and relative pathname, file and directory permissions) Introduction to vi editor (start vi, the three modes, create, save and open a text file, positioning by character, positioning by line, positioning by word, positioning in the word, positioning on a numbered line, inserting text, deleting text), Simple Linux commands, Shell Programming

Module2:

Semaphores, Shared Memory and Message Queues: Semaphore (Binary semaphore, Linux Semaphore Facilities, Using Semaphores), Shared Memory, Message Queues

Module3:

Processes and Signals : Process Structure, Starting a new Process, Replacing a Process Image, Duplicating a Process Image, Waiting for a process, Zombie Processes, Terminating a Process, Signals (Signal handling, Sending signals, Signal interface, Signals sets).

Module4:

POSIX Threads: Creating threads, Simultaneous execution of threads, Synchronization and Critical sections, Synchronization with Semaphores, Synchronization with Mutexes, Thread Attributes, Cancelling a thread.

Inter-Process Communication: Pipes, Process Pipes, and The Pipe Call, Parent and Child processes, FIFOs (Accessing a FIFO, opening a FIFO, Reading and Writing FIFO).

Mapping of COs with Syllabus:

Course Outcomes	Module1	Module2	Module3	Module4
CO1	H	M		
CO2		H	M	

CO3		M	H	L
CO4	L	M	H	
CO5		L	M	H

CADA6033: DATA STRUCTURES AND ALGORITHM LAB**(2 Credits)****Objectives**

To introduce first level topics covering basics in algorithms and data structures.

To enable students to choose appropriate data structures, understand the ADT/libraries, and use of it to design algorithms for a specific problem.

To understand the necessary mathematical abstraction to solve problems.

To apply important algorithmic design paradigms and methods of analysis.

COURSE/LEARNING OUTCOMES

At the end of the course, students would be able to:

Get introduced to existing algorithms and how to analyse them using graph notation. (Remembering)

Demonstrate the existing standard algorithms. (Understanding)

Apply existing algorithms in developing different applications. (Applying)

Analyse the time complexity of standard algorithms. (Analysing and Evaluating)

Create efficient applications by using the right algorithm depending on input pattern and size. (Creating).

List of Programs

Implement the linear search and binary search algorithm to search for a given element e from a list of n numbers. Analyze the algorithms.

Prove that the Bubble Sort algorithm has time complexity of $O(n^2)$ by showing the graph notation.

Prove that the Selection Sort algorithm has time complexity of $O(n^2)$ by showing the graph notation.

Implement the Insertion Sort algorithm and analyse the algorithm using the graph notation.

Implement the Divide-and-Conquer technique and analyze the algorithm showing the graph notation.

Implement the Greedy Programming technique and analyze the algorithm showing graph notation.

Implement the Dynamic Programming technique and analyze the algorithm showing graph notation.

Design a small file compressor and decompressor by using Huffman coding technique.

Suggested Readings

Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, The Design and Analysis of Computer Algorithms. Addison Wesley, 2001. (Modules I, II, III and IV)

Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, Data Structures and Algorithms.. Addison Wesley, 2000. (Modules I and V)

Thomas H Corman, Charles E Leiserson, Ronald L Rivest and Clifford Stein, Introduction to Algorithms, 2nd PHI, 2004

V Manbar, Introduction to Algorithms - A Creative Approach, Addison Wesley, 2000.

Ellis Harwitz, Sartaz Sahani, Fundamentals of Computer Algorithms.. , Computer Science Press, 2000.

Peter Linz, An Introduction to Formal Languages and Automata. Narosa Publishing House 2001

Mapping of COs with Syllabus

Course Outcomes	1	2	3	4	5	6	7	8
CO1	H	H	H	H				
CO2	H	H	H	H				
CO3					H	H	H	
CO4	H	H	H					
CO5								H

CAPJ6014: PROGRAMMING THROUGH JAVA LAB
(2 credits)
COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

List various GUI and thus will be able to select the suitable GUI to resolve a given problem. (Remembering)

Distinguish among the various utility class like vector, stack, Hash Table, String Tokenizer, etc. (Understanding)

Apply their knowledge to solve practical problems like reading from a dataset, writing into a file and develop games using JAVA program. (Applying)

Evaluate the performance of various swing GUI components and design various applications using Swings depending on the domain and requirement. (Evaluating)

At the end of the experiments, students will be able to

Program to illustrate class, objects and constructors

Program to implement overloading, overriding, polymorphism etc

Program to implement the usage of packages

Program to create our own exception

Program for handling file operation

Implement the concept of thread programming

Program to implement Generic class and generic methods

Program for event-driven paradigm in Java

Program that uses Menu driven Application

Program to implement JDBC in GUI and Console Application

Socket programming to implement communications 12. Develop a multi-threaded GUI application of your choice.

E-resource for learning Java, www.spoken-tutorial.org

Mapping of COs with Syllabus:

Course Outcomes	1,2,3,4,5	6,7	8,9,10,11,12
CO1		M	H
CO2	H		
CO3		M	H
CO4	M	M	H

CACC6034: DATA COMMUNICATION AND COMPUTER NETWORKS LAB
(2 Credits – 60 Hours)
Objective

Network programming involves writing programs that communicate with other programs across a computer network. Most operating systems provide pre-compiled programs that communicate across a network. This course envisages providing an introduction to such networking programming, whereby students will learn to write their own network programs. At the end of this course in network programming, the students are expected to have elementary ideas about the socket programming and their usage in setting up TCP and UDP communications.

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1:List various network related commands. They will get introduced to socket programming in TCP and UDP environments. (Remembering)

CO2: Illustrate the functions used in TCP and UDP client server communication. (Understanding)

CO3: Apply their knowledge of socket programming to perform various types of communications, address conversions and so on. (Applying)

CO4: Analyze the efficiency of TCP and UDP client –server communication. (Analysing)

CO5: Design and evaluate code for conducting chat or communication between client and server in UDP environment. (Creating, Evaluating)

Module I

Introduction to Network Programming: Introduction to Sockets; Address Structure – IPv4, IPv6; Value-Result Arguments; Byte Order Functions; Byte Manipulation Functions; `inet_aton`, `inet_addr`, `inet_ntoa`, `inet_pton`, `inet_ntop`, `readn`, `written`, `readline`, `isfdtype` functions

Elementary TCP Sockets: Introduction; `socket`, `connect`, `bind`, `listen`, `accept`, `fork`, `exec`, `close`, `getsockname`, `getpeername` functions; TCP Client Server example; `signal`, `sigaction`, `wait`, `waitpid` functions; Connection Termination; `SIGPIPE` signal

I/O Multiplexing: I/O models; `select` function; Batch input; `shutdown`, `pselect`, `poll` functions; Example – TCP Echo Server.

Socket Options: `getsockopt`, `setsockopt`, `fchmod`, `ioctl` functions; Socket status – generic socket options

Elementary UDP Sockets: Introduction; `recvfrom`, `sendto` functions; UDP Examples; `connect` function with UDP; UDP socket receive buffer; Example – UDP Echo Server

Module II

Elementary Name and Address Conversion: Introduction; `gethostbyname` function; `RES_USE_INET6` resolver option; `gethostbyaddr`, `uname`, `gethostname`, `getservbyname`, `getservbyport` functions.

IPv4 and IPv6 Interoperability: Introduction; IPv4 Client - IPv6 Server, IPv6 Client – IPv4Server; IPv6 Address Testing Macros, `IPV6_ADDRFORM`.

Advanced Name and Address Conversions: Introduction; `getaddrinfo`, `gai_strerror`, `freeaddrinfo`, `getnameinfo` functions; Reentrant functions.

Daemon Processes: Introduction; `syslogd` daemon; `syslog`, `daemon_init` functions; `inetd` daemon; `daemon_inetd` function.

Suggested Readings

1. W Richard Stevens, UNIX Network Programming – Volume I, Second Edition, Prentice Hall of India Pvt. Ltd., 2002
2. Douglas E Comer, David L Stevens, Internetworking with TCP/IP: Design, Implementation, and Internals – Volume II, Third Edition, Prentice Hall of India Pvt. Ltd.
3. Douglas E Comer, David L Stevens, Internetworking with TCP/IP: Client Server Programming and Applications – Volume III, Second Edition, Prentice Hall of India Pvt. Ltd.

Mapping of COs with Syllabus

Course Outcomes	Module I	Module II
CO1	H	M
CO2	H	M
CO3	H	
CO4	H	
CO5		H

CAIT6017: INTERNET TECHNOLOGY AND APPLICATIONS LAB

(2 credits)

COURSE / LEARNING OUTCOMES

At the end of this course students will be able to:

CO1:Utilise and experiment with mark-up languages such as XHTML and style sheets such as CSS to design static web pages. (Applying)

CO2:Design and validate a website and can also identify the faults in the design. (Analysing)

CO3:Create and develop a web application using various available frameworks and scripting languages such as JavaScript and PHP. (Creating)

CO4:Validate and examine a dynamic web application using database handling and various other services and deploy them after proper validation (Evaluating and creating)

Module I

XHTML: Components of XHTML; Elements of XHTML (Headers, Linking, Images, Special Characters, Lists, Tables, Forms, Framesets)

Cascading Style Sheets: Inline Styles; Embedded Style; Conflicting Style; Linking External Styles; W3C CSS Validation

Service; Use of CSS (Positioning Elements, Backgrounds, Text flow)

Web Site Design Considerations: Using Logical Design: Planning your website, drawing a map, using a top-down approach, flexibility, other web design metaphors. Creating templates. Creating a Compatible Design: Designing for different color depths, resolutions, different browser considerations, accommodating limited bandwidth. Validating your work.

Module II

Web servers: HTTP Request Types; System Architecture of a Web server; Client-side Scripting versus Server-side Scripting; Accessing Web servers; Apache Web Server. b) Databases: Introduction to each one of the following: SQL, MYSQL, DBI

Scripting Languages: JavaScript: Operators, Data Types, Control Structures, Functions, Arrays, String Manipulation. VBScript Introduction to Perl and CGI (Common Gateway Interface).

PHP: Introduction to PHP; Data Types; Control Structures; Functions; Strings; Arrays; Querying Web Databases using PHP; Writing to Web Databases; Errors, Debugging and Deployment.

Suggested Readings

1. Deitel and Deitel, Internet and World Wide Web: How to Program, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi
2. Hugh E. Williams and David Lane, PHP and MySQL, 2nd Edition, O'Reilly, Shroff Publishers and Distributors Pvt. Ltd.
3. Internet Complete, 2nd Edition, BPB Publications. New Delhi
4. Douglas E. Comer, The Internet Book: Everything you need to know about Computer Networking and how the Internet works, 3rd Edition, Prentice Hall of India Pvt. Ltd., New Delhi

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	
CO2	H	
CO3	L	H
CO4		H

CADM6035: ADVANCED DATABASE MANAGEMENT SYSTEMS LAB
(2 Credits – 60 Hours)

Objectives:

1. Learn to create and use a database
2. Be familiarized with a query language.
3. Have hands on experience on DDL Commands
4. Have a good understanding of DML Commands and DCL commands
5. Familiarize advanced SQL queries.
6. Be Exposed to different applications

COURSE / LEARNING OUTCOMES

At the end of the Lab experiments students will be able to:

CO1:Identify basic SQL operations and fetch results with respect to specific requirement.

(Remembering/Evaluating)

CO2:Describe PL/SQL program structure like conditional constructs, iterative construct, and exception handling. (Understanding)

CO3:Use different program structures and apply them to solve problems. (Applying)

CO4:Apply and analyze PL/SQL procedures, functions, packages, triggers to practice assignments. (Analysing)

CO5:Create applications using Oracle forms and Oracle report. (Creating)

Module I: Query handling with SQL in Oracle

Creation, altering and dropping of tables and inserting rows into a table (use of constraints while creating tables) examples using SELECT command.Queries using ANY, ALL, IN, EXISTS, NOTEXISTS, UNION, INTERSECT, Constraints.

Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views.Queries implementing various joins (left,right,full). Implementation of complex queries: nested queries,sub queries.

Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions

Module II: PL/SQL Programming

Language fundamentals - PL/SQL block structure, character set, identifiers, literals, delimiters, comments, data types in

PL/SQL

Program Structure - Conditional constructs, Iterative constructs, Exception handling

SQL in PL/SQL- DML and Transaction Management (Commit and Rollback), Data Retrieval, Cursors (Explicit and Implicit), error handling with Cursors

b. d) Procedures, Functions, packages, Triggers- creating and managing functions, procedures, packages and triggers

a. Built-in functions - String functions (ascii, chr, concat, greatest, instr, least, length, lower, lpad, ltrim, replace, rpad, rtrim, substr, trim, upper) Numeric functions (bitand, ceil, exp, floor, ln, mod, power, round, sign, sqrt, trunk) , Date and time functions (add_months, current_date, current_timestamp, last_day, months_between, next_day, round, sysdate, systimestamp, trunk) Conversion functions (to_number, to_char, cast, to_date, to_timestamp)

Module III: Forms Builder and Reports Builder

Components of application development in Oracle Forms (Form modules, menus, PL/SQL libraries, Object libraries, Database objects), Features of the Report Builder, defining a data model for a report, specifying the layout of the report using the Oracle Reports Wizard.

Suggested Readings

1. Ivan Bayross, Commercial Application Development Using Oracle Developer 2000 Forms 6i, BPB Publications, 2nd Revised Edition, 2005
2. John Day, Craig Van Slyke, Starting out with Oracle, Dreamtech Press, 2004
3. Steven Feuerstein, Oracle PL/SQL Programming, O'Reilly Publications, 3rd Edition.

Mapping of COs with Syllabus

Course Outcomes	Module I	Module II
CO1	H	M
CO2	M	H
CO3	M	H
CO4	M	H
CO5	M	H

CAML6036: MACHINE LEARNING LAB

(2 Credits – 30 Hours)

COURSE/LEARNING OUTCOMES:

CO1: Explain the implementation procedures for the machine learning algorithms. (Understanding)

CO2: Design Java/Python programs for various Learning algorithms. (Creating)

CO3: Apply appropriate data sets to the Machine Learning algorithms. (Applying)

CO4: Identify and apply Machine Learning algorithms to solve real world problems (Applying)

Experiments:

For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.

Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.

Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.

Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Builtin Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.

Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.

Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

Suggested Readings:

1. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems – 2nd edition, Aurelien Geron, O'Reilly.
2. Building Machine Learning Systems with Python, Willi Richert and Luis Pedro Coelho, Packt Publishing.

Mapping of COs with Syllabus

Course Outcomes	1	2	3	4	5	6	7	8	9
CO1	H	H	H						
CO2	M	M	M	M	M	M	M	M	M
CO3				H	H	H	H	H	H
CO4	M	M	M	M	M	M	M	M	M

CAMN6038: MINOR PROJECT – MCA (5 CREDITS)

Objective: The objective of the Minor project is to consolidate the concepts and practices that were learned during the course and to serve as a record of competence. It should enable a student to apply concretely in a small package the concepts gained from Software Engineering.

COURSE / LEARNING OUTCOMES

At the end of this Minor Project students will be able to:

- CO1: Recall and distinguish client end programming from a server end programming, web based application from a smart phone based application, approach to an application based project from a research based project. (Remembering, Understanding)
- CO2: Identify different API and development environment tools for building the project, research terminologies for research-based projects. (Applying)
- CO3: Apply the knowledge of programming to develop application specific but not limited to Web, Android, IoT etc., for research-based projects the different algorithm design techniques. (Applying)
- CO4: Analyse the advantage and limitation of different development languages, APIs, platforms, algorithms. (Analysing)
- CO5: Create applications to meet real time needs (Creating)
- CO6: Judge the efficiency of the project using various evaluation parameters and testing methodologies, efficiency of the algorithm for research-based complexity measure. (Evaluating)

E-resource for learning

LaTeX, www.spoken-tutorial.org

CAMP6039: MAJOR PROJECT – MCA (18 Credits)

Objective

The primary objective of the Major Project is to enable students to have a thorough understanding of the theoretical principles learnt in earlier five semesters through a prolonged practical

experience. The major project is oriented towards developing requisite skills, knowledge of latest technologies and an entrepreneurial attitude in a student which are needed to make an effective start as a computer/IT professional.

COURSE / LEARNING OUTCOMES

At the end of Major Project students will be able to:

- CO1: Apply programming knowledge and requirement analysis to develop solutions for Web, Android, IoT, etc. Applying algorithm design, classification, and clustering techniques for research projects, including detailed project planning and resource allocation. **(Applying)**
- CO2: Analyze the pros and cons of various development languages, APIs, platforms, and algorithms. Conduct feasibility studies and risk analysis to inform tool and technique selection. **(Analyzing)**
- CO3: Create applications to meet real-time needs with comprehensive project plans that include requirement analysis, risk management, and feasibility assessments. Design novel or hybrid research techniques for research projects. **(Creating)**
- CO4: Evaluate project efficiency using evaluation parameters, testing methodologies, and continuous requirement validation. Assess algorithm complexity for research projects and ensure deliverables meet objectives through risk assessment and feasibility study. **(Evaluating)**

AUDIT COURSES

EGCS0110: COMMUNICATION SKILLS (Audit Course)

Objective: *The objective of this audit course is to prepare students to be effective in their career in the corporate world where they will use their professional expertise. This course enables students*

To understand the difference between hard skills and soft skills

To learn the importance of communication skills as part of the soft skills,

To be familiar with the various features of effective communication, which includes verbal, non-verbal, written communication and body language.

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

- CO 1:** *Recognise* the difference between hard and soft skills
- CO 2:** *Understand* the importance of communication skills
- CO 3:** *Analyse* features of effective communication
- CO 4:** *Apply* the soft skills in the corporate world

CMES0023: ENTREPRENEURSHIP (AUDIT COURSE)

Objective: *The objective of the course is to introduce students to the concept of entrepreneurship, entrepreneurial skills and their use in a variety of situations. The students are examined on the personal skills to help them define entrepreneurial opportunity and are taught to develop a criterion to judge a situation to develop into a venture, plan and prepare business plans considering the market, technical, financial and legal requirements.*

The various topics that are generally covered in the course are:

Meaning of entrepreneur and entrepreneurship and its relation with problem - solving, characteristics of an entrepreneur, factors influencing entrepreneurship

Identify and explain entrepreneurial opportunities, generating a list of entrepreneurial opportunities in a number of commercial and non-commercial situations

Preliminary Project appraisal methods - Selecting the right opportunity, market

Survey and research, techno-economic feasibility, financial feasibility- sources of finance – identify various sources of capital, ways to access the capital. Legal environment – identify the types of the regulatory systems and predict their effects on the creation of the entrepreneurial venture, role of government and government agencies.

Creating the business model – business plan preparation.

Recognize and assess the expected life of a venture, break-even analysis, recognize the common causes of failure of business ventures, how to deal with seven business crisis- planning for survival and growth.

LIST OF VALUE ADDED COURSES OFFERED BY THE DEPARTMENT OF COMPUTER APPLICATIONS

SI No	Course Code	Course Name
1	CARP6051	Robotic Process Automation
2	CABC6052	Blockchain
3	CAAW6053	Advanced Web Application Development Techniques
4	CARE6054	React JS Essentials
5	CAGE6055	Fundamentals of Generative AI
6	CADV6054	Data Visualization

VALUE ADDED COURSES

CARP6051: ROBOTIC PROCESS AUTOMATION (30 Hours)

COURSE/ LEARNING OUTCOMES

1. Explain the RPA Developer enablement journey and an introduce to the role. (Understanding)
2. Explain the three constructs that are fundamental in any software process: variables, arguments and control flow. (Understanding)
3. Address what selectors are, the UI Explorer, the Property Explorer, Selector types, where to use them and how to finetune selectors when encountering difficult situations. (Remembering)
4. Creating UI input and output actions. (Creating)
5. Learn about the many email tasks that can be automated to help you save valuable time. (Applying)

Module I: (8 Hours)

RPA Overview: Overview of Robotic Process Automation (RPA), Benefits of RPA in industries and business processes, Introduction to the RPA Developer Role, Variables, Data Types and Control Flow, Version Control, Data Manipulation, Excel and Data Tables, Selectors.

Module II: (22 Hours)

Bot Building: UI Automation, Introduction to Logging in Studio, IMDB Movie Rating, Contact Details, RPA Challenge.

Amazon Data Scrapping, Recording Demo.

Calculate Client Hash, PDF Automation, Error and Exception Handling, Debugging.

Email Automation, Connecting Robot to Orchestrator, Publishing workflow to Orchestrator, Orchestrator Demos.

Suggested Readings

1. The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems by Tom Taulli, Publisher: Apress

2. Learning Robotic Process Automation: Create Software Robots and Automate Business Processes with the Leading RPA

Tool – UiPath by Alok Mani Tripathi, Publisher: Packt Publishing; 1st edition

3. Robotic Process Automation Projects: Build Real-world RPA Solutions Using UiPath and Automation Anywhere by Arun
Kumar Asokan and Nandan Mullakara, Publisher: Packt Publishing Limited

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO1	H	
CO2	H	
CO3		H
CO4		H
CO5		H

CABC6052: BLOCKCHAIN (30 Hours)

COURSE/ LEARNING OUTCOMES

CO1: To understand what Blockchain is and why it is used. (Remembering)

CO2: To be able to explain the different components involved within Blockchain. (Understanding)

CO3: To know when and why you may want to use Blockchain within your environment.
(Remembering)

Module I: (7 Hours)

Introduction to Blockchain Technology and its Importance; Evolution of the Blockchain Technology,

Module II: (7 Hours)

Elements of a Blockchain, Basic Crypto Primitives – Cryptographic Hash, Digital Signature

Module III: (16 Hours)

Blockchain Consensus I – Permissionless Models, Blockchain Consensus II – Permissioned Models, Smart Contract Hands On I –

Ethereum Smart Contracts (Permissionless Model), Blockchain Applications

Suggested Readings

1. Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020,
2. Hyperledger Tutorials - <https://www.hyperledger.org/use/tutorials>
3. Ethereum Development Resources - <https://ethereum.org/en/developers>

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module II
CO1	H		
CO2	M	H	
CO3		M	H

CAAW6053: ADVANCED WEB APPLICATION DEVELOPMENT TECHNIQUES (30 Hours)

COURSE/ LEARNING OUTCOMES

CO1. Explain the JavaScript and an introduce to the role in client server architecture.(Understanding)

CO2. Explain the importance of data validation and understand the process of data sanitization.
(Understanding)

CO3. Address the threat handling mechanism while development. (Remembering)

CO4. Creating User interface, service design pattern, and remote connection. (Creating)

CO5. Learn about the recent trend in web development architecture based on micro service design pattern. Cover an overview of recent trend in management of load balancing and service scalability.
(Applying)

Module I: (18 Hours)

JavaScript Overview: Form events, Client Side Validation (Length check, Numeric field check, Alpha-numeric field check, Empty Field, special character, password format, All field entry check), Server Side validation (Data sanitization), SQL Injection, Overview of session management, Cross site scripting, URL validation, Importance of Asynchronous JavaScript and XML (Ajax), loading page content using AJAX, Database connection, Back end data update using AJAX.

Module II: (12 Hours)

Micro Service Applicability: Micro Service design pattern, Overview of Service Oriented Architecture, Principles of Web Service, SOAP / RESTful Web Service, Overview of Containerization: Kubernetes with Docker.

Suggested Readings

1. Beginning JavaScript with DOM Scripting and Ajax – Russ Ferguson and Christian Heilmann, Publisher: Apress ; 2nd edition
2. Ajax programming for the absolute beginner, Jerry Lee Ford, Jr. Publisher: Course Technology, 1st Edition
3. Kubernetes Microservices with Docker by Deepak Vohra, Publisher: Apress, 1st Edition

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO1	M	
CO2	M	
CO3		M
CO4		H
CO5		H

CARE6054: ReactJS Essentials
(30 Hours)
Objective

The objective of this course is to introduce to students the various aspects of React components and the use of responsive UI design. It also aims to make knowledgeable about React router and how to utilize it for creating controlled forms and single-page applications.

Course/Learning Outcomes:

At the end of this course, students will demonstrate the ability to

- CO1: Be familiar with client-side JavaScript application development and the React library. (Understanding)
- CO2: Use various React features including components and forms. (Remembering)
- CO3: Use React library for designing responsive React applications. (Creating)
- CO4: Implement a functional front-end web application using React. (Applying)

Module I: Fundamental of ReactJS (14 Hours)

React Environment Setup, React Features, Creating private/public/global fields, DOM, Validation, React Component, JSX, state, React Props, React Constructor, Component Life Cycle, react Forms, functions, handling events, React List, Keys, React router, React MAP, Table, React context, Loop array.

Module II: Applications of ReactJS (16 Hours)

React Hooks, useState, useEffect, and other built-in hooks, Redux, Multiple checkbox, date picker, React Axios, React API Communication, Database integration, Operations, **Building a React Project.**

Suggested Readings:

Stoyan Stefanov, React Up and Running: Building Web Applications

Michele Bertoli, React Design Patterns and Best Practices

Kirupa Chinnathambi, Learning React: A Hands-On Guide to Building Web Applications Using React and Redux

Mapping of CO to Syllabus

CO	Module I	Module II
1	H	H
2	H	M
3	M	H
4	M	H

CAGE6055: Fundamentals of Generative AI (30 Hours)

Objective

The objective of this course is to introduce to students the fundamentals of Generative AI. Throughout the course, students will gain a comprehensive understanding of the principles, techniques, and applications of Generative AI, equipping them with the knowledge and skills necessary to create and work with generative models. Topics covered will include the underlying concepts, popular algorithms, practical implementations, and real-world use cases, enabling students to apply generative AI in diverse fields such as image generation, text synthesis, and more. By the end of the course, students should be proficient in the foundational aspects of Generative AI and be prepared to explore advanced topics in the field.

Course/Learning Outcomes:

At the end of this course, students will demonstrate the ability to

- CO1: Apply theoretical knowledge to implement basic generative models, demonstrating proficiency in generating synthetic data for simple tasks. (Applying)
- CO2: Integrate generative algorithms, including GANs, VAEs, and other advanced techniques, into the formation of a situation analysis (Evaluating)
- CO3: Understand and apply responsible AI practices, considering ethical considerations in the development and deployment of generative models. (Understanding)

Module I: Introduction to Generative AI (10 Hours)

Overview of AI and Generative AI: Introduction to AI and its basics; Definition and signification of Generative AI; Real-world applications and Use-cases

Core Concepts in Generative AI: Exploring generative models; Understanding the role of neural networks; Differentiating between supervised and unsupervised learning

Hands-on Activity - Building a Simple Generative Model: Using a beginner-friendly framework (e.g., TensorFlow or PyTorch); Generating basic patterns and data.

Module II: Generative Models: Advanced Techniques and Applications (14 Hours)

GANs (Generative Adversarial Networks): In-depth study of GAN architecture; Case studies showcasing GAN applications

Autoencoders and Variational Autoencoders (VAEs): Understanding the principles behind autoencoders; Implementing VAEs for image generation

Creative Applications of Generative Models: Exploring generative art and design; Building interactive applications using generative models.

Module III: Ethical Considerations and Future Trends (6 Hours)

Ethical Implications of Generative AI: Discussion on biases and fairness; Ensuring responsible use of generative models; Examining the impact of generative AI in various sectors

Future Trends and Open Research Questions: Overview of the latest advancements; Identifying potential research areas and opportunities

CADV6054: DATA VISUALIZATION (30 Hours)

Objective of the Course

The objective of this course is to provide students with practical knowledge and skills in data visualization, using various tools and techniques to transform raw data into meaningful visual representations. The course is designed to be fully hands-on, ensuring that participants gain real-world experience in creating and interpreting data visualizations.

Course Outcomes:

CO1: Apply data cleaning and transformation techniques to prepare data for visualization (Applying)

CO2: Create and customize a variety of basic and advanced charts using data visualization libraries (Creating)

CO3: Design and develop interactive dashboards and reports using standard data visualization tools (Creating)

Module I: Introduction to Data Visualization and Data Preparation [10 Hours]

Overview of Data Visualization, Importance and benefits, Types of data visualizations, Data visualization process, Visual Encoding, Data Visualization Libraries (Matplotlib, Seaborn, Plotly)

Data Cleaning and Transformation, Handling missing values (filling missing values with zero, mean, mode, and median), Smoothing noisy data (Binning), Detecting and Removing outliers (Standard deviation method), Data normalization and standardization

Module II: Basic and Advanced Visualization Techniques [12 Hours]

Creating Basic Charts - Line charts, bar charts, pie charts, donut charts, scatter plots, line plots, and bar plots, area plots, histograms, Customizing charts, Interactive features and customization

Creating Advanced Charts - Box Plots, Bubble Plots, Violin Plots, Heat Map, Dendrogram, Radar Chart, Venn Diagram, 3D Scatter Plots, Geospatial Visualizations, Maps and geographical data, Visualizing networks and connections, Creating time series plots

Module III: Dashboards and Reports [8 Hours]

Introduction to standard Data Visualization tools, connecting to data sources (connecting to databases and APIs), Creating basic visualizations, Calculations and parameters, Building interactive reports and dashboards (Adding filters, parameters, and calculated fields to dashboards)

Suggested Readings

Chen, Min, et al., eds. *Foundations of data visualization*. Cham, Switzerland: Springer International Publishing, 2020.

Healy, Kieran. *Data visualization: a practical introduction*. Princeton University Press, 2018.

Wilke, Claus O. *Fundamentals of data visualization: a primer on making informative and compelling figures*. O'Reilly Media, 2019.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H		
CO2		H	
CO3		L	H

BRIDGE COURSE FOR MCA 1ST SEMESTER NON-CREDIT:
30 Hours (L-T-P: 1-1-0)

COURSE OBJECTIVE:

The objective of this bridge course is to strengthen the understanding of basic computer fundamentals, digital systems, and programming concepts and to develop analytical and problem-solving skills through exposure to data visualization, logical reasoning, and computational thinking.

COURSE / LEARNING OUTCOMES:

After successful completion of this course, students will be able to:

- CO1: Recall the basic concepts of computer systems, digital logic, and networking components. (Remembering)
- CO2: Explain the significance of data visualization techniques and the role of the internet in modern computing. (Understanding)
- CO3: Analyze simple datasets using basic visualization methods and evaluate network structures for different applications. (Analyzing)
- CO4: Apply fundamental computer, data visualization, and networking concepts to solve basic real-world problems in computing. (Applying)

COURSE CONTENT:

Module I – Basics of Computer and Digital Systems (8 Hours)

Introduction to Computer Systems: Evolution, generations, and classifications, Computer Hardware Basics: Input, output, memory, storage devices
Number Systems: Binary, octal, decimal, hexadecimal, and conversions,
Digital Logic Fundamentals: Logic gates, Boolean algebra, truth tables, Basic Architecture of a Computer System: CPU, memory, I/O organization, Operating System Overview: Functions and types

Module II – Algorithm Design and Data Visualization (12 Hours)

Algorithms: Meaning, characteristics, basic problem representation
Flowcharts and Pseudocode: Symbols, sequence, decision and iteration, design of flowcharts/pseudocode for simple tasks
Control Structures: Sequential, conditional and iterative logic illustrated using basic algorithmic examples
Data vs Information: Basic concepts and importance, Role of Data Visualization in computing and decision support, Types of Data: Structured, semi-structured, unstructured
Basic Statistical Concepts: Mean, median, mode, variance, standard deviation
Introduction to Charts and Graphs: Line, bar, pie, histogram, scatter plots, Hands-on with Tools (Excel / Python libraries like Matplotlib, Seaborn – conceptual exposure only)
Case Studies: Visualization applications in business, social media trends, scientific research

Module III – Fundamentals of Internet Applications and Networking (10 Hours)

Introduction to Internet and WWW: Evolution, features, and applications, Web Technologies Overview: HTML basics, client-server model, browsers, and search engines
Cloud Storage & Collaboration Tools: Google Drive, OneDrive, shared documents
Fundamentals of Computer Networks: Topologies, protocols, OSI & TCP/IP models, Networking Devices: Switches, routers, hubs, and firewalls
Basics of Cybersecurity: Threats, safe browsing, and data protection, Setting up a basic LAN / Internet configuration demo

Suggested Reading:

1. Computer Fundamentals – by P.K. Sinha & P. Sinha, BPB Publications
2. Data Visualization: A Practical Introduction – by Kieran Healy, Princeton University Press
3. Data Communications and Networking – by Behrouz A. Forouzan, McGraw Hill Education

Mapping of COs to Modules

Course Outcome	Module I	Module II	Module III
CO1	M		M
CO2		H	M
CO3		H	M
CO4	M	H	M

Continuous Internal Assessment:

The Continuous Internal Assessment (CIA) component evaluates students' engagement and performance throughout the duration of the bridge course. It emphasizes consistent participation, timely completion of academic tasks, and overall involvement in the learning process. The CIA will be based on the following criteria:

- **Attendance:** Students must maintain a minimum of 70% attendance to be eligible for assessment. Regular participation ensures continuity in learning and reflects commitment to the course.
- **Timely Submission of Assignments and Quizzes:** All assignments, exercises, and quizzes should be submitted within the stipulated deadlines. Late submissions may lead to deductions or may not be accepted, depending on the course policies.
- **Classroom Involvement:** Active participation during lectures, discussions, and practical sessions forms an integral part of the assessment. This includes asking questions, contributing to discussions, engaging in group activities, and demonstrating a willingness to learn.

MOOC SYLLABUS

Course Title: *Artificial Intelligence for Higher Education: Bridging Curriculum and Career*

Duration: 60 Hours

Level: Undergraduate / Postgraduate (MOOC)

COURSE OBJECTIVE

The course aims to equip learners with a foundational and practical understanding of Artificial Intelligence (AI) by exploring its key concepts, modern tools, and applications across diverse domains. It emphasizes AI's role in enhancing employability, bridging the gap between academic learning and industry expectations, and preparing students for AI-driven hybrid job roles. Through hands-on activities, interdisciplinary case studies, and ethical discussions, the course helps students understand how AI can be effectively integrated into higher education for skill development. It also aims to foster continuous learning, critical thinking, and innovation by enabling learners to design AI solutions for real-world challenges through a capstone project.

COURSE OUTCOMES

After completing this MOOC, learners will be able to:

- CO1:** Explain the fundamental concepts evolution, and applications of Artificial Intelligence, including its role in bridging the skill gap. (Understanding)
- CO2:** Apply AI tools and platforms to build simple models by understanding datasets, features, metrics, and real-world problem structuring. (Applying)
- CO3:** Analyze AI applications across multiple disciplines to understand domain-specific use cases and interdisciplinary innovations. (Analyzing)
- CO4:** Evaluate ethical, social, and regulatory challenges in AI and propose responsible approaches for academic and industry use. (Evaluating)
- CO5:** Assess industry-academia collaboration models and *identify* AI-driven future skill requirements for career readiness. (Analyzing, Evaluating)
- CO6:** Design and develop a basic AI-based solution addressing a real-world problem through a capstone project. (Creating)

COURSE CONTENT

Module I: Introduction to Artificial Intelligence (8 Hours)

Evolution and history of AI, key concepts - Machine Learning, Deep Learning, NLP, Computer Vision; understanding data-driven decision making, AI in everyday life and industries, Role of AI in bridging the skill gap

Module II: Practical Foundations of AI (12 Hours)

Introduction to AI tools and platforms (Google Colab, Kaggle Notebooks, Teachable Machine, Hugging-Face spaces); Understanding datasets, features, and performance metrics; AI in problem-solving: How to structure a real-world problem for AI; Use of AI in problem-solving across disciplines

Module III: AI Applications Across Disciplines (12 Hours)

AI in Computing and Engineering: automation, IoT, robotics; AI in Data Science, analytics, and cloud platforms; Business & Management applications: customer analytics, risk scoring, forecasting; AI in Healthcare: diagnosis support, medical imaging, drug discovery; AI in Social Sciences: sentiment analysis, public policy modelling, social good; Interdisciplinary projects showcasing real impact: agriculture, environment, smart cities, arts & humanities

Module IV: Ethical, Social, and Regulatory Dimensions of AI (8 Hours)

What is Responsible AI; Bias, fairness, transparency, and explainability; Risks: privacy issues, digital divide, algorithmic discrimination; National and international frameworks: India's AI policies, National Ethics Framework, EU AI Act basics, UNESCO ethics recommendations; AI in education: ethical guidelines and classroom responsibilities

Module V: Industry–Academia Collaboration & Future Skills (10 Hours)

Models of collaboration: internships, live projects, mentorship; Incorporating AI into curriculum: elective courses, labs, multidisciplinary pathways; Hybrid job roles: AI + domain skills (examples: AI+Finance, AI+Biology, AI+Management); Future skillsets: creativity, data literacy, computational thinking; Continuous upskilling: MOOCs, certifications, research internships; Role of institutions in preparing “AI Ready Graduates”

Module VI: Capstone Project (10 Hours)

Learners will design and implement a small AI-driven solution:

Possible project themes:

- Sentiment analysis on student feedback
- Simple flood prediction model
- AI-based timetable generator
- Recommendation system for learning resources
- Chatbot for academic support
- Basic image classification (e.g., leaf disease detection)

Deliverables:

- Problem statement and dataset selection
- Working model (basic prototype)
- Short report + video presentation
- Evaluation based on creativity, application, and clarity

Mapping of COs to Modules

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	M	–	–	–	–
CO2	L	H	L	–	–	M
CO3	L	L	H	M	L	–
CO4	–	–	–	H	M	–
CO5	–	–	M	M	H	–
CO6	–	M	–	–	–	H

M. COM PROGRAMME (AS PER NEP STRUCTURE)

M.COM 2 YEAR PG PROGRAM AS PER NEP 2020

PROGRAMME VISION

To be the transformative two-year Post Graduate Program that provides a new direction and impetus for the growth of business education, fostering a strong theoretical foundation, practical application, and research orientation to produce graduates who are equipped to accept challenges, achieve success in life, and meet the needs of different stakeholders.

PROGRAMME MISSION

The M. Com Programme is committed to:

- Foundational Knowledge and Practical Application: Offer up-to-date, comprehensive disciplinary knowledge in different aspects of Commerce, covering functional areas like Accounting, Finance, Taxation, Marketing, and Human Resource Management, while translating classroom learning into practical solutions for business problems.
- Analytical and Critical Skills Development: Enhance critical thinking and analytical abilities among students through project work and application of appropriate analogical systems and teaching methods, thereby developing the potential to face the complexities of the outside world.
- Professional and Research Competency: Develop research competencies and provide specialized knowledge in industry-aligned groups—Accounting & Finance or Human Resources & Marketing—to prepare students for various competitive exams and foster self-employability.
- Ethical Leadership and Societal Accountability: Cultivate ethical and socially accountable citizens by enabling effective decision-making and fostering the ability to ascertain unethical behaviour and manipulation of information, supported by mandatory Service Learning and ethical curriculum components.

The purpose of establishing the Department is:

1. To provide a broad-based policy direction for the development of Commerce education.
2. To identify new programs to be launched in the Department of Commerce.
3. To coordinate and monitor various activities in research and extension.

The Department focuses on the following aspects:

- a. To offer up-to-date knowledge in different aspects of Commerce.
- b. To develop healthy interactions by applying appropriate analogical systems and teaching methods.
- c. To evaluate the performance of the learners by using transparent, effective and reliable methods of evaluation.
- d. To develop an acceptable standard of learning that caters to the needs of different stakeholders

The M. Com Program structure aims to provide

- a. A conducive environment for learning and the dissemination of knowledge.
- b. To establish a strong theoretical foundation and practical application.
- c. To develop research orientation.
- d. To prepare students for various competitive exams.
- e. To prepare students to accept challenges, face and achieve success in life.

The Major Subjects have the following Specialization:

Group 1 - Accounting and Finance

Group 2 - Human Resources Management and Marketing Management

Apart from the regular curriculum, skilled development programs are also conducted to enhance the special skill sets of students. The curriculum also provides opportunities for students to select any other course of their interest from any other Department in the University Campus and earn extra credit over and above their normal credits. Students of other Departments can choose any of the subjects run by the Department and earn extra credits. The specializations offered at the Department are decided as per the needs of the industry. The program thus offers a wide range of choice to broaden their capabilities and skills thus providing them enough potential to face the complexities of the outside world.

Duration of the Program: It is a Two-Year (Four semesters) Program. At the End of the Year, student will receive a Post graduate degree in the required Specialization chosen by the candidate.

Program Outcomes

PO1	Disciplinary Knowledge	Acquire Comprehensive disciplinary knowledge and its implications.
PO2	Critical Thinking	Ability to engage in reflective and independent thinking by understanding the concepts of Commerce and Business. Ability to examine the problems in different branches of Commerce and Business.
PO3	Problem Solving	The capability to reduce a business problem and apply the classroom learning into practice to offer a solution for the same.
PO4	Leaders in communities	Effective decision-making in business and commerce through meaningful and impactful community engagement practices.
PO5	Research Skills	Ability to search for, locate, extract, organize, evaluate, analyze and report information that is relevant to particular problem
PO6	Moral and Ethical Values	Ability to ascertain unethical behaviour, falsification, and manipulation of information

Program Specific Outcomes (PSO)

PSO 1: To enhance knowledge in different functional areas of Commerce viz. Accounting, Finance, Taxation, Marketing, and Human Resource Management.

PSO 2: To enhance Critical Thinking, Analytical and Problem-Solving abilities among the students by engaging them in real life projects and assignments.

PSO 3: To develop the research competencies among students by enabling them to conduct research and project work in the different areas of Commerce.

PSO 4: To foster self-employability among the graduates by enriching the entrepreneurial traits required to create and manage their own ventures.

PSO 5: To groom the students to be ethical and socially accountable citizens.

M.com Two Year PG Program structure

Year	Semester	Category	Description	Credit	Type
I	1	Major	1.1 Advanced Accounting	4	Core Course
			1.2 Managerial Economics	4	Core Course
			1.3 Organizational Behavior	4	Core Course
		Project	1.4 Entrepreneurship Development	4	Project Work
		Minor	1.5 Financial Statement Analysis	4	To be offered by other departments
		CVB	1.6 Service Learning	2	Mandatory for all (Theory and Field work) P/NP
		CVB	1.7 Constitution of India	P/NP	Mandatory for all (Theory and Field work) P/NP – To be done in Moodle
		Total credit		22	
	2	Major	2.1 Consumer Behavior and Relationship Management	4	Core Course
			2.2 Corporate Finance	4	Core Course
			2.3 Statistics & Business Decisions	4	Core Course
			2.4 International Business	4	Core course

II		Pro- ject	2.5 Project Work- Formation of a Company	4	To cater the pre- sent-day require- ment
		Minor	2.6 Investing in Stock Market	4	To be offered by other departments
		Total credit		24	
	3	Major	3.1 Research Methodology	4	Core Course
		Major	3.2 Ethics, Corporate Governance and Sus- tainability	4	Core Course
		Major	3.3 Income Tax Laws and Compliance	4	Core Course
			3.4 Accounting and Finance-Group-1		Specialization
		Major Elec- tive	3.4.1 Recent Advances in Accounting	4	Specialization course
		Major Elec- tive	3.4.2 Business Analysis and Valuation	4	Specialization course
			3.5 HR & Marketing-Group-2		Specialization
		Major Elec- tive	3.5.1 HR Analytics	4	Specialization course
		Major Elec- tive	3.5.2 Advanced Marketing Management	4	Specialization course
			3.6 Dissertation-Phase-I	2	Research-
			Total Credit	22	
	4	Major	4.1 Production and Operation Management	4	Core Course
		Major	4.2 Accounting and Finance-Group-1		Core Course
			4.2.1 Strategic Cost and Management Ac- counting	4	Specialization course
			4.2.2 Financial Analytics	4	Specialization course
			4.3 HR & Marketing-Group-2		Specialization
			4.3.1 Digital Marketing and E-Commerce	4	Inspired from prem- ier institution abroad like LSE
			4.3.2 Strategic Human Resource Management	4	Required for deci- sion making
		Major	4.4 Dissertation- Phase II	8	Major Research
		Total credit		20	

Total Credits: 88 Credits

Note: After the First-semester examination (during the Semester break), students will have to complete 60 hours of service-learning fieldwork. A report of the field survey is to be submitted along with a Viva voce examination. The maximum mark for the service learning is 100.

COURSE OUTCOMES MAPPING WITH POs/PSOs

Course	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
1.1	M				M	M	H	M	M	M	
1.2	L	L			L	M	L	L	L		L
1.3				H				M		M	

1.4		M			M	L		L			
1.5			M							L	M
1.6		L						H			
1.7				H						M	
2.1	M				M	H	M		M		
2.2	M	L			L	M	L	L	L		M
2.3		L					M			H	
2.4	M	M	M				M	L	L		
2.5		M			M		L				H
2.6		H							H		M
3.1	M	L				M		M	H	H	
3.2	H	M	M		M	M	H	H	M		M
3.3	M	M	H					M	L		
3.4.1		M	H		M			M	H		
3.4.2				M						H	
3.5.1		M				M	M	M	H	M	
3.5.2					M					H	
3.6	M					H					L
4.1	H	M			L	M	H	M	M		
4.2.1	H	L				L		M		M	
4.2.2	M	L				L	H	M	M		
4.3.1		H			H	M		H	M	M	H
4.3.2	M	L			L	M	H		M		H
4.4			H					M			H

DETAILED SYLLABUS:
FIRST SEMESTER:

1.1 MAJOR- ADVANCED ACCOUNTING (Course Code)

(4 Credits-60 hours) (L-T-P: 4-0-0)

Objective: The objective of this course is to provide advanced knowledge in the field of accounting. It stresses on specialized accounting processes followed in specific organizations.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: Understand the procedure followed in government accounting (Understanding)

CO2: Apply different valuation methods to estimate the intrinsic value of different investment vehicles (applying)

CO3: Construct financial statements of insurance companies (Creating)

CO4: Develop the ability to critically analyze and creatively apply their knowledge in the dynamic context of the banking industry (Creating)

CO5: Build a strong base on financial statement analysis (Creating)

Module I: Preparation of Financial Statements and Analysis: (12 hours)

Preparation and presentation of Financial Statements: Objectives, Purpose, Constituents of Financial Statements, how to read Financial Statements, Different techniques of Financial Statement Analysis

Module II: Accounts of Banking Companies (14 hours)

Features of Banking Companies, Banking Regulation Act, 1949, Rebate on Bills Discounted, Income recognition, Statutory books to be maintained, special features of Bank book keeping, Preparation and presentation of Financial Statements of Banks, Advances and its classification, provisions to be made against advances.

Module III: Accounts of Insurance Companies (14 hours)

Accounting of Insurance Companies: Meaning of Insurance Business, Accounts of Life Insurance Company – Revenue Account, Profit and Loss Account and Balance Sheet, Ascertainment of profit under Life insurance business, Accounts of general insurance business – Revenue Account, Profit and Loss Account and Balance Sheet.

Module IV: Investment Accounts (12 hours)

Investment Account: Meaning, features, concept of cum-interest, ex-interest, cum-dividend, ex-dividend, Accounting for fixed interest earning securities and variable earning securities, bonus shares and right shares, Intercompany investment.

Module V: Government Accounting (8 hours)

Government Accounting: Meaning, features and Objectives; Consolidated Fund, Contingency Fund and Public Accounts; General Principles of Government Accounting;

Audit of Government Accounts: Comptroller and Auditor General of India- Role and Function System of financial administration and financial control in India.

Suggested Readings and E-resources:

1. JawaharLal, Financial Accounting, S Chand
2. Hanif & Mukherjee, Advanced Accounting, McGraw Hill Education.
3. Dam B. B., Advanced Accounting, Capital Publishing Company
4. Khan M. Y. , Advanced AccountingM.C. Shukla, Advanced Accounting, S Chand & Co.
5. Maheshwari S. N. , Advanced Accounting, Vikas Publishing.
6. https://vipss.yolasite.com/resources/PCC_BOOKS/Advanced%20Accounting%20Vol.%201.pdf

Experiential Learning:

- Detailed case studies and visits to banks to observe how their finance departments operate and how financial statements are prepared.
- Assigning projects where students analyze the financial statements of different companies, focusing on comparative analysis
- Students can role-play as different types of investors (e.g., risk-averse retirees vs. aggressive young investors) to understand diverse investment goals and risk profiles
- Students can work on preparing and analyzing mock budgets that includes creating budget proposals, forecasting revenue and expenses, and monitoring budget performance.

Mapping of Course Outcomes to syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1					H
CO 2				H	
CO 3			H		
CO 4		H			
CO 5	H				

1.2 MAJOR- MANAGERIAL ECONOMICS (Course Code)**(4 credits-60 Hours) (L-T-P: 4-0-0)**

Course Objective: This course is designed to equip the students with basic tools of economic theory and its practical applications. The course aims at familiarizing the students with the understanding of the economic aspects of current affairs and thereby prepares them to analyse the market behavior with economic way of thinking. In addition to providing an insight into application of economic principles in business decisions, it also intends to widen analytical ability of the students and to provide them a foundation for further study of economics. In order to make the study practically oriented, the paper requires discussion of some cases involving the use of concepts of business economics.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: Understand the procedure followed in government accounting (Understanding)

CO2: Apply different valuation methods to estimate the intrinsic value of different investment vehicles (applying)

CO3: Construct financial statements of insurance companies (Creating)

CO4: Develop the ability to critically analyze and creatively apply their knowledge in the dynamic context of the banking industry (Creating)

CO5: Build a strong base on financial statement analysis (Creating)

Module I: Basic principles in Managerial Economics: (15 hours)

Meaning and scope of Managerial Economics – twin principles of scarcity and efficiency; incremental and Marginal principle; profit maximization principle; market economy and invisible hand; production possibility frontier; Opportunity cost - accounting profit and economic profit; market failure, externality, public goods, and economic role of Government

Module II: Demand and Supply analysis: (15 hours)

- Determinants of demand – market demand function - theory of attributes, snob appeal, bandwagon, and Veblen effect and demand function. Law of supply- elasticity of supply
- Applications of elasticity of demand and supply to economic issues: Paradox of bumper harvest- tax on price and quantity - minimum floor and maximum ceilings: minimum wages controversy and administered price control
- The theory of consumer choice - Consumer preference and budget constraint - equilibrium position of tangency with the help of Indifference curve analysis- effect of changes in price and income on consumer equilibrium

Module III: Production decisions and Cost analysis: (10 hours)

- **Production function - short run and long run - Law of variable proportion, returns to scale, scale economies, scope economies- least cost factor combination for a given output- Expansion path and Multiproduct firm- cost reduction through experience - learning curve**
- Economic Analysis of Cost: Classification of costs, short-run and long-run cost functions.

Module IV: Market structure analysis: (20 Hours)

- Perfect competition - Sources of market power – Price Determination, profit maximization of a perfect competitive market.
- Different forms of imperfect competition – Monopoly, Monopolistic competition and Oligopoly – Price Determination under monopoly, monopolistic and oligopoly; Strategic decision making in oligopoly markets collusive and non-collusive oligopoly- colluding oligopoly: rivalry among few, price war and kinked demand curve- collusive oligopoly models of price leadership and cartel - basic concepts of game theory - Using Game theory to analyse strategic decisions - application of model of prisoner's dilemma in market decisions.
- Price determination under different markets.

Suggested Readings and E-Resources

1. Salvatore, D.: Managerial Economics in a global economy (Thomson South Western Singapore, 2001)
2. Frank Robert. H, Bernanke. Ben S., Principles of Economics (Tata McGraw Hill (ed.3)
3. Gregory Mankiw., Principles of Economics, Thomson South western (2002 reprint)
4. Samuelson & Nordhas.: Economics (Tata McGraw Hills, New Delhi, 2002)
5. Hirchey .M., Managerial Economics, Thomson South western (2003)
6. Mehta, P.L.: Managerial Economics – Analysis, Problem and Cases (S. Chand & Sons, N. Delhi, 2000)

E resources:

1. https://backup.pondiuni.edu.in/storage/dde/dde_uq_pg_books/Business%20Economics.pdf
2. https://icmai.in/upload/Students/Syllabus2022/Fdn_Stdy_Mtrl/P4_Revised_1409_22.pdf
3. https://www.icai.org/post.html?post_id=19141

Experiential Learning:

1. Participation in Quiz, Debate and Group discussion on Union Budget of last two years.
2. Project work on GDP calculation of a small village
3. Field trip to wholesale market to understand the demand and supply dynamics.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	L	L
CO 2	L	M	H	H
CO 3		L	H	H
CO 4				H

1.3- MAJOR- ORGANISATIONAL BEHAVIOUR (Course Code)
(4 Credits-60 hours) (L-T-P: 4-0-0)

Course Objective: The objective of this paper is to provide the students an insight into the principles of organizational behavior and its relation to other activities in an organization, and to introduce the students to the techniques of organizational behavior used as a management tool.

COURSE/LEARNING OUTCOMES.

At the end of the course students will be able to:

- CO 1: Define the concepts of Organizational Behavior in the global context (Remembering)
- CO 2: Explain the Cognitive processes of organizational behavior and its application in workplace (Understanding)
- CO 3: Develop models of group dynamics, leadership theories, power & politics in terms of its application in workplace (Applying)
- CO 4: Analyze the importance of communication and decision making techniques for improving productivity of employees (Analyzing)
- CO 5: Determine and develop models of Organizational culture, work stress and Conflict & negotiation in various workplace settings (Evaluating and Creating)

Module I: Introduction to Organizational Behavior (8 Hours)

Defining Organizational Behavior, historical background: the Hawthorne Studies; early development, conceptual development; the nature of people; theoretical frameworks; explaining and predicting behavior; OB in the global context.

Module II: Cognitive processes of organizational behavior (12 Hours)

Nature and importance of Perception and attribution; perception and individual decision making; values, nature and dimensions of attitudes and job satisfaction; personality; aptitude; interests; learning; intelligence, motivation - theories of motivation.

Module III: Group Dynamics (14 Hours)

a) Understanding group dynamics, types of groups, group goals, group cohesiveness, group pressure and norms, teamwork; group structure - formal leadership, roles and norms; group member resources - abilities, personality, characteristics, stages in group development.

b) Leadership Theories - trait, behavioral, contingency, attributional, charismatic, transactional vs. transformational.

c) Power and politics: Contrasting leadership and power; power in groups; power tactics; politics-power in action.

Module IV: Communication and Decision Making (12 Hours)

Role of communication; Communication media and technology, communication networks - formal vs. informal; barriers to effective communication; communication skills; feedback information; persuasion in communication; active listening; participative decision-making techniques; groups vs. the individual; groupthink and group shift; the decision-making process

Module V: Organizational culture and Work Stress (14 Hours)

a) Definition of organizational culture; cultural typologies; organizational culture vs. national culture; functions of culture; formation of cultures; potential sources of stress - environmental factors, organizational factors; individual differences - perception, job experience, social support, locus of control, hostility; Stress – the emergence of stress, causes of stress; stress consequences - physiological symptoms, psychological symptoms, behavioral symptoms, stress management strategies : individual approaches, organizational approaches.

b) Conflict and negotiation: Definition of conflict; the conflict process; conflict in intergroup relations; creating functional conflicts; bargaining strategies; role of personality traits on negotiation; third party negotiations; intergroup relations and factors affecting intergroup relations.

Experiential Learning

Experimental learning in organizational behavior for students involves practical, hands-on activities that simulate real-world organizational scenarios. This approach helps students understand and apply key concepts through direct experience, enhancing their learning and retention. Key components include:

1. Role-playing and Simulations: Students assume roles within simulated organizational settings to explore decision-making, leadership, and teamwork.
2. Case Studies: Analyzing real-life organizational cases to understand dynamics, challenges, and solutions.
3. Group Projects: Collaborating on projects to experience group dynamics, conflict resolution, and collective problem-solving.
4. Field Studies: Visiting organizations to observe and interact with professionals, gaining insights into organizational practices and culture.
5. Reflection: Encouraging students to reflect on their experiences and link them to theoretical concepts to deepen their understanding.

This experiential approach promotes active learning, critical thinking, and the application of theoretical knowledge to practical situations in organizational behavior.

Suggested Readings

1. Luthans Fred, Organizational Behavior, 10th Edition, McGraw Hill India, 2005
2. Robbins Stephen P, Organizational Behavior, 11th Edition, Prentice Hall of India Pvt. Ltd., New Delhi, 2004
3. Gilmer, Industrial Psychology, McGraw Hill.
4. Ghiselle and Brown, Personnel and Industrial Psychology, McGraw Hill.
5. Davis Keith, Human Relations at Work, Tata McGraw Hill.
6. Leavitt, Managerial Psychology, University of Chicago Press.
7. Bass BM , Leadership Psychology and Organizational Behavior, Harper International.
8. Litterer, Analysis of Organizations, John Wiley.

E-Resource:

https://www.tmv.edu.in/pdf/Distance_education/BCA%20Books/BCA%20VI%20SEM/BCA-629%20OB.pdf

<https://www.uakron.edu/armyrotc/MS1/14.pdf>

https://ddceutkal.ac.in/Syllabus/MA_English/Paper_21.pdf

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	L			
CO 2		M	L	L
CO 3	M	M	M	
CO 4		H	H	M
CO 5				H

1.4 Project- Entrepreneurship Development (Course Code) (4credit- 60 hours) (L-T-P: 4-0-0)

Course Objectives: This Course aims at imparting Entrepreneurial education to the students by giving an overview of who the entrepreneurs are and what competences are needed to become an entrepreneur. The primary objective of the Project work on Entrepreneurship Development in the M.Com programmed is to strengthen the entrepreneurial ecosystem by equipping students with the skills and knowledge necessary to embark on successful entrepreneurial journeys. This initiative aims to instill in students the essential skills and knowledge required to achieve their business goals and contribute to economic growth.

Course Outcome:

CO1: Learners will pick up about Foundation of Entrepreneurship Development and its theories.

CO2: Learners will explore entrepreneurial skills and management function of a company with special reference to SME sector.

CO3: Learners will understand various steps involved in starting a venture and to explore marketing methods & new trends in entrepreneurship.

CO4: Project selection criteria, Clarity about the business idea, Market potential for the product or service.

CO5: Skills in preparing business plan, Conducting project feasibility study, Role and assistance by various promotional organizations

Module I: Concept of MSME sectors in India. (15 hrs)

MSME Act 2006, MSME sector as germinating bed for small enterprises. Financing of enterprises, effect of over or less capitalization, capital structure planning, role of debt or equity in capital structure. Business plan preparation, capital structure of a small enterprise, Estimating fixed capital and working capital requirement, establishing feasibility of a business plan. Role of Creativity and techno commercial innovation for business success, Management of functional areas in the start-up phase and growth phase.

Module II: Different modes of start-up finance. (15 hrs)

SME promotion scheme of Government, Angel investors and venture capital, venture capital financing in India. Funding the start up with venture capital, Stages of venture capital financing. Business feasibility assessment process of venture capitalist.

Module III: Project work on Entrepreneurship Development. (30 hrs)

Guidelines:

1. Exploring and Investigating the Business Concept

Idea Identification: Recognize a potential business idea and undertake detailed research to collect essential information.

Data Collection: Gather financial and operational data to evaluate the business idea's feasibility.

- Collaborate with marketing, production, and design teams.
- Conduct consumer surveys to gather insights.

2. Thorough Evaluation of the Business Concept

Comprehensive Assessment: Scrutinize every aspect of the business plan.

- Determine if the business opportunity justifies the investment.
- Identify the primary requirements for the product or service.

- c) Evaluate the cost feasibility.
- d) Assess competitive advantages.
- e) Calculate the required capital and identify funding sources.
- f) Analyze associated risks, including technical, economic, social, and environmental factors.
- g) Ensure alignment with the company's goals.

3. **Business Plan Development:**

Plan Creation: Develop a detailed business plan to serve as the foundation and benchmark for the venture.

- a. Outline vision, goals, objectives, required capital, and product details.
- b. Commit to a thorough and dedicated planning process.

4. **Resource Mobilization**

Securing Resources: Identify and obtain necessary financial and human resources.

- a. Seek investors and recruit skilled individuals.
- b. Assemble an effective marketing team and recruit an HR professional to manage human resources.

6. **Establishing the Organizational Structure**

Management Framework: Define the management and hierarchical structure for effective organizational support.

- a) Ensure the management team adheres to the established command structure for smooth operations.

7. **Strategizing for Future Growth**

Expansion Planning: Prepare for business expansion and future advancements.

- a. Identify reputable sources for financing.
- b. Implement new structures to support company growth.

8. **Managing Finance**

Financial Management: Understand and manage the financial landscape to make informed decisions and allocate resources efficiently.

- a. Create detailed budgets, forecast cash flow, and monitor expenses.
- b. Maintain a balance between investment and expenditure.
- c. Prioritize essential expenses while allocating funds for growth opportunities.
- d. Implement strategic planning for optimal use of resources.

9. **Learning Finance and Accounting Basics**

Educational Enhancement: Gain essential skills in finance and accounting.

- a. Study topics like accounting, import/export rules, and economic policies.
- b. Learn to analyze information and solve real business problems using various approaches.

Books Recommended/Suggested:

1. Indian Entrepreneurship and Industries: Challenges Ahead- Dr. Vivek Deolankar, Commonwealth Publishers, New Delhi, 1996.
2. Management of Small-Scale Industries- Dr. Vivek Deolankar, Commonwealth Publishers, New Delhi, 1996.
3. Entrepreneurship of Small-Scale Industries; Concept Growth Management M.U. Deshpande, Deep and Deep Publications, New Delhi, 1982.
4. Labor Laws- Taxman, Taxman Allied Services, (P) Ltd. New Delhi, 1995.
5. Small-Scale Industries and Entrepreneurship- Dr. Vasanta Desai, Himalaya Publishing, 1st Edn. 1995.
6. Entrepreneurial Challenge in Under Developed Sectors- P. Subba Rao & M. Sundaram, Entrepreneurial Development Programme Series, Kanishka Publishers Distributors, Delhi, 1993.
7. Self-Mode Impact Making Entrepreneurs- Research Teamby Gautam Raj Jani and M. Akbar Ansari, Entrepreneurship Development Institute of India, Ahmedabad 1988.
8. No-born- The created entrepreneurs- Jose Subastian and Thakur, Entrepreneurship Development Institute of India, Ahmedabad 1994.
9. Zimmerer: Essential of Entrepreneurship and Small Business Management, Pearson Education, Delhi-6

e-Resources:

Module I:

1. <https://msme.gov.in/faqs/q1-what-definition-msme>
2. <https://testbook.com/ias-preparation/msme>
3. https://loksabhadocs.nic.in/Refinput/Research_notes/English/09122019_163229_102120495.pdf
4. <https://www.egyankosh.ac.in/bitstream/123456789/76265/1/Unit-15.pdf>

Module II:

1. <https://www.extension.iastate.edu/agdm/wholefarm/html/c5-92.html>
2. <https://www.startupindia.gov.in/content/sih/en/funding.html>

Experimental Learning:

1. Preparation of a business plan in the form of detailed project report

Mapping of Course Outcome (Cos):

	Module I	Module II	Module III
CO1	H	L	L
CO2	H	M	M
CO3		M	M
CO4		M	H
CO5			H

1.5 MINOR-FINANCIAL STATEMENT ANALYSIS (Course Code)**(4 credits – 60 hours) (L-T-P: 4-0-0)**

Objective: The course provides decision makers with the necessary knowledge about a business enterprise to support decision-making, evaluate the firm's economic condition, and forecast its future trajectory based on financial statements

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: List the fundamental concepts and terminologies used in business financial statements (Remembering)

CO2: Explain the role of financial statements in the decision-making process of a business enterprise. (understanding)

CO3: Apply the financial statements to assess the economic situation of a firm. (Applying)

CO4: Examine the financial data of a company to identify trends and insights relevant to its economic health. (Analyzing)

CO5: Judge the financial performance of a business by interpreting its financial statements. (Evaluating)

CO6: Develop predictions about a firm's future performance based on a comprehensive analysis of its financial statements (Creating)

Module I: Introduction to Financial Statement Analysis (10 hours)

Meaning, objective and Scope of Financial Statement Analysis; Financial Statements and other information sources; Financial Statement Analysis Framework; Classification of Business Activities; Financial Reporting Standards; Regulatory Authorities; International Financial Reporting Standards Framework (IFRS); Comparison of IFRS with other Reporting Standards.

Module II: Analysis of Income Statement and Balance sheet (25 hours)

Components and format of Income Statement; Revenue Recognition; Expense Recognition; Non-recurring and non-operating items; Earnings Per Share (EPS): Simple Vs complex capital structure, Basic EPS, Diluted EPS; Components and format of Balance Sheet; Measurement Bases of Assets and Liabilities; Equity: Components, Statement of Changes in Shareholders Equity; Analysis of Income Statement and balance sheet: Common size analysis and Ratios analysis.

Module III: Cash Flow Statement (15 hours)

Components and format of Cash Flow Statement; Linkages and Preparation: Cash Flow Statement with Income Statement and Balance Sheet, Preparation of Cash Flow Statement, Conversion from Indirect to Direct method; Cash Flow Statement Analysis: Evaluation of Sources and Uses of Cash, Common size analysis, Free Cash Flow to Firm and Free Cash Flow to Equity, Cash Flow Ratios. Case Study III

Module IV: Analysis the important contents of Annual Reports of a company (10 hours)

Understanding Annual Report of a Company; Director's Report, Management Discussion and Analysis, Notes to Account, Basic computation of Free Cash Flows for Equity.

Experimental Learning

This course is designed to provide an in-depth understanding of financial statements, regulatory frameworks, and practical financial analysis. Students begin by reviewing real-world financial statements to identify key components, followed by participating in workshops on IFRS and other reporting standards, and engaging in discussions on their impact. Practical exercises involve analyzing income statements and balance sheets using ratio analysis, and role-playing as financial analysts to present findings on revenue and expense recognition. Guest lectures from industry professionals further enhance understanding of asset and liability measurement. Hands-on preparation of cash flow statements, analytical workshops on cash flow sources and uses, and case studies on financial health deepen the learning experience. Additionally, students dissect annual reports, perform financial modeling, and collaborate on group projects to analyze and summarize the financial health of companies, providing a comprehensive, hands-on approach to financial education.

Suggested Readings

1. Thomas R. Robinson and Elaine Henry: International Financial Statement Analysis, Wiley.
2. Charles H. Gibson: Financial Statement Analysis, Cengage.
3. Subramanyam K R and Wild John J.: Financial Statement Analysis, McGraw Hill.

Digital resources:

Module 1: Meaning, Objective, and Scope of Financial Statement Analysis: <https://www.khan-academy.org/economics-finance-domain/core-finance/accounting-and-financial-statements>

Financial Reporting Standards and Regulatory Authorities: <https://online.hbs.edu/blog/post/how-to-read-financial-statements>

Module 2: Ratio analysis: <https://www.khandolacollege.edu.in/web/downloads/studymaterials/FYB-Com%20B%20class%20of%20CC6.pdf>

Common size statement analysis: <https://mgcub.ac.in/pdf/material/202005051103465a7cb0f897.pdf>

Module 3:

Cash flow statements <https://ncert.nic.in/textbook/pdf/leac206.pdf>

Module 4: understanding of Annual report: <https://egyankosh.ac.in/bitstream/123456789/80366/1/Unit-12.pdf>

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	L	L		M
CO 2	M	H	H	
CO 3		M		
CO 4			H	
CO 5			M	
CO 6	M	H	H	H

1.6CVB- SERVICE LEARNING (Course Code)

(Credit: 2 Hours: 30)

Course Objective: Service Learning will aim to support the development of basic skills among the students namely, critical and creative thinking, reflection, communication, collaboration, information literacy, and social skills. The emphasis will be on active civic participation. As the students will actively involve in a wide range of experiences, which will benefit both the community at large and the students in particular and in the process the goals of the curriculum shall be achieved

Course/ Learning Outcomes

After learning this course, the students will be able to:

- CO1: Define and explain the Service-Learning framework (Remembering)
- CO2: Explain the nature and types of community engagement work (Understanding)
- CO3: Identify the need and importance of social responsibility (Applying)
- CO4: Analyze the need for social intervention through community partners (Analyzing)
- CO5: Evaluate the academic outcomes through Service Learning (Evaluating)
- CO6: Elaborate upon the social understanding to the issues faced in the community (Creating).

Module I: Concept of Service Learning (3 Hours)

Service Learning – meaning, concept, definition; value based framework of Service Learning; Understanding the core standards of Service Learning such as respect, reciprocity, relevance, and reflection; Elements of Service Learning; Understanding Service Learning – Its philosophy, historical background, purpose, value and theoretical framework; Locating Service Learning within the University context; Principles of Service Learning; Classification of Service Learning Models; Experiential Learning; Reflective Learning;; Journaling; Service Learning Pedagogy; Difference between Service Learning and other community experiences

Module II: Community Engagement and Community Partnerships (3 Hours)

Community Engagement – concept, meaning, definition and principles; benefits of community engagement, models of community engagement; Civic Engagement, University Community Engagement, Community partnerships – meaning, benefits, Reflection – meaning, definition and implications; Critical inquiry - meaning, definition and implications; Engaged Research - meaning, definition and implications; Historical context of University Community Partnership; Understanding Community & Community Partnership; Ethical understanding of partnership; Understanding the agency of the Community – as co-educators; Community barriers

Module III: Social Responsibility and Communication Basics (3 Hours)

Social Responsibility – meaning, benefits, Socio-economic context – meaning, definition, Social issues – meaning, understanding of society & social issues ; Conflict – meaning, types, understanding various conflict resolution strategies; Community level partnerships – meaning, significance, types; Social Justice – meaning and implications; Communication – meaning, types, channels of communication, models of communication

Module IV: Identifying the Partners in the Community (3 Hours)

Partners in the community – meaning, types and functions of Community Partners namely, Corporate, Government and PSU Organizations, Panchayats, Community settings, Clinical settings, NGO's, Anganwadi Centers, Self Help Groups, Schools, Business Firms, Community Markets, Weekly Haats, Customer Relationship Management, etc

Module V: Basics of Professional Skills (3 Hours)

Aspects of Professional Skills Development: Factors affecting individual behavior - personal, environmental and organizational, individual diversity –biographical and demographic characteristics, self-esteem, self-monitoring Individual decision-making process, rational decision-making, decision-making styles, common biases and judgment errors in decision-making, individual v/s group decision-making.

Basics of Planning and Organizing - Nature and purpose of planning, planning process, types of plans Types of groups, stages of group development, characteristics of effective teams, how group status influences individual behavior, leaders and their role in teams, characteristics of an effective leader.

Module VI: Service-Learning Projects (15 hours)

Service-Learning Projects – stages, investigation, preparation, action, reflection, demonstration and documentation. Areas of Study in Service Learning: Capacity building of youths, Single entry accounting system for small retailers, Preparation and benefits of maintain balance sheet, Financial Literacy, Financial Planning for Business Organizations, Basic Marketing Techniques, Selling Skills, Insurance, Human Resource Management, MSME schemes, Entrepreneurship ideas, startup ventures, Feasibility studies, Undertaking New Business Ventures, Venture Funding, Angel Investors, Partnership, Business Communication skills, Soft Skills Development, Poverty, livelihood, Health, Education, Water, Sanitation, Disability, Children, Women, NGO Management Practices, Environment, SDG's - technological solutions/suggestions for development, etc.

Note: Emphasis on Group Work, Projects, Case Studies, Assignments, Journaling, Report Preparation, Presentations, Workshops, Group Conferences Individual Conferences etc.

Suggested Readings

1. Kaye Cathryn Berger, the complete Guide to Service Learning: Proven Practical Ways to Engage Students in Civic Responsibility, Academic Curriculum and Social Action, Free Spirit Publishing
2. Barbara Jacoby, Service Learning in Higher Education: Concepts and Practices
3. Patty H. Clayton, Robert G. Bringle and Julie A. Hatcher, Research on Service Learning: Conceptual Frameworks and Assessment
4. Barbara Jacoby, Service-Learning Essentials: Questions, Answers and Lessons Learned
5. Julie A. Hatcher and Robert G. Bringle, Understanding Service Learning and Community Engagement
6. Farber Katy, Change the World with Service Learning

1.7 CONSTITUTION OF INDIA (Course Code)

Credit – 1 (0-0-1) – 15 Hours

Course Outcomes

CO 1: At the end of this course, students will be able to explain the social, cultural and religious diversity of India and its impact on Indian psyche.

CO 2: At the end of this course, students will be able to evaluate the political and economic system of India.

Module 1: India and its Diversity (18 hours)

Overview of India's geography, diversity, demographics and development indicators □ A brief survey of India's history, highlighting key events, personalities and movements that shaped its identity and destiny □ An exploration of India's rich and varied cultural heritage, including its languages, religions, arts, literature and philosophy □ An overview of India's social structure, institutions, norms and values, with a focus on issues such as caste, gender, class and ethnicity

Module 2: Indian Political System (12 hours)

A study of India's political system, institutions, parties and ideologies □ India's role in regional and global affairs □ A review of India's economic performance; the challenges and opportunities for growth; □ An overview of sectors such as agriculture, industry, services, and trade. □ A discussion of India's environmental problems & the solutions for sustainable development □ A discussion on India's journey towards a developed nation.

Suggested Readings

1. Thapar, R. (2015). The Penguin History of Early India: From the Origins to AD 1300. India: Penguin Books Limited.
2. Kosambi, D. D. (2022). The Culture and Civilization of Ancient India in Historical Outline. United Kingdom: Taylor & Francis.
3. Zimmer, H. R. (2020). Philosophies of India. United States: Princeton University Press.
4. Mohanty, M. (2004). Class, Caste, Gender. India: SAGE Publications.
5. Mitra, S. K. (2017). Politics in India: Structure, Process and Policy. United Kingdom: Taylor & Francis.
6. Kothari, R. (1970). Politics in India. India: Orient Longman.
7. Balasubramanyam, V. N. (2019). The Economy of India. United Kingdom: Taylor & Francis.
8. Fisher, M. H. (2018). An Environmental History of India: From Earliest Times to the Twenty-First Century. United Kingdom: Cambridge University Press.

SECOND SEMESTER

2.1 MAJOR-CONSUMER BEHAVIOUR AND RELATIONSHIP MANAGEMENT

(4 Credits-60 hours) (L-T-P: 4-0-0)

Course Objectives: The objective of this course is to make the students understand the concept of consumer behavior and the importance of regulatory measures in consumer marketing. The course also aims to develop an understanding of underlying concepts and issues in consumer relationship and will make the students competent for taking responsible positions in the area of marketing in different organizations.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: Explain the concept of consumer behavior and the factors affecting it (Understanding).

CO2: Analyze various CRM strategies and their effectiveness in fostering customer loyalty and satisfaction (Analyzing)

CO3: Evaluate the effectiveness of diverse marketing communication strategies across various channels (Evaluating).

CO4: Evaluate the status of customer relationship management in different service industries in India. (Evaluating)

Module I: Introduction to Consumer Behavior (10 hours)

Definition, Nature, Scope, Consumer Behavior's Applications in Marketing, Consumer research process – Defining Research Objectives, Collecting & Evaluating Secondary Data, Primary Research Design, Collecting Primary Data, Analyzing Data & Report Preparation.

Module II: Factors affecting Consumer Behavior (10 hours)

Factors influencing Consumer Behavior– External Influences – Culture, Sub Culture, Social Class, Reference Groups, Family, Internal Influences– Needs & Motivations, Perception, Personality, Lifestyle, Values, Learning, Memory, Beliefs & Attitudes.

Module III: Marketing Communications, Decision Making Models, Consumer Rights (10 hours)

Marketing Communication Process, Types of Communication systems – Interpersonal, Impersonal, Persuasive Communication, Consumer Decision Making Models – Black Box Model - Economic model - Howard & Sheth model, Consumer Protection Act 1986, rights of consumers.

Module IV: Customer Relationship Management (15 hours)

Meaning, concept, Characteristics, and Elements of CRM – CRM Process – Importance of CRM – Planning and Managing CRM Programmed – Concept of Customer Loyalty – Customer Value Assessment – Customer Acquisition, Customer Retention Strategies – CRM in modern times and recent development.

Module V: Services of CRM in various sector: (15 hours)

Status of Customer Relationship Management in service industry in India; Relevance of CRM for Hospital Services; Customer Relationship Management in Banking and Financial Services; CRM in Insurance Sector; Future of CRM.

Suggested Readings and E- Resources:

1. Reference Books: 1. Hawkins, Best and Coney, Consumer Behavior, Tata McGraw Hill, New Delhi
2. John A Howard, Consumer Behavior in Marketing Strategy, Prentice Hall New Delhi
3. Schiffman L G and Kanuk L L Consumer Behaviour, Prentice Hall New Delhi
4. Anita Ghatak, Consumer Behavior in India, D K Agencies (P) Ltd New Delhi
5. Sarkar A Problems of Consumer Behaviour in India, Discovery Publishing House New Delhi
6. Khanna, Sri Ram, Savita Hanspal, Sheetal Kapoor, and H.K. Awasthi. Consumer Affairs" (2007) Delhi University Publication.
7. https://www.oup.com.au/_data/assets/file/0025/131983/9780195597080_SC.pdf
8. <https://course.cutm.ac.in/wp-content/uploads/2021/02/Consumer-Behaviour.pdf>
9. <http://ndl.ethernet.edu.et/bitstream/123456789/88700/3/3%20%20Consumer%20behaviour.pdf>

Experiential Learning:

- Visit to local retail stores or supermarkets to observe real-world consumer behaviour.
- Conducting Surveys to collect data on consumer preferences and behaviors
- Role Play by setting up a mini-marketplace in the classroom where students can act as both sellers and buyers to observe and analyse buying decisions and marketing tactics.

Mapping of Course Outcomes to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	H			
CO2				H	M
CO3			H		
CO4				M	H

2.2 MAJOR- CORPORATE FINANCE (Course Code)

(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective: The course aims to understand the various areas of corporate finance and also to develop the sources of finance and investment.

Course/Learning Outcomes

At the end of the course, students will be able to:

CO 1: Explain the basic tools and concepts necessary to understand modern financial theory and its application in corporations. (Understanding)

CO 2: Apply capital budgeting tools for evaluating investments. (Applying)

CO 3: Analyze the relationship between capital structure, risk and shareholder value, using the Modigliani Miller Theorems. (Analyzing)

Module I: Introduction to Corporate Finance (15 hours)

Objective of Corporate Finance; Role of finance manager in corporations; types of firms; stock markets; financial institutions; Financial Statement Analysis: Balance Sheet analysis, Income Statement analysis, Cash Flow statement; Case Study - Enron.

Module II: Investment Decisions (10 hours)

Net Present Value (NPV) rule; Payback rule; Internal Rate of Return (IRR) rule; Modified Internal Rate of Return; Choosing between projects; Capital Budgeting process; Forecasting Incremental Earnings; Break even Analysis; Scenario analysis; Options in Capital Budgeting – Delay, Expand, Abandon.

Module III: Risk and Return in Capital Markets (20 hours)

Variance and volatility of returns; Tradeoff between risk and return; Arithmetic Average returns Vs Compounded Annual returns; Normal Distribution; Systematic Risk Vs Equity Risk; Measuring Corporate valuation: Conceptual framework of valuation; Approaches/Methods of valuation: Assets based Method; earning based methods and cash flow based Method Systematic risks; Beta; Capital Asset Pricing Model (CAPM); Cost of Capital: Weighted Average Cost of Capital (WACC), Cost of Debt, Cost of Equity, Using WACC to value a project.

Module IV: Long Term Financing (15 hours)

Equity financing for Private Companies; Initial Public Offerings (IPO); Case Study – Google's IPO; Debt Financing: Private Debt and Public Debt, Bond Covenants, Repayment Provisions; Capital Structure: Capital Structure Choices, Capital Structure in Perfect Capital Markets, Modigliani and Miller (MM) Model, Debt and Taxes. Start up Financing: Introduction to Start up financing; Sources of funding and start-up financing through venture capital financing:

Experiential Learning

Experimental learning in this course is structured to immerse students in practical financial scenarios, beginning with the analysis of real financial statements and progressing through strategic financial decision-making, investment project evaluation, and stock market simulations. Each module is designed to build for providing hands-on experience with critical financial tools and techniques such as NPV, IRR, CAPM, and WACC. Through activities like role-playing as finance managers, engaging in stock market simulations, and participating in IPO processes, students develop a deep, practical understanding of financial dynamics, risk management, and strategic decision-making. This approach ensures that students not only learn theoretical concepts but also apply them in simulated real-world contexts, enhancing their readiness for professional financial roles.

Suggested Readings

1. Berk and DeMarzo : Corporate Finance, Pearson.
2. Brealey, Richard/ Myers, Stewart C. / Allen, Franklin :Principles of Corporate Finance, McGraw Hill.
3. Aswath Damodaran : Investment Valuation, John Wiley.

Digital Resources:

Module 1: Introduction to Corporate Finance: <https://resource.cdn.icai.org/66667bos53808-cp1.pdf>

Module 2: Investment Decision: <https://resource.cdn.icai.org/66673bos53808-cp7.pdf>

Module 3: Risk and Return in Capital Markets : <https://resource.cdn.icai.org/66674bos53808-cp8.pdf>

Corporate Valuation: <https://resource.cdn.icai.org/67850bos54415-cp12.pdf>

Module 4: Financing decision: <https://resource.cdn.icai.org/66671bos53808-cp5.pdf>

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		M
CO 2	M	H	H	
CO 3		M		

2.3 MAJOR- STATISTICS AND BUSINESS DECISIONS (4 Credit – 60 Hours) (L-T-P: 4-0-0)

Objectives: The main objective of this course is to familiarize the students with basic concepts of Statistics in Business and an in-depth learning of the various statistical techniques. The aim of this course is to impart knowledge to students to improve their logical reasoning ability and interpretation of various business results. The course makes an effort to acquaint the students with the emerging issues in business, trade, and commerce regarding analyzing business facts.

Learning/Course Outcomes:

On the successful completion of the course, learners should be able to demonstrate:

- CO1: Define the various statistical terms (Remembering)
- CO2: Understand correlation and Regression Analysis. (Understanding)
- CO3: Application of probability theory and statistical decision theory. (Applying)
- CO4: Analyze different sampling techniques and hypothesis testing. (Analyzing)
- CO5: Ability to understand the analysis of variance and non-parametric tests.

Module I: Correlation and Regression Analysis: (15 hours)

Simple, multiple and partial correlation analysis. Rank correlation. Simple and Multiple linear regression analysis (involving up to three variables). Multiple regression analysis.

Module II: Theory of Probability: (13 hours)

Approaches to calculation of probability. Marginal, joint and conditional probabilities. Probability rules. Bayes' theorem. Probability Distributions: Expected value and standard deviation of a probability distribution. Standard probability distributions - Binomial, Poisson. Statistical Decision Theory: Decision-making process. Payoff and Regret tables. Decision rules under risk and uncertainty.

Module III: Sampling Distributions and Estimation: (12 hours)

Sampling concepts. Sampling methods. Concept of sampling distribution, its expected value and standard error. Sampling distribution of means and Central Limit Theorem. Sampling distribution of proportions. Point and interval estimation; Properties of a good estimator. Confidence intervals for means (a) when σ is known, and (b) when σ is not known. Sample size determination for a mean. Confidence intervals for proportions.

Hypothesis Testing: One and Two-sample Tests: General methodology of hypothesis testing. One and two-tailed tests. Type I and Type II Errors. Power of a test. Calculation and use of p-value.

Module IV: One Sample Tests and Two-sample Tests: (15 hours)

Hypothesis testing of means when the population standard deviation is known and when it is not known. Hypothesis tests concerning proportions. Two-sample Tests: Tests for difference between means when population standard deviations are known, and when they are not known. Inferences about difference between two means for matched samples. Testing of difference between two proportions.

Module V: Analysis of Variance and Parametric vs. Non-parametric Tests: (15 hours)

One-factor ANOVA (Completely randomized Model) and Two-factor ANOVA without replication (Randomized Block Model). Parametric vs. non-parametric tests, Parametric Tests (z-test, t-test, Chi-Square test, and F-test)

Suggested Readings:

1. Aczel, Amir D., and Sounderpandian, J., Complete Business Statistics, Tata McGraw Hill Publishing.
2. Anderson, Sweeny and Williams, Statistics for Business and Economics, CENGAGE Learning, New Delhi
3. Ashish J.Dave Statistics for Management Indica Publishers & Distributors Pvt Ltd New Delhi
4. Business Mathematics, Ramesh Mangal, Satish Printers and publishers.
5. Business Mathematics, S.P.Gupta, S.M.Shukla, Sahitya Bhawan Publications.
6. Freund, J. E. And F. J. Williams, Elementary Business Statistics – The Modern Approach, Prentice Hall of India Private Ltd., New Delhi.
7. Gupta & Gupta Business Statistics Himalaya Publishing House Pvt Ltd New Delhi
8. Gupta .S.C.Fundamentals of Statistics Himalaya Publishing House Pvt Ltd New Delhi
9. J. K. Sharma, Business Statistics, Pearson Education.

10. Kazmeir Leonard J: Business Statistics, Tata McGraw Hill Publishing Company, New Delhi
11. Levin, R.I. and D.S. Rubin, Statistics for Management, Prentice-Hall of India.
12. S.C. Gupta, Fundamentals of Statistics, Himalaya Publishing House.
13. S.P. Gupta and Archana Gupta, Elementary Statistics, Sultan Chand and Sons, New Delhi.
14. Sejal Desai Statistical Methods in Business Management Indica Publishers & Distributors Pvt Ltd New Delhi
15. Vohra, N. D., Business Statistics, Tata McGraw Hill Publishing Company, New Delhi

e-Resources:

Module I: <https://rcub.ac.in/econtent/ug/bcom/sem4/Business%20Statistics%20Unit%204%20Correlation%20and%20Regression.pdf>

Module II: <https://mu.ac.in/wp-content/uploads/2021/10/probability-theory.pdf>

Module III: <https://www.lboro.ac.uk/media/media/schoolanddepartments/mlsc/downloads/HELM%20Workbook%2040%20Sampling%20Distributions%20and%20Estimation.pdf>

Module IV: <https://statisticsbyjim.com/hypothesis-testing/t-tests-1-sample-2-sample-paired-t-tests/>

Module V: <https://www.analyticsvidhya.com/blog/2021/06/hypothesis-testing-parametric-and-non-parametric-tests-in-statistics/>

Experiential Learning:

Experimental learning in business statistics and decision-making involves practical, hands-on experiences to apply statistical concepts and decision-making frameworks in real-world scenarios. This approach includes:

1. Data Collection and Analysis: Students gather and analyze real data sets to understand statistical methods.
2. Statistical Software: Use tools like SPSS, R, or Excel to perform statistical analyses.
3. Case Studies: Solve real-world business problems using statistical techniques and decision models.
4. Simulation Exercises: Engage in simulations that mimic business environments to apply statistical decision-making.
5. Project-Based Learning: Work on projects that require the application of statistics to make business decisions, such as market analysis or financial forecasting.

This experiential learning method helps students develop practical skills and confidence in using statistics for effective business decision-making.

Mapping of Course Outcomes (COs):

	Module I	Module II	Module III	Module IV	Module V
CO1	H	M	M	H	H
CO2	H	H	M	M	M
CO3	M	M	M	L	H
CO4	L	M	M	M	H
CO5	M	M	H	H	L

2.4 MAJOR- INTERNATIONAL BUSINESS (Course Code)

(4 CREDITS – 60 HOURS) (L-T-P: 4-0-0)

Objective: This course provides an overview of the environment, concepts, and basic differences involved in international business.

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO 1: Describe the foundation of international business.

CO 2: Describe international organizations and multinational corporations.

CO 3: Define forms of foreign involvement.

CO 4: Discuss international trade theory.

Module I: Introduction to Global Business (15 hours)

Global Business: Scope, Global Linkages today; Culture and Global Business: Elements of culture, Training Challenge; Global Trade and Investment Theory: Mercantilism, Classical Trade Theory, Factor Proportion Theory, International Trade and Product cycle theory, Theory of International Investments; Structure of Indian Foreign Trade: Composition & direction; EXIM Bank; Exit Policy of India; Regulation and Promotion of Foreign Trade.

Module II: Global Financial Markets (15 hours)

Foreign exchange markets; Fixed and Floating Foreign exchange rates; Significant monetary events; Exchange rates, interest rates and economic policy; Economic Integration; Government Trade Policies.

Module III: Global Business Environment (15 hours)

Private International Law; Public International Law; Risk to Global Business; Doctrine of Sovereign Immunity; Doctrine of Eminent Domain; Labor Law Differences; Theoretical foundations of International Business; Balance of Payments; International Liquidity; International Economic; Accounting and Tax differences; Multinational Corporations; Foreign Direct Investment.

Module IV: International Finance (15 hours)

Financing exports and imports; International Capital and Cash Management; Capital Structure: International Dimensions; International Capital Markets; International Banking and Security Markets; IMF; World Bank; IFC; ITA; ADB; WTO.

Suggested Readings

1. Joshi Rakesh Mohan: International Business, Oxford University Press.
2. Charusila F: International Business: Text and Cases, PHI Learning.

e-Resources

Module I: https://josephscollege.ac.in/lms/Uploads/pdf/material/GLOBAL_BUSINESS.pdf

<https://s3.studentvip.com.au/notes/6619-sample.pdf>

ModuleII: <https://dde.pondiuni.edu.in/files/StudyMaterials/MBA/MBA4Semester/IB/1GlobalFinancialMarkets&Instruments.pdf>

<https://ebooks.inflibnet.ac.in/mgmt08/chapter/international-financial-markets-i/>

ModuleIII: <https://dde.pondiuni.edu.in/files/StudyMaterials/MBA/MBA3Semester/IB/1InternationalBusinessEnvironment.pdf>

<https://www.tutorialsduniya.com/notes/global-business-environment-notes/>

ModuleIV: <http://www.jmpcollege.org/Adminpanel/AdminUpload/Studymaterial/International%20finance.pdf>

[https://www.distanceeducationju.in/pdf/International%20Finance%20\(Unit%20I-IV\).pdf](https://www.distanceeducationju.in/pdf/International%20Finance%20(Unit%20I-IV).pdf)

Experimental Learning

Experimental learning for students in international business involves engaging them in practical, hands-on experiences that mimic real-world scenarios. This can include:

1. **Simulations and Role-Playing:** Students participate in simulations of international business negotiations, market entry strategies, and cross-cultural communication.
2. **Case Studies:** Analyzing and discussing real-life business cases to understand the complexities and challenges of operating in a global market.
3. **Internships and Study Abroad Programs:** Providing opportunities to work or study in a foreign country to gain firsthand experience of international business environments.
4. **Project-Based Learning:** Working on projects that involve international market research, business plan development, and strategic planning for global expansion.
5. **Guest Lectures and Workshops:** Learning from industry experts and professionals who share their experiences and insights on international business practices.

These methods help students develop critical thinking, problem-solving, and decision-making skills essential for success in the global business arena.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	M	L
CO2	H	M	L	L
CO3	L	M	H	H
CO4	L	M	M	

2.5 PROJECT-FORMATION OF A COMPANY (Course Code) (4 Credits- 60 hours) (L-T-P: 2-0-2)

Course Objective: The objective of this project work is to provide students with a comprehensive understanding on the formation a company which is foundational for entrepreneurs embarking on business ventures. It involves navigating legal requirements and documentation, defining goals and strategies, exploring financing options, building a strong team, promoting the company, and navigating legal obligations.

Learning outcome of this course:

- CO1-Identify and evaluate different business structures and choose the most suitable one for a given venture.
- CO2-Explore various financing options available to entrepreneurs and assess their suitability for different business scenarios.
- CO3-Build strong and cohesive teams by defining hiring needs, crafting job descriptions, sourcing candidates, and implementing effective on boarding processes.
- CO4-Develop compelling value propositions and marketing strategies to attract and retain customers and navigate legal obligations and compliance requirements relevant to business operations.
- CO5-Evaluate the feasibility and sustainability of business ideas and plans.

The outline of the project work to be done has been delineated as follows:

Module-I: Understanding the importance of formation of a company

Legal Requirements and Documentation

- **Understanding the Legal Framework:** Registering a company involves adhering to the legal framework set by relevant authorities, including specific laws and regulations governing company formation in a particular jurisdiction.
- **Choosing the Right Business Structure:** Before registration, determining the most suitable business structure is crucial due to each structure's unique legal implications and requirements.
- **Name Reservation and Availability:** Selecting a distinct and suitable name is vital. Checking its availability and reserving it ensures the company's identity is protected and avoids conflicts with existing businesses.
- **Memorandum & Articles of Association:** These documents outline fundamental company details like purpose, address, share structure, and governing rules, requiring preparation and filing with relevant authorities.
- **Shareholders and Directors:** Depending on the structure, identification and provision of shareholder and director information are necessary.

Module-II: Defining Your Goals and Strategies

- **Identifying Business Objectives:** Clearly defining the business's purpose and objectives provides direction for strategies.
- **Conducting Market Research:** Gathering information about the target market, competitors, and industry trends offers insights into customer needs and market demand.
- **Defining Target Audience:** Determining ideal customer profiles and creating buyer personas helps tailor strategies to effectively engage them.
- **Developing a Unique Value Proposition:** Clearly articulating what sets the business apart from competitors highlights unique benefits and value offered to customers.
- **Outlining Marketing and Sales Strategies:** Detailing plans to promote and sell products or services, considering target audience and effective channels.
- **Financial Planning:** Creating a comprehensive financial plan, including revenue projections, expenses, and funding sources, ensures understanding of financial feasibility.
- **Operational Strategies:** Outlining operational aspects such as production processes, supply chain management, and resource allocation ensures scalability and efficiency.

Module-III: Exploring Financing Options for Your Company

- **Bootstrapping:** Utilizing personal savings, revenue from initial sales, or contributions from friends and family for autonomy in funding.
- **Angel Investors:** Seeking investment from high-net-worth individuals for capital and mentorship.
- **Venture Capital (VC) Funding:** Attracting investment from VC firms for expertise, networks, and strategic guidance

- **Crowd funding:** Raising small amounts from a large number of individuals via crowdfunding platforms to validate market interest.
- **Debt Financing:** Borrowing money through loans or credit lines while retaining ownership.
- **Grants and Subsidies:** Obtaining funds from governments, nonprofits, or industry-specific organizations, often with specific requirements.
- **Strategic Partnerships and Joint Ventures:** Collaborating with other companies to access resources, distribution channels, or shared risks.
- **Initial Coin Offerings (ICOs) and Token Sales:** Relevant for blockchain projects, raising funds by selling tokens to investors.

Module-IV: Building a Strong Team for Your Business

- **Defining Hiring Needs:** Identifying required skills, assessing workload, and considering growth plans to determine hiring needs.
- **Crafting Effective Job Descriptions:** Writing clear job descriptions that attract suitable candidates and set clear expectations.
- **Sourcing Candidates:** Finding potential employees through internal referrals, online platforms, and networking events.
- **Interviewing Techniques:** Conducting behavioral interviews, assigning role-specific tasks, and assessing cultural fit.
- **On boarding and Integration:** Providing structured onboarding, mentoring, and feedback for new hires to ensure a smooth transition.

Module-V: Promoting Your Company to Attract Customers

- **Understanding Your Target Audience:** Conducting market research to identify customer needs and preferences.
- **Crafting a Compelling Value Proposition:** Clearly communicating unique benefits and value to attract customers.
- **Developing a Consistent Brand Identity:** Building a recognizable and memorable brand through consistent visual elements and messaging.
- **Utilizing Multiple Marketing Channels:** Leveraging various digital and traditional marketing channels to reach a wider audience.
- **Engaging Content Creation:** Creating valuable and relevant content to establish credibility and engage customers.

Mapping of the COs

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	M					
CO2		H	M		H	
CO3	H		H	H		
CO4					M	H
CO5		H				

2.6-MINOR-INVESTING IN STOCK MARKETS (Course Code)

(4 credits-60 Hours) (L-T-P: 4-0-0)

Course Objective:

- To give knowledge and insights into the functioning of the Indian Stock market
- To develop tools and skills for security analysis-fundamental and technical
- To develop trading and investment skills in the securities market

Course/Learning Outcomes

At the end of the course, students will be able to:

CO1: Understand the functioning of the Indian Stock market and the regulations governing the stock market

CO2: Understand the fundamental principles of investment, including risk and return

CO3: Develop the necessary skills to make informed trading and investment decisions

CO4: Analyze different investment strategies, including long-term and short-term investments

Module I: Basics of Investing (15 hours)

Basics of Investment & Investment Environment; Risk and Return, Instruments of Investment- Equity shares, Preference shares, Bonds and Debentures. Indian Security Markets: Primary Markets (IPO, FPO, Private placement, offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE, NSE, MSEI. Security Market Indices: Nifty & Sensex, Sources of financial information; Trading in securities: types of orders, using brokerage and analyst recommendations.

Module II: Indian Security Markets (15 hours)

Primary Markets (IPO, FPO, Private placement, offer for sale), Secondary Markets (cash market and derivative market: Futures and Options) Market Participants: Stock Broker, Investor, Depositories, Clearing House, Stock Exchanges. Role of stock exchange, Stock exchanges in India: BSE, NSE, MSEI. Security Market Indices: Nifty & Sensex; Sources of financial information; Trading in securities: types of orders, using brokerage and analyst recommendations.

Module III: Fundamental Analysis (15 hours)

Top down and bottom-up approaches, Analysis of international & domestic economic scenario, Industry analysis, Company analysis (Quality of management, financial analysis: Both Annual and Quarterly, Income statement analysis, position statement analysis including key financial ratios, Cash flow statement analysis, Industry market ratios: PE, PEG, Price over sales, Price over book value, EVA), Understanding Shareholding pattern of the company.

Module IV: Technical Analysis (15 hours)

Trading rules (credit balance theory, confidence index, filter rules, market breath, advances vs declines and charting (use of historic prices, simple moving average and MACD) basic and advanced interactive charts. Do's & Don'ts of investing in markets.

Suggested Readings and E-Resources

1. Kumar, Vinod and Nangia, Raj Sethi, Investing in Stock Markets, Ane books
2. Singh J K , Singh Amit Kumar, Investing in Stock Markets, A K Publications, Delhi.
3. Tripathi, Vanita and Pawar, Neeti (2019), Investing in Stock Market, Taxmann Publications

E-Resources:

1. <https://www.nism.ac.in/about-elearning/>
2. <https://pass4sure.in/workbook/>
3. <https://investor.sebi.gov.in/iematerial.html>
4. https://www.flame.edu.in/pdfs/fil/presentations/FIL_Stock%20Market.pdf
5. <https://www.investopedia.com/articles/basics/06/invest1000.asp>
- 6.

Experiential Learning

1. Open DEMAT account and experience how investing & trading executed
2. Field trip to broker house and SEBI local office, Guwahati
3. Case study (Prepare project report on fundamental analysis considering some companies)
4. Case Study (Prepare project report on technical analysis considering some companies)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

THIRD SEMESTER

3.1 MAJOR- RESEARCH METHODOLOGY (Course Code)

(4 credits-60 Hours) (3-0-1: L-T-P)

Course Objective: This course is designed to provide students with the necessary skills and knowledge to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.

Course/Learning Outcomes

At the end of the course students will be able to:

- CO1: Define basics of research and its types. (Remembering)
- CO2: Explain research design. (Understanding)
- CO3: Explain survey methods for data collection, research instruments, best practices used and apply various data collecting techniques. (Applying)
- CO4: Classify, analyse and draw inferences from Data. (Analysing)
- CO5: Preparation of draft thesis and presenting research report (Creating)

Module I: Introduction to research (10 Hours)

Concept, objectives, types of research; approaches to research-qualitative and quantitative research, case study research, research methodology.

Module II Research Design (10 hours)

Research Design: Defining and developing a Research Problem, how to approach. Types of research approach and research design.

Module III Survey design & Measurement (15 hours)

Survey design & Measurement: Survey Design- Variables, design of research instruments and data preparation - Validity & Reliability, Best Practices.

Measurement & Scaling Types, Sampling – sample size and techniques

Module IV Research Analytics (15 hours)

Research Analytics: Hypotheses testing, Correlation and Regression overview and intro to SPSS, MS-Excel, Factor analysis, Cluster Analysis, MS-Excel

Module V Research Report writing - (10 hours)

Best practices, References and Bibliography, Ethics in Research.

Experiential Learning: (Any 2/3 experiential learning best practices will be done in one of the semesters)

1. Assignment to prepare notes on introduction of research, its type, research methodology etc. Second- Group discussion among different groups and summary of the discussions will be presented by each group
2. Do some literature review from existing research publications and find out the research design and make note of it. Assignment on Research design and approach with example
3. Select any research topic and finalize it and make a survey related to research title framed and submit to the department
4. Analyze the research data collected through survey: Learn basics of SPSS Analytics tool; Analyze the data using excel MS office platform; Finally submit an analysis report.
5. Assignment on Bibliography, Plagiarism etc. and Also One assignment to submit style with example the references and Bibliography.

Suggested Readings

- 1.Kothari C.R, Research Methodology: Methods and Techniques, New Age International,
- 2.Srivastava, S. C. : Foundation of Social Research and Economics Techniques, Himalaya Publishing House, 1990.
- 3.Sharma H.D. and Mukherji S. P: Research Methods in Economics and Business, New York : The Macmillan Company, 1992.
- 4.Saunders M , Philip Lewis and Adrian Thornhill, Research Methodology for business students, Pearson Education
- 5.Michael V.P, Research Methodology in Management, Himalaya Publishing House

Digital Resources:

1. Research Methodology: <https://www.uou.ac.in/sites/default/files/slm/BHM-503T.pdf>
2. Types of research design: <https://emeritus.org/in/learn/types-of-research-design/>
3. YouTube Video Lectures on Research: <https://www.youtube.com/watch?v=51HnRTt4KeQ>
4. YouTube Video Lectures on Sampling: <https://www.youtube.com/watch?v=Yw9cctUHULo>
5. Thesis writing: <https://web.uri.edu/engineering/student-support/thesisguide/bibliography/>
6. Writing Bibliography: https://www.tezu.ernet.in/dener/programme/Bibliography_Style.pdf

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M		M	
CO 2	M	H	H		
CO 3		M			H
CO 4	M			H	
CO 5			M		H

3.2 ETHICS, CORPORATE GOVERNANCE AND SUSTAINABILITY (Course Code)**(4 credits-60 Hours) (4-0-0: L-T-P)**

Course Objective: To familiarize the students with the knowledge of ethics, good governance practices; Corporate Social Responsibility in the global and Indian context and Sustainability

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: Define ethics, different ethical theories, Code of Ethics, Ethical compliances

CO2: Explain the conceptual framework of corporate governance

CO3: Explain different committees involved and its structure

CO4: Define whistle-blowing and its policy details

CO5: Elaborate sustainability and role of corporate governance in sustainability

Module I: Business Ethics (15 Hours):

The concept of ethics; various approaches to business ethics; ethical theories; ethical governance; social responsibility-an extension of business ethics; ethical principles in business; role and functions of Board of Directors; addressing ethical dilemmas; code of ethics; standing committees, ad-hoc committees, task force committees, advisory committees; powers, functions and duties of board committees; enhanced performance of board committees; limitations of board committees; statutory committees of board- audit committee, remuneration committee, nomination committee, compliance committee, shareholders grievance committee, investors relation committee, investment committee, risk management committee, other committees.

Module II: Conceptual Framework of Corporate Governance (8 Hours)

Introduction, need and scope; Evolution of corporate governance; developments in India; regulatory framework of corporate governance in India; Developments in Corporate Governance- A Global Perspective; Management vs. Governance; internal constituents of the corporate governance; key managerial personnel

(KMP); chairman- qualities of a chairman, powers, responsibilities and duties of a chairman; green governance/e-governance

Module III: Board Committees: (8 Hours)

Role and Functions of Board Committees: Standing committees, ad-hoc committees, task force committees, advisory committees; powers, functions and duties of board committees; enhanced performance of board committees; limitations of board committees; statutory committees of board- audit committee, remuneration committee, nomination committee, compliance committee, shareholders grievance committee, investors relation committee, investment committee, risk management committee, other committees.

Module IV: Whistleblowing and Corporate Governance: (8 Hours)

The Concept of Whistle-Blowing; Types of Whistle-blowers; Whistle-blower Policy; the Whistle-Blower Legislation across Countries; developments in India.

Module V: Sustainability: (8 Hours)

Meaning and scope; Corporate Social Responsibility and Corporate Sustainability; Triple Bottom Line; Corporate Sustainability Reporting Framework; Global Reporting Initiative Guidelines; Sustainability Indices; Challenges in Mainstreaming Sustainability Reporting.

Module-VI: Navigating Legal Obligations for Your Company

- **Understanding Regulatory Frameworks:** Adhering to industry-specific laws and regulations governing operations.
- **Compliance Challenges:** Navigating evolving regulations to avoid legal consequences and financial penalties.
- **Compliance Programs and Policies:** Establishing compliance programs and policies to ensure adherence to relevant laws.
- **Compliance Monitoring and Reporting:** Implementing mechanisms to monitor compliance efforts and address violations promptly.
- **Compliance Training and Awareness:** Providing comprehensive training to educate employees about relevant laws, regulations, and company policies.

Suggested Readings and E-Resources

1. Business Ethics and Corporate Governance by Redshine Publications pvt Ltd by Dr. Indrajit Goswami, Dr. S. Saravanan, Dr. Sanjay Prasad Lalita, Babulal Malusare, Dr. Pankaj Choudhary
2. Corporate Governance and Business Ethics by K Sravana

Experiential Learning: (Any 2/3 experiential learning best practices will be done in one of the semesters)

1. Form a board committee and analyses through group discussions on the ethical considerations in business houses. Draw a road map out of the discussions.
2. Prepare a mini project on Corporate Governance: Indian Perspectives as well as in Global Perspectives
3. Appoint the members in the Board committee and do a case study and analyze on the role of Board committee members
4. Whistle-Blower Legislation across Countries; developments in India- Narrate through debate and open writing competition
5. Sustainability indices, Global Reporting Initiative Guidelines

Mapping of the COs

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	L					L
CO2		L	L	M		
CO3					H	
CO4			M			
CO5						H

3.3 INCOME TAX LAWS AND COMPLIANCE

(Credits: 4 – 60 hours) (L-T-P: 4-0-0)

Course Objective: To provide basic knowledge and equip the students with application of the principles of taxation and to acquaint them with the various provisions of Income-tax Act, 1961 and the relevant rules for filing of returns.

Course/Learning Outcomes

After learning this course, the students will be able to:

- CO1: Understand the various concepts and provisions related to direct tax laws. (Understanding)
- CO2: Execute the knowledge of the provisions of the direct tax laws to the various situations in actual practice. (Applying)
- CO3: Analyze the procedures related to filing of returns and TDS (Analyzing)
- CO4: Evaluate the requirements of different assessed for filing tax returns under the income tax laws. (Evaluating)
- CO5: Develop the skill of creativity in the field of direct tax laws with regard to tax savings. (Creating)

Module I: Introduction (10 hours)

Basic concepts: Income, agricultural income, person, assessee, assessment year, previous year, gross total income, total income, Permanent Account Number (PAN). Residential status: Scope of total income on the basis of residential status, Exempted income under section-10

Module II: Computation of Income under different heads (18 hours)

Income from Salaries; Income from house property

Module III: Computation of Income under different heads (10 hours)

Profits and gains of business or profession; Capital gains; Income from other sources

Module IV: Total income and Tax Computation (12 hours)

Income of other persons included in assessee's total income; Aggregation of income and set-off and carry forward of losses; Deductions from gross total income; Rebates and reliefs,

Module V: Preparation of Return of Income (10 hours)

Computation of total income of individuals and firms; Tax liability of an individual and a firm; Filing of returns, TDS Provision & Procedures of Compulsory Online filing of returns for assessee with salaried income and/or business income

Suggested Readings and E resources:

1. Singhania, Vinod K. and Monica Singhania. Students' Guide to Income Tax, University Edition. Taxmann Publications Pvt. Ltd., New Delhi.
2. Ahuja, Girish and Ravi Gupta. Systematic Approach to Income Tax. Bharat Law House, Delhi. Journals
3. Income Tax Reports. Company Law Institute of India Pvt. Ltd., Chennai.
4. Taxman. Taxmann Allied Services Pvt. Ltd., New Delhi.
5. Singhania Vinod Kumar, e- filing of Income Tax Returns and Computation of Tax, Taxmann Publication Pvt. Ltd., New Delhi. Latest version
6. Excel Utility' available at incometaxindiaefiling.gov.in
7. https://onlinecourses.swayam2.ac.in/cec22_cm01/course

Experiential Learning:

- Real-life case studies, role-play scripts to enhance their ability to apply tax laws to different situations.
- Providing students with anonymous real-life salary slips and asking them to analyze different components.
- Assigning projects where students research specific deductions or tax strategies and present their

- findings. Students investigate various deductions and their eligibility criteria.
- Demonstration of online filing of Returns of Income

Mapping of COs to Syllabus:

	Module-1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		M	M	M	
CO 3					H
CO 4		M	M	M	H
CO 5	L	M	M	H	

3.4 MAJOR ELECTIVE COURSES-GROUP 1 (ACCOUNTING AND FINANCE)**3.4.1 RECENT ADVANCES IN ACCOUNTING (Course Code)****(4 Credits-60 Hours) (L-T-P: 4-0-0)**

Objectives: The course "Recent Advances in Accounting" aims to provide students with a comprehensive understanding of the latest developments and emerging trends in the field of accounting.

Course/Learning Outcomes

At the end of the course the students will be able to:

- CO1: Identify and recall key concepts and recent developments in Indian Accounting Standards, International Financial Reporting Standards (IFRS), inflation accounting, environmental accounting, forensic accounting, behavioral accounting, social accounting and Human resource Accounting. (Remembering)
- CO2: Explain the fundamental principles and recent changes in accounting standards, as well as the processes and purposes of specialized accounting fields such as inflation, environmental, forensic, behavioral, and social accounting and Human resource Accounting (Understanding)
- CO3: Utilize advanced accounting techniques to prepare financial statements under various accounting frameworks, including inflation and environmental accounting. (Applying)
- CO4: Critically examine the impact of adopting new accounting standards and practices on financial reporting, business decision-making, and compliance. (Analysing)
- CO5: Assess the effectiveness, benefits, and challenges of recent advances in accounting practices and standards. (Evaluating)
- CO6: Develop comprehensive financial and non-financial reports that incorporate advanced accounting practices and address contemporary issues in the field. (Creating)

Module I: Introduction to Indian Accounting standard (10 Hours)

Indian Accounting Standard, Indian reporting standard; Recent changes in Indian Accounting standard; International Financial Reporting Standards Framework (IFRS); Comparison of IFRS with other Reporting Standards.

Module II: Inflation Accounting (10 Hours)

Meaning; techniques of inflation accounting; determination of value of assets and liabilities under inflation accounting; accounts preparation under inflation accounting.

Module III: Social and Environmental Accounting (10 Hours)

Meaning; purpose of social accounting; scope & objectives of social accounting; benefits & challenges of social accounting; accounting under social accounting, Meaning; functions of environmental accounting; valuation process under environmental accounting, methods of evaluation under environmental accounting; accounts preparation under environmental accounting.

Module IV: Forensic Accounting (10 Hours)

Meaning; branches of forensic accounting; activities under forensic accounting; procedure of forensic accounting; stages of forensic accounting; application and consequences of forensic accounting.

Module V: Behavioural Accounting (10 Hours)

Meaning; process of behavioural accounting; application of behavioural accounting; techniques of behavioural accounting; influence of accounting information on behaviour.

Module VI: Human Resource Accounting

Definition and objectives of HRA, Evolution and historical development, Importance and relevance in modern business, Methods of Human Resource Valuation- Cost-based methods (historical cost, replacement cost), Economic value methods (present value of future earnings, opportunity cost) Behavioral approaches to valuation, Human Capital Reporting Standards and Guidelines Global standards (e.g., International Accounting Standards - IAS) Reporting guidelines for human capital.

Experimental learning:

Experiential learning in this course involves a series of practical activities designed to deepen students' understanding of financial and accounting principles through real-world applications. Students will analyze case studies on IFRS adoption, identifying challenges and benefits while proposing transition plans, and engage with industry experts to discuss recent changes in accounting standards. They will participate in hands-on workshops to adjust financial statements for inflation and simulate the role of financial analysts in dynamic market scenarios. Environmental impact assessments and field trips to sustainable businesses will expose students to environmental accounting practices. Forensic accounting simulations and role-playing exercises will help them understand the procedures and perspectives involved in investigating financial fraud. Behavioral experiments and interactive workshops with psychologists will explore how accounting information influences decision-making. Lastly, case studies and workshops on human resource valuation will allow students to apply various methods to assess the impact of human resource accounting on financial statements.

Suggested Readings

1. Lal, Jawahar, Accounting Theory and Practice, Himalaya Publishing House, New Delhi
2. Pedneault, Stephen, Forensic Accounting and Fraud Investigation for Non-Experts, John Wiley & Sons; 3rd edition, New Delhi.
3. Pahuja, Shuchi, Environmental Accounting & Reporting: Theory, Law & Empirical Evidence, New Century Publications, New Delhi.
4. Hellmann, Andreas, Behavioural Accounting, Routledge; 1 edition, New Delhi.
5. Rao, P.M., Corporate Social Accounting and Reporting, Deep & Deep Publications Pvt.ltd , Delhi.

Digital Resources:

Module 1: Recent changes in Indian Accounting standard:

<https://kb.icai.org/pdfs/PDFFile5b2790f4a60cd2.23292873.pdf>

Module 2 : Inflation Accounting: <https://vitiyagyan.icai.org/wp-content/uploads/2023/01/Copy-of-Inflation-Accounting.pdf>

Module 3: Social and Environmental Accounting: https://www.caluniv.ac.in/dj/BS-Journal/2002-2004/social_and_environmental.pdf

Module 4: Forensic Accounting <https://egyankosh.ac.in/bitstream/123456789/80372/1/Unit-16.pdf>

Module 5: Behavioural Accounting : http://www.untag-smd.ac.id/files/Perpustakaan_Digital_1/ACCOUNTING%20Behavioral%20management%20accounting.pdf

Module 6: Human Resource Accounting: https://backup.pondiuni.edu.in/storage/dde/downloads/hrmiv_hra.pdf

Mapping of Course Outcomes

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M		M	M	M
CO 2	M	H	H			M
CO 3		M		M	H	M
CO4	M	M	H	M	H	M
CO5	M	M	H		M	
CO6	M	M		H	M	H

3.4.2 BUSINESS ANALYSIS AND VALUATION (Course Code)**(4 credits-60 Hours) (L-T-P: 4-0-0)**

Objective: This course provides a comprehensive framework for using financial statements to evaluate a company's strategy execution, performance, financial prospects, and value. The objective of the course is to provide hands-on experience in financial statement analysis and valuation that enhances investment decisions. Students will be able to analyze complex financial statements to gain a richer understanding of firm performance and value.

Course/Learning Outcomes

At the end of the course students will be able to:

CO2: Understand the critical valuation challenges of IPOs and M&As deals.

CO3: Conduct fundamental analysis using real-world financial data.

CO3: Detect the overall quality of financial reporting information provided by firms.

CO3: Analyse credit risk and equity risk using financial statements.

CO4: Use accounting information to assess past and current firm financial performance.

CO4: Implement prospective analysis to forecast future earnings growth.

CO4: Apply discounted cash flow and residual income valuation models to estimate equity and enterprise values.

CO4: Apply relative valuation techniques.

Module I: Performance analysis (15 Hours)

Assessing performance through Financial Statements: Income statements, Balance sheets & Cash Flow Statement, analyzing the Chairman's statement; Directors' report, management discussion & analysis. Assessing current performance and its future sustainability; making forecasts of future profitability and risk; and valuing businesses using earnings and book value data.

Module II: Valuation (15 hours)

Assessing a firm's value proposition and identifying its key value drivers and risks; Basis and need for valuation, Approaches to valuation: DCF; CAPM; relative valuation and contingent valuation; Estimating discount rates- cost of equity and cost of capital, measuring cash flows, and forecasting cash flows. Equity discounted cash flows models. Firm valuation models; Valuing publicly traded firms and private businesses; Ratio analysis and bankruptcy detection.

Module III: Financial restructuring (15 hours)

Financial restructuring: Debt restructuring; Equity restructuring; reduction of capital; reorganization of share capital; buy back of shares –concept and necessity; procedure for buy back of shares; Equity-investment analysis, IPOs, mergers, M&As.

Module IV: Relative valuation (15 Hours)

Overview of relative valuation; application of relative valuation models; Reasons for popularity and potential pitfalls. Standardized values and multiples- Earnings multiples, book value multiples, revenue multiples, and sector-specific multiples; Equity and Value multiples; Basic steps to using multiples; Reconciling relative and discounted cash flow valuation.

Suggested Readings and E-Resources

1. Foster, George Financial Statement Analysis, Pearson Education Pvt Ltd.
2. Damodaran, A. Damodaran on Valuation, Security Analysis for investment and Corporate Finance (2nd ed.). Wiley India Pvt. Ltd.
3. K. G., CA, & Sehrawat, N. K. Handbook on Valuation- Concept & Cases. New Delhi, Bharat Law House Pvt. Ltd, ISBN: 978-93-5139-497-6
4. Damodaran, Investment Valuation, Tools and Techniques for determining the value of any asset, 3rd Edition, Wiley India Pvt. Ltd.
5. Damodaran, Corporate Finance (2000), Theory and Practical, 2nd Edition, Wiley India Pvt. Ltd.
6. [Business Analysis Using Financial Statements | Sloan School of Management | MIT OpenCourseWare](#)
7. [Investments | Sloan School of Management | MIT OpenCourseWare](#)

Experiential Learning

1. Module 1: Project work on analyzing firms' performance.
2. Module 2: Applied Valuation – valuation of a real company through DCF (matured company) using excel.
3. Module 3: Project work on detecting bankruptcy through financial ratios.
4. Module 4: Applied Relative Valuation – valuation of a real company through relative valuation method (matured company) using excel.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M	M	M	M
CO 2	H	M	H	M
CO 3	M	H	M	H
CO4	M	H	H	H

3.5 MAJOR ELECTIVE- GROUP 2 (HR and Marketing)**3.5.1 HUMAN RESOURCE ANALYTICS (Course Code)****(Credit 4 - 60 Hours.) (L.T.P:4-0-0)**

Course Objective: The objective of this course is to encourage students' data-driven skills, empowering them to utilize analytical tools effectively for understanding employee behaviour in an organisation.

Course Outcomes: The successful completion of this course shall enable the student.

CO1: To understand role of analytics in Human Resource Management.

CO2: To develop knowledge about HR Metrics and types of analytics in HR

CO3: To critically analyse the HR effectiveness and its impact on employee life cycle & experience

CO4: To enable students to analyse data driven insights out of HR analytics

CO5: To help in implementation of predictive modelling and dashboards in HR

Module 1: Introduction to HR Analytics (15 hours): Evolution of HR Analytics, HR Analytics and Changing Role of HR Professionals, Importance and Scope of HR Analytics, challenges with HR analytics, strategic focus on HR analytics; Common pitfalls of HR analytics; HR analytics process, Key Influencers of HR Analytics Process. and skillset needed in HR analytics team.

Module 2: Approaches to Data Analytics(15hours): Current approaches to measuring HR; Strategic HR metrics versus benchmarking; HR scorecards & workforce scorecards; Types of analytics in HR- descriptive, predictive and prescriptive; HR analytics framework, HR Analytics for Recruitment & Selection, Training & Development, Performance Appraisal, Talent Management, Employee Engagement, Compensation Management and Expatriate Management.

Module 3: Dynamics of HR Metrics (10 hours): People analytics cycle, employee lifecycles and employee experiences, performance and succession management; Agile framework; HR value chain; Metrics to measure HR effectiveness; Factors driving employee turnover; Link between engagement and performance; Competitive edge and HR analytics.

Module 4: Data Mining Techniques (10 hours): Data analysis, data visualization techniques and effective utilization using tools; Common pitfalls associated with data visualization; Driving insights out of HR analytics

Module 5: Decision Making Based on Analytics (10 hours): Data driven culture in an organization; Implementation of predictive modelling; Importance of predictability in fulfilling strategic objectives; Effective HR dashboards.

Experiential Learning

1. Hands-on exercises and case studies demonstrating the application of various approaches to real-world HR data.
2. Using HR analytics software tools (e.g., excel, R, Python, specialized HR analytics platforms) for analysis and visualization.

3. Group projects or assignments where students apply different approaches to solve specific HR challenges

Suggestive learning and E-Resources

1. Martin R. Edwards "Predictive HR Analytics: Mastering the HR Metric"
2. Linda Holbeche "HR Analytics Handbook"
3. Dr. Michael Walsh "HR Analytics Essentials"
4. Vinod Kumar Patel, Deepali Soni, Abhishek Singhal, Dinesh Gupta "Fundamentals of HR Analytics"

E-resources

[https://www.gartner.com/en/human-resources/glossary/hr-analytics#:~:text=HR%20analytics%20\(also%20known%20as,and%20promote%20positive%20employee%20experience.](https://www.gartner.com/en/human-resources/glossary/hr-analytics#:~:text=HR%20analytics%20(also%20known%20as,and%20promote%20positive%20employee%20experience.)
<https://www.aihr.com/blog/hr-metrics-examples/>
https://www.researchgate.net/publication/321376109_HR_Analytics-The_Data_driven_Human_Resource_Management_Applications_and_Challenges

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	L		M	
CO 2	M	H	H		
CO 3		M			H
CO 4			H	L	
CO 5			M		H

3.5.2 Major- Elective- Advance Marketing Management (Course Code) (4 credits-60 Hours) (L-T-P: 4-0-0)

Objective: This course delves into the intricacies of marketing management at an advanced level, focusing on strategic decision-making, innovative approaches, and the integration of emerging technologies. Students will analyze real-world case studies, engage in hands-on projects, and develop the skills needed to lead marketing efforts in dynamic business environments. Students will acquire the knowledge and skills required to develop, implement, and control successful marketing strategies.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: Articulate an in-depth understanding of a range of contemporary marketing issues, theories, practices, models and phenomena;

CO2: Evaluate and critique contemporary marketing practices and understand the best methods of implementation to maximize business performance;

CO3: Be proficient in presenting, analyzing, discussing, evaluating, persuading, and making decisions regarding contemporary marketing initiatives within an organization;

CO4: Critically evaluate and synthesize advanced academic literature and other evidence

CO5: Apply theoretical frameworks in relation to marketing literature and /or practice

Module I: Introduction to Marketing (10 Hours)

Introduction: Traditional view of marketing; Evolution of marketing concept; Modern concept of marketing; Marketing functions and role; Marketing Mix, Marketing management process- a strategic perspective; Marketing Environment: Significance of scanning marketing environment; Economic, demographic, socio-cultural, technical, political and legal environment of marketing in India

Module II Consumer Behavior and Market Research (10 Hours)

Consumer market and buying behavior; Psychological factors influencing consumer behavior, Cultural, social, and demographic influences, Theories of Consumer Behavior Market research methodologies and data analysis techniques, Customer insights Market Segmentation, Targeting, Positioning, and segmentation strategies.

Module III Integrated Marketing Communications and Global Marketing (10 Hours)

Advertising, public relations, and sales promotions, Digital marketing and social media strategies, Content marketing and influencer partnerships, Measuring the effectiveness of integrated campaigns, Global market entry strategies, Cross-cultural marketing challenges and adaptations, Standardization vs. customization of marketing strategies, Managing international distribution channel

Module IV Green Marketing and Sustainable Development (10 Hours)

Meaning and concept, green marketing Mix, Three R's of Environmentalism, Green Consumer, Green packaging, green packaging symbols, FSSAI, Corporate Strategies of Environmental Marketing, Role of CSR and its approaches, sustainable development, role of NGO in protecting environment.

Module V Emerging Trends in Marketing (10 Hours)

Artificial intelligence, Augmented Reality Driven Marketing, Machine Learning, digital marketing Strategy, Marketing 4.0, Digital Business Model, E-business, Tele marketing, M-business, Social networked marketing, Viral marketing, Interactive Television, Relationship marketing, Customer Relationship Management.

Suggested Readings and E-Resources

1. Principles of Marketing: Philip Kotler, PHI.
2. Marketing Management: A South Asian Perspective – Philip Kotler and Kevin Lane Kotler, Pearson Education
3. Stanton WJ: Fundamental of Marketing
4. Marketing Management: A South Asian Perso
5. Marketing Management: Ramaswamy & Nandakumar, Tata McGraw Hill
6. Marketing Planning and Strategy: Jain, Cengage learning. 8. Marketing Management: Gandhi IC, Tata McGraw Hill

Links for E-Resources:

1. [Marketing_Management.pdf](#)
2. <https://www.scribd.com/presentation/420124579/Chapter-1-Advanced-Marketing-Management>

Experiential Learning

Experiential learning in advanced marketing management involves students engaging in hands-on, practical activities that simulate real-world marketing challenges. This approach includes:

1. **Live Projects:** Collaborating with companies on actual marketing campaigns, allowing students to apply theoretical concepts to practical scenarios.
2. **Case Studies:** Analyzing and solving complex marketing problems based on real or hypothetical business situations.
3. **Simulations:** Participating in marketing simulations that mimic market conditions and competitive dynamics.
4. **Internships:** Gaining on-the-job experience by working with marketing teams in various organizations.
5. **Workshops and Seminars:** Attending sessions led by industry experts to gain insights into current marketing trends and practices.

These methods enhance students' strategic thinking, decision-making skills, and ability to adapt to dynamic marketing environments.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M		M	
CO 2	M	H	H		
CO 3		M			H

3.6 DISSERTATION-PHASE-1

(4 credits- 60 hours) (L-T-P: -0-0-4)

Objective: The objective of the course would be to educate the students about the various dimensions of a research-based project work. The students will also be taught about the application of statistical tools through SPSS.

This phase of the Dissertation will comprise of the following:

- 1.Synopsis: Submission of a write up on a specific area/topic of study (10hours)
- 2.Review of Literature: Submission of a specified number of reviews to respective guide (15 hours)
- 3.Research Methodology: Lecture based on the topic of study. (10 hours)
- 4.Referencing Style: Lecture on referencing style to be followed while submitting report (5 hours)
- 5.Training on application of Statistical software used in research (20hours)
- 6.Submission of Progress Report after completion of Phase I: Report should comprise of Introduction, Review of Literature, Research Methodology and References.

Evaluation:

A diary will be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester. Evaluation at Phase I will be done by the respective guide based on timely submission of part-work and quality of work as follows:

- Synopsis (30marks)
- Review of Literature (30marks)
- Research Methodology (30marks)
- Referencing (10marks)

FOURTH SEMESTER

4.1 MAJOR-.PRODUCTION AND OPERATION MANAGEMENT (Course Code)

(4 credits-60 Hours))(L-T-P: 4-0-0)

Course Objective: One of the most critical areas for success in any business enterprise is how Production and Operations are managed. This course is designed to equip students with the necessary skills and knowledge required to excel in the field of production and operation. The students will gain an understanding of relevant approaches and principles of production and operation, recognize role and importance of operations in overall business strategy, manage projects effectively and make informed decisions on facility location and layout, utilize six sigma for process improvement and application of productivity improvement techniques.

Course/Learning Outcomes

At the end of the course students will be able to:

- CO2: Develop an understanding of production & operations management in organisation.
- CO3: Explain fundamental frameworks and techniques in production operations management.
- CO4: Apply these frameworks and techniques to solve problems and analyse practical applications.
- CO3: Identify operational issues and recommend solutions, and evaluate the suitability of alternative solutions.

Module I: Introduction to production and operation management (10 Hours)

Production System, Classification of Production System, Production Management, Objectives of Production Management, Operations management, Distinction between Manufacturing Operations and Service Operations, Objectives of Operations Management, Managing Global Operations, Scope of Production and Operations Management.

Module II: Plant location and layout (10 Hours)

Introduction, Need for Selecting a Suitable Location, Factors Influencing Plant Location/Facility Location, Location Theories, Location Models - Factor Rating Method, Weighted Factor Rating Method, Load-distance Method, Centre of Gravity, Break Even Analysis. Plant layout and design – product layout, process layout, service layout. Material Handling and management- relationship between material handling and plant layout.

Module III: Operations Research (20 Hours)

Applications of Operations Research, Introduction to Linear Programming- Graphical Method- Simplex Method - Duality. Transportation & Assignment Problem - Inventory Control - Introduction to Inventory

Management - Basic Deterministic Models - Purchase Models - Manufacturing Models with and without Shortages. Game Theory- Two Person Zero-sum Games -Graphical Solution of (2 x n) and (m x 2) Games - LP Approach to Game Theory - Goal programming - Formulations - Introduction to Queuing Theory - Basic Waiting Line Models: (M/M/1):(GD/a/a), (M/M/C):GD/a/a).

Module IV: Productivity improvement & Quality management: (20 Hours)

Productivity Improvement Techniques: Work study; Method study; Work measurement: time study: stop watch time study; Work sampling. Maintenance: total productive maintenance (TPM); Quality characteristics of goods and services; Tools and techniques for quality improvement: check sheet, histogram, scatter diagram, cause and effect diagram, Pareto chart, process diagram, Total quality management (TQM) model, concept of Six Sigma and its application.

Suggested readings & e-resources:

1. Kanishka Bedi, PRODUCTION & OPERATIONS MANAGEMENT, Oxford, New Delhi.
2. Panneerselvam, R, OPERATIONS RESEARCH, Prentice-Hall of India, New Delhi.
3. G.Srinivasan, OPERATIONS RESEARCH, PHI Learning, NewDelhi.
4. Tulsian & Pandey, QUANTITATIVE TECHNIQUES, Pearson, NewDelhi.
5. Vohra, QUANTATIVE TECHNIQUES IN MANAGEMENT, Tata McGrawHill, NewDelhi, 2010
6. Production and Operations Management: With Skill Development, Caselets and Cases (ascdegreecollege.ac.in)
7. Resources | Introduction to Lean Six Sigma Methods | Aeronautics and Astronautics | MIT OpenCourseWare
8. Lecture Notes | Introduction to Operations Management | Sloan School of Management | MIT OpenCourseWare

Experiential Learning

1. Students are to pay visit to a nearby manufacturing unit and prepare a report on the suitability of plant location and layout of that manufacturing unit.
2. Students are to prepare a report on adoption of Six Sigma and its implication in business. For these students are to identify and select companies of their choice.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 2	H	M	M	M
CO 3	M	H	H	H
CO 4		M	M	H

4.2 MAJOR-ELECTIVE-GROUP 1 (ACCOUNTING AND FINANCE)

4.2.1 STRATEGIC COST & MANAGEMENT ACCOUNTING (Course Code)

(4 credits- 60 hours) (L-T-P: 4-0-0)

Course Objectives:

- To provide understanding of various aspects in strategic cost and management accounting
- To elucidate the role of cost accounting for better managerial decision making
- To study the application of various techniques of Strategic Cost Management in the modern business environment.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: Remember the various tools and techniques used in the field of cost and management accounting to make strategic decisions.

CO2: Understanding of calculation and use of modern Strategic Cost Management Techniques required for analytical & decision-making skills in this current competitive environment.

CO3: Application of modern Cost Management Techniques for strategic decision-making in this current competitive environment.

CO4: It seeks to provide specialisation-level knowledge to financially motivated managers to be on the role of the management accounting in complex modern industrial organisations.

Module I: Cost Management (10 hours)

Developments in Cost Management- Life Cycle costing, Target costing, Kaizen Costing, Value Analysis and Value Engineering, Throughput Costing, Business Process Re-engineering, Back-flush Accounting, Lean Accounting, Socio Economic Costing, Cost Control and Cost Reduction – Basics, Process, Methods and Techniques of Cost Reduction.

Module II: Strategic cost management tools and techniques (15 hours)

Decision Making Techniques, Marginal Costing- Differential costing-CVP Analysis – Profit Volume Graphs – Contribution Approach, Decisions involving alternative choices – Optimum utilization of resources – Make or Buy – Evaluation of Orders – Multiple scarce resource problems- Product sales pricing, shut down decisions.

Module III: Budgetary control & Standard Costing (15 hours)

Variance Analysis - Investigation of Variances, Planning and Operating Variances, Controllable / Non-controllable Variances, Relevant Cost Approach to Variance Analysis; Variance analysis under marginal costing and absorption costing; Activity Ratios; Application of budgetary control and Standard Costing in Profit planning, Standard Costing Vs Budgetary Control, Reconciliation of Actual Profit with Standard Profit and /or Budgeted Profit.

Module IV: Activity Based Costing and Total Quality Management (20 hours)

a. Activity Based Costing- Concept, purpose, benefits, stages, relevance in decisionmaking and its application in Budgeting, Responsibility accounting, Traditional Vs. ABC System – comparative analysis
b. Cost of Quality and Total Quality Management- TQM - Basics, Stages, Principles, Control, Corrective actions; PRAISE-Steps, Problems, implementation PARETO Analysis, Quality Costs, Application of Operation Research and Statistical Tools in Strategic Decision Making -Learning Curve, Linear Programming (Formulation only), Assignment, Transportation, Simulation, Network Analysis – CPM / PERT

Suggested Readings and E-Resources:

1. Atkinson, Kaplan, Matsumara, Yong, & Kumar. Management Accounting. Pearson Education.
2. Banerjee, B. Cost Accounting. Prentice Hall of India.
3. Banerjee, B. Financial Policy & Management Accounting. PHI.
4. Banerjee, B. Financial Policy and Management Accounting. Prentice Hall of India.
5. Basu, Banerjee, & Dandapat. Strategic Cost Management. University of Calcutta.
6. Blocher, Chen, Cokins, & Lin. Cost Management: A Strategic Emphasis. TMH.
7. Chandra, P. Financial Management. TMH.
8. Drury, C. Management and Cost Accounting. Thomson Learning and Taxman.
9. Horagren, Dabur, & Foster. Cost Accounting: A Managerial Emphasis. PHI and Persons Education.
10. Horne, V. Financial Management & Policy. Pearson Education.
11. Horne, V. Fundamentals of Financial Management. PHI.
12. Khan, M. Y., & Jain, P. K. Financial Management. TMH.
13. Kishore, R. M. Cost Management. Taxman.
14. Lucey, T. T. Management Accounting. ELBS.
15. Pandey, I. M. Financial Management. VIKAS.
16. Saxena, & Vashisht. Cost and Management Accounting. Sultan Chand.

E-Resources:

1. <https://www.caluniv.ac.in/academic/Commerce/Study/S-IV-CC-402-SCMA.pdf>
2. <https://icmai.in/upload/Students/Syllabus2016/Final/Paper-15-Oct-2020.pdf>
3. <https://www.distanceeducationju.in/pdf/Mcom%20Book.pdf>
4. https://www.icsi.edu/media/webmodules/publications/FULL_BOOK_PP-CMA-2017-JULY_4.pdf

Experiential Learning:

1. Prepare a project report considering real data to determine make or buy decision
2. Visit some manufacturing industries and experience the tools and techniques used.

Mapping of COs to Syllabus

Course Out-comes	Module I	Module II	Module III	Module IV
CO 1	H		H	

CO 2		H	H	H
CO 3				H
CO 4		H		H

4.2.2 MAJOR ELECTIVE -GROUP-1 FINANCIAL ANALYTICS (Course Code) (4 credits – 60 hours) (L-T-P: 4-0-0)

Course Objectives: The course "Financial Analytics" aims to equip students with the knowledge and skills necessary to effectively analyze financial data using various tools and techniques. By integrating theoretical concepts with practical applications, the course covers data management, descriptive and predictive analytics, and financial risk management. Students will gain hands-on experience with software like Excel, Python, R, Tableau, and Power BI, enabling them to clean, process, and visualize financial data. Through this comprehensive approach, the course fosters critical thinking and decision-making abilities, preparing students for advanced roles in finance and data analysis, and enhancing their capability to generate insightful financial reports and models.

COURSE/LEARNING OUTCOMES

CO1: Identify and recall the key concepts and tools in financial analytics, including data sources and software.

CO2: Explain the importance and applications of financial analytics in various financial contexts.

CO3: Utilize financial data management techniques to clean, process, and transform financial datasets.

CO4: Critically examine and interpret financial data using descriptive analytics and visualization tools.

CO5: Assess predictive models and their applications in finance, including stock price prediction and credit scoring.

CO6: Develop and implement predictive analytics models and risk management strategies using advanced analytical tools.

Module I: Introduction to Financial Analytics (10 hours)

Overview of Financial Analytics, Importance and Applications in Finance, Introduction to Financial Data Sources; Tools and Software for Financial Analytics (Excel, Python, R)

Module II: Financial Data Management and Cleaning (10 hours)

Data Collection Methods, Data Cleaning and processing, Handling Missing Data and Outliers Data Transformation Techniques Module

Module III: Descriptive Analytics and Data Visualization (15 hours)

Descriptive Statistics for Financial Data, Data Visualization Techniques, Creating Financial Dashboards, Tools: Tableau, Power BI, and Matplotlib /Seaborn in Python

Module IV: Predictive Analytics in Finance (15 hours)

Introduction to Predictive Analytics, Time Series Analysis and Forecasting, Regression Analysis and Machine Learning Models, Applications in Stock Price Prediction, Credit Scoring, etc.

Module V: Risk Management and Financial Analytics (10 hours)

Introduction to Financial Risk Management, Value at Risk (VaR) and Stress Testing Risk Analytics and Scenario Analysis, Tools for Risk Management: MATLAB, R, Python.

Experiential Learning:

This course immerses students in practical financial data analysis and management using advanced tools and techniques. Beginning with hands-on sessions utilizing Excel and Python, students gain foundational skills in data manipulation. They then progress to cleaning and managing financial datasets, addressing real-world data issues through case studies and projects with Python/Pandas and R. The course also emphasizes visualization, with workshops on creating financial dashboards and projects using Tableau, Power BI, and Python libraries. Students further explore predictive analytics, engaging in stock price prediction projects and machine learning exercises for financial forecasting. The course concludes with a focus on risk management, featuring case studies, practical sessions on calculating Value at Risk (VaR), conducting stress tests, and risk analysis projects using MATLAB and Python, thus equipping students to tackle complex financial challenges.

Suggested Readings:

1. S. Christian Albright/Wayne L. Winston Business Analytics: Data Analysis and Decision Making with MindTap Paperback – 1 September 2022
2. Sanjiv Jaggia, Kevin Lertwachara, Alison Kelly, Leida Chen : Business Analytics: Communicating with numbers; MC Graw hil
3. U Dinesh Kumar: Business Analytics: The Science of Data - Driven Decision Making Paperback – 1 January 2017, Willy publication

Digital Resources**Module 1: Introduction to Financial Analytics**

https://ebooks.lpude.in/newscheme/arts/ma_math/sem_4/DEFIN526_FINANCIAL_ANALYTICS.pdf

Module II: Financial Data Management and Cleaning

https://www.aranca.com/assets/uploads/resources/special-reports/Financial_Data_Management%E2%80%93A_Detailed_Step-by-Step_Approach.pdf

Module III: : Descriptive Analytics and Data Visualization

<https://02402.compute.dtu.dk/enotes/chapter1-DataVisualization.pdf>

Module IV: Predictive Analytics in Finance

https://www.predictiveanalyticsworld.com/book/pdf/Predictive_Analytics_by_Eric_Siegel_Excerpts.pdf

Module V: Risk Management and Financial Analytics

<https://core.ac.uk/download/pdf/43020566.pdf>

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L	L		M	
CO 2	M	H	H		
CO 3		M			H
CO 4			H		
CO 5			M		H

4.3 MAJOR-ELECTIVE-GROUP 2(HR AND MARKETING)**4.3.1 DIGITAL MARKETING AND E-COMMERCE (Course Code)**

(4 credits - 60 hours) (L-T-P: 4-0-0)

Course Objective: After studying this course, the students will be able to learn about the different knowledge and skills needed for effective digital marketing in the corporate sectors and entrepreneurial ventures.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the fundamentals of website marketing and basic knowledge of Electronic Commerce, Mobile Commerce, IoT Platforms and Social commerce (Remembering)

CO 2: Explain the fundamentals of search engine technology (Understanding)

CO 3: Interpret the various types of social media marketing. Digital Payments systems and methods (Applying)

CO 4: Analyze the models of digital marketing (Analyzing)

CO 5: Evaluate the web analytics and social media analytics (Evaluating)

Module I: Electronic Commerce, Mobile Commerce, Social Commerce, IoT (15 hours)

Definition, Benefits, Limitations, Ecommerce Platforms, Impact of E-Commerce on Business, government, customer and society. E-Business, E-Markets, Electronic Storefronts, Types of e transactions – B2B, B2C, C2C, C2B, Business Models. Affiliated and Hybrid Models. Digital Economy, Enterprise and online Communities. Mobile & Social Commerce - Meaning, Attributes, Applications and Benefits to customers, retailers, employees. Social Collaboration and its essentials. Concepts of Internet of Things (IoT) and its applications.

Module II: The E-Business Technology and E Security (15 Hours)

Understanding Networks - routing, switching and protocols, Web Presence – domain registration, website development and hosting, Web server hardware and software; Data center services, Security – service providers, digital certificates, encryption, SSL, Digital signatures.

Module III: Digital Payments (10 Hours)

Smart Cards, Stored-Value Cards, EC Micropayments, Payment Gateways, Mobile Payments, Digital and Virtual Currencies, Security, Ethical, Legal, Privacy, and Technology Issues.

Module IV: Digital Business Applications (20 Hours)

Electronic Retailing, E-Tailing, Social Shopping, Fintech: E-Banking, Mobile Banking, Pure Virtual Banks, Insurance, and Stock Trading, Other Mobile Finance Applications. Digital Government: Government-to-Citizens, Government-to-Business, Government-to-Government, Government-to-Employees Models. E Learning, E-Training, and E-Books, Distance Learning and Online Universities, Online Corporate Training, E-Learning Management Systems. Online Travel and Tourism, E-Employment: Online Job Market, Social Networks Based Job Markets, Social Recruiting, Virtual Job Fairs and Recruiting Events, E-Health, Electronic Medical Record Systems (EMR), Doctors' System, Patients Services, Medical Devices and Patients Surveillance. Entertainment, Media & Gaming: Service Industry Consumer Applications. Digital Products, Internet TV and Internet Radio, Social Television (TV) Mobile Entertainment, Mobile Marketing, Mobile Streaming Music and Video Providers, Entertainment in Cars; Gaming - Mobile Games, Social Games and Gamification, Business of Social Games, Educational Social Games; Mobile Gambling, Mobility and Sports; Social Entertainment.

Suggested Readings

1. Introduction to E Commerce & Social Commerce, Turban E , Whiteside J , King D, Outland J Springer
2. E-Business and E-Commerce Management- Strategy, Implementation and Practice, Dave Chaffey, Pearson Education.
3. Electronic Commerce – A Managerial Perspective, Efraim Turban, David King, Dennis Viehland, Jae Lee, Pearson Education.
4. E-Commerce: Strategy, Technologies and Applications Paperback – 2001 by David Whiteley
5. E-Commerce: An Indian Perspective Paperback – Import, 30 Nov 2015-by P. T. Joseph
6. One Click: Jeff Bezos and the Rise of Amazon.com Kindle Edition- by Richard L. Brandt
7. Ahuja V. Digital Marketing, Oxford University Press.
8. Dodson, I. (2016). The Art of Digital Marketing: The Definitive Guide to Creating Strategic.

e-Resources:

Module I: <https://www.scribd.com/document/514335334/Unit-2-Mobile-Commerce-Social-Commerce-IOT>

<https://www.geeksforgeeks.org/difference-between-e-commerce-and-m-commerce/>

Module II: <https://www.getastra.com/blog/knowledge-base/ecommerce-security/>

Module III: <https://www.betterthancash.org/define-digital-payments>

<https://razorpay.com/learn/digital-payments-india-definition-methods-importance/>

Module IV: <https://www.simplilearn.com/digital-business-article>

https://vikramuniv.ac.in/files/wp-content/uploads/BE_EE-EC_2nd_Sem_BCE_Computer_applications_in_E-Business_Pratibha_Saraf.pdf

Experiential Learning

1. Experimenting with various software tools and apps, data analysis and securities systems
2. Case study
3. Group discussions about the benefits and challenges of digital marketing.
4. Class Test, Assignment and practical know how and End Semester Examinations.

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV	Module V
CO I	H	H	M	M	M
CO II	H	H	H	M	L
CO III	H	L	H	H	M
CO IV	L	L	M	M	M
CO V	H	M	H	H	L

4.3.2 STRATEGIC HUMAN RESOURCE MANAGEMENT (Course Code)

(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective: The objective of this course is to develop within the students the understanding of the student with relevant concepts, roles and challenges related to strategic human resource management practices in the workplace and design the requisite skills to be competent contributors in the organization's strategic

decision-making process and make them competent to for various managerial and administrative positions in different organizations.

Course/ Learning Outcomes:

After learning this course, the students will be able to:

CO 1: Define the hierarchy of strategy, classify between traditional HR and strategic HR. (Remembering)

CO 2: Explain the factors behind the emergence of strategic human resource management (Understanding)

CO 3: Choose the aims of strategic HRM, interpret the various approaches to strategic HRM and identify the barriers in implementing HR strategies (Applying)

CO 4: Analyze the concept of HR strategies, explain the approaches of developing HR strategies and analyses the ways in which HR strategies can be implemented (Analyzing)

CO 5: Analyze the strategic role of the HR director, determine the strategic role of the HR specialists and design the new mandate for HR

CO 6: Evaluate the various approaches to motivation, develop the retention strategy and flexibility strategy that should be adopted by an organization (Creating)

Module I: Introduction to Strategic Human Resource Management (12 hours)

Introduction, Strategy, Hierarchy of Strategy, Corporate Level Strategy, Business Level Strategy, Functional Level Strategy, Strategic HRM, Emergence of Strategic Human Resource Management (SHRM), The Evolutionary Stages of Strategic HRM, Difference Between Traditional HR and Strategic HR.

Module II: Concepts of Strategic Human Resource Management (12 hours)

Introduction, Trends in Strategic Human Resource Management, HR Practitioners Role, Human Resource as Competitive Advantage, Aims of Strategic HRM, Approaches to Strategic HRM, Formulation of HR Strategies, The Classical Sequential Approach, The Empirical Need-based Approach, Achieving Strategic Fit, Problems in Achieving Strategic Fit, Benefits of Strategic HRM, Barriers to Strategic HRM.

Module III: Human Resource Strategies and its Implementation (12 hours)

Introduction, HR Strategies, Types of HR Strategies, Overarching Strategies, Specific HR Strategies, Criteria for an Effective HR Strategy, Developing HR Strategies, Methodology for Formulating HR Strategies, Setting Out the Strategy, conducting a Strategic Review, Implementing HR Strategies Barriers to the Implementation of HR Strategies, Overcoming the Barriers.

Module IV: Roles in Strategic Human Resource Management (12 hours)

The Strategic Role of Top Management, The Strategic Role of Front-line Management, The Strategic Role of the HR Director, The Strategic Role of the HR Specialists, The New Mandate for HR, The Specific Strategic Roles of HR, Business Partner, The Innovation Role, The Change Manager Role, The Implementer Role.

Module V: Challenges in Strategic Human Resource Management (12 hours)

Introduction, The Challenges of Workplace Diversity, The Management of Workplace Diversity, Managing Diverse Workforce in an Organization, planning a Mentoring Program, Organizing Talents Strategically, Retention Strategy, Talent Management Strategy and its components, Approaches to Human Resource Planning, Managing Executive Information Systems, Challenges for HR Managers, HRM Strategic Challenges.

Experiential Learning:

Experiential learning in strategic human resource management (SHRM) involves students engaging in hands-on, real-world activities to understand and apply HR concepts and strategies. This approach includes:

1. Simulations and Role-Playing: Students participate in scenarios that mimic real HR challenges, such as negotiations, conflict resolution, and strategic decision-making.
2. Case Studies: Analysis of real or hypothetical business cases to identify and solve HR issues, allowing students to apply theoretical knowledge to practical situations.
3. Internships and Field Projects: Direct involvement in HR functions within organizations to gain practical experience and insights into HR practices and strategies.
4. Workshops and Seminars: Interactive sessions with HR professionals to discuss current trends, challenges, and innovations in the field.
5. Collaborative Projects: Team-based assignments where students develop HR strategies or solutions for specific organizational needs.

This method helps students develop critical thinking, problem-solving skills, and a deeper understanding of strategic HRM by connecting theory to practice.

Suggested Readings

1. Deb Tapomoy , Strategic Approach to Human Resource Management Concept, Tools and Application, Atlantic Publishers & Distributors Pvt Ltd.
2. Nayantara Padhi, Strategic Human Resources Management: Theory and Practice, Atlantic Publishers and Distributors Pvt. Ltd; 1 edition
3. Mello Jeffrey A., Strategic Management of Human Resources, Cengage Learning, 3rd edition
4. Sharma A, Khandekar A, Strategic Human Resource Management – An Indian Perspective, SAGE Publications
5. Schuler, R. S., & Jackson, S. E., 2009, Strategic Human Resource Management.2nd ed., Wiley-India
- 6.Sharma, A and Khandekar, A., 2006, Strategic Human Resource Management: an Indian perspective.1st ed., Response Books.

E- Resources:

<https://www.otaru-uc.ac.jp/~js/downloads/SP2005-PDF/SP2005-Chapter2SHRM.pdf>

<https://unicourse.org/wp-content/uploads/2020/10/U3-Human-Resource-Management.pdf>

https://www.fcs.uga.edu/docs/Managing_Diversity_in_the_Workplace.pdf

https://allcatsrgrey.org.uk/wp/download/management/human_resources/Talent-Management-Strategy-App-1.pdf

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	L			
CO 2		M	L	L
CO 3	M	M	M	
CO 4		H	H	M
CO 5				H

4.4 DISSERTATION- PHASE-ii

(8 credits- 120 hours))(L-T-P: 0-0-8)

Course Objective: The objective of the course would be to develop analytical skills among the students for solving any research queries. The students will also be taught about the preparation of a project report.

This phase of the Dissertation will comprise of the following:

- 1.Field Work: Collection of data and validation with the respective guide (30 hours)
- 2.Analysis of Data: Analysis and presentation of the data collected though application of various statistical tools though SPSS and other statistical software packages. (10 hours)
- 3.Test of Plagiarism.
- 4.Submission of Project Report: Submission of the complete report in continuation from Phase I.
- 5.Presentation of work using PPT and Viva Voce Examination.

Evaluation:

Evaluation at Phase II will be done by a panel comprising of an external and internal expert along with the respective guide based on quality of work as follows:

Report (50marks)

Presentation (30marks)

Viva-Voce (10marks)

DISSERTATION GUIDELINES**Chapter I: INTRODUCTION**

- a. Broad introduction to thesis topic and method. Page or two. Write after remainder of proposal is completed.
- b. Research problem. State broadly, in question form. Give sub-questions. Explain carefully. In one sense, usually the problem is to expand the body of knowledge examined in the literature review.
- c. Need for the research. Who will benefit? Discuss applied and scientific contributions.
- d. Nominal definitions. Define central terms.
- e. Context. Add further info to clarify the research problem.

Chapter II: THEORY: LITERATURE REVIEW

Organize by idea; avoid stringing together abstracts of articles

- a. Overview. Theoretical foundations.
- b. Literature. Group articles by ideas. For a given idea, first discuss common strands in the literature, then departures.
- c. Model. Of a process, usually. Based on the lit reviewed.
- d. Hypotheses (in broad sense of the term; also called Propositions). For each, give brief restatement of justification tied to earlier sections; explain derivation and implications. Include assumptions. Explicitly state plausible rival hypotheses (explanations of process) of a substantive nature
- e. Scope of the study. Theoretical assumptions; discuss limitations they impose.

Chapter III: METHODS

Outline in a few pages.

- a. Introduction. General description of method and design
- b. Design. Experiment, quasi-experiment, survey, and so forth. Detailed description
- c. Sample. Universe, population, element, sample design, tolerance, probability.
- d. Measurement. Operational definitions, Include, as applicable, detailed discussion of indexes/ scales. Specify methods used to assess validity and reliability.
- e. Analysis. Techniques to be used; justification. Nature of relationships expected (e.g., a symmetrical, symmetrical, reciprocal; linear, monotonic, other curvilinear; necessary, sufficient, necessary and sufficient). Include dummy tables and worked examples of statistics.
- f. Validity. Design: Internal and external, with relevant subtypes.
- g. Methodological assumptions. Discuss limitations they impose.

APPENDICES:

- a. Schedule. In Gantt Chart form.
- b. Facilities. Faculty and staff expertise, library and computer resources, other special facilities contributing to a successful study
- c. Budget.
- d. Bibliographic essay. Sources searched (indexes, abstracts, bibliographies, etc.). Strengths and weaknesses of literature.

Chapter IV: FINDINGS

- a. Brief overview.
- b. Results of application of method; any unusual situations encountered. Nature of sample.
- c. Descriptive analysis. One-way frequency distributions on central variables.
- d. Validity/reliability analysis.
- e. Tests of hypotheses. ANOVAs, cross tabulations, correlations, and such, depending on techniques used; give in same order as hypotheses.

Chapter V: DISCUSSION

When discussing implications, deal with both the theoretical and the practical. Present only interpretations of the findings, not opinion.

- a. Brief overview.
- b. Discussion of results of application of method. Implications.
- c. Discussion of descriptive analysis. Implications.
- d. Discussion of tests of hypothesis. Implications.
- e. post-hoc analysis. Implications.

Chapter VI: CONCLUSION

May include writer's opinion

- a. Summary of entire thesis in a few pages.

- b. Conclusions. Refer to lit review.
 - c. Implications. Speculate about broadest possible consequences, both theoretical and practical. Label speculation clearly.
 - d. Limitations. Theory, method
 - e. Suggestions for future research.
- APPENDICES, Bibliographic essay, Questionnaire and coding manual, if any. Raw data.
- BIBLIOGRAPHY, include all relevant sources examined, whether cited or not.

M.com 1 Year PG Program as per NEP 2020

PROGRAMME VISION

To be the transformative two-year Post Graduate Program that provides a new direction and impetus for the growth of business education, fostering a strong theoretical foundation, practical application, and research orientation to produce graduates who are equipped to accept challenges, achieve success in life, and meet the needs of different stakeholders.

PROGRAMME MISSION

The M.Com Programme is committed to:

- 1. Foundational Knowledge and Practical Application: Offer up-to-date, comprehensive disciplinary knowledge in different aspects of Commerce, covering functional areas like Accounting, Finance, Taxation, Marketing, and Human Resource Management, while translating classroom learning into practical solutions for business problems.
- 2. Analytical and Critical Skills Development: Enhance critical thinking and analytical abilities among students through project work and application of appropriate analogical systems and teaching methods, thereby developing the potential to face the complexities of the outside world.
- 3. Professional and Research Competency: Develop research competencies and provide specialized knowledge in industry-aligned groups—Accounting & Finance or Human Resources & Marketing—to prepare students for various competitive exams and foster self-employment.
- 4. Ethical Leadership and Societal Accountability: Cultivate ethical and socially accountable citizens by enabling effective decision-making and fostering the ability to ascertain unethical behaviour and manipulation of information, supported by mandatory Service Learning and ethical curriculum components.

The purpose of establishing the Department is:

1. To provide a broad-based policy direction for the development of Commerce education.
2. To identify new programs to be launched in the Department of Commerce.
3. To coordinate and monitor various activities in research and extension.

The Department focuses on the following aspects:

- a. To offer up to date knowledge in different aspects of Commerce.
- b. To develop healthy interactions by applying appropriate analogical systems and teaching methods.
- c. To evaluate the performance of the learners by using transparent, effective and reliable methods of evaluation.
- d. To develop an acceptable standard of learning that caters to the needs of different stakeholders

The M. Com Program structure aims to provide

- i) A conducive environment for learning and dissemination of knowledge.
- ii) To establish a strong theoretical foundation and practical application
- iii) To develop research orientation.
- iv) To prepare students for various competitive exams
- v) To prepare students to accept challenges, face and achieve success in life.

The Major Subjects have the following Specialization:

- Group 1 - Accounting and Finance
- Group 2 - Human Resources Management and Marketing Management

Apart from the regular curriculum, skilled development programs are also conducted to enhance the special skill sets of students. The curriculum also provides opportunities for students to select any other course of their interest from any other Department in the University Campus and earn extra credit over and above their normal credits. Students of other Departments can choose any of the subjects run by the Department and earn extra credits. The specializations offered at the Department are decided as per the needs of the industry. The program thus offers a wide range of choice to broaden their capabilities and skills thus providing them enough potential to face the complexities of the outside world.

Duration of the Program: It is a Two-Year (Four semesters) Program. At the End of the Year, student will receive a Post graduate degree in the required Specialization chosen by the candidate.

Program Outcomes

PO1	Disciplinary Knowledge	Acquire Comprehensive disciplinary knowledge and its implications.
PO2	Critical Thinking	Ability to engage in reflective and independent thinking by understanding the concepts of Commerce and Business. Ability to examine the problems in different branches of Commerce and Business.
PO3	Problem Solving	Capability to reduce a business problem and apply the classroom learning into practice to offer a solution for the same.
PO4	Leaders in communities	Effective decision making in business and commerce through meaningful and impactful community engagement practices.
PO5	Research Skills	Ability to search for, locate, extract, organize, evaluate, analyse and report information that is relevant to particular problem
PO6	Moral and Ethical Values	Ability to ascertain unethical behaviour, falsification and manipulation of information

Program Specific outcomes (PSO)

PSO 1: To enhance knowledge in different functional areas of Commerce viz. Accounting, Finance, Taxation, Marketing and Human Resource Management.

PSO 2: To enhance Critical Thinking, Analytical and Problem-Solving abilities among the students by engaging them on real life projects and assignments.

PSO 3: To develop the research competencies among students by enabling them to conduct research and project work in the different areas of Commerce.

PSO 4: To foster self-employability among the graduates by enriching the entrepreneurial traits required to create and manage their own ventures.

PSO 5: To groom the students to be ethical and socially accountable citizens.

M.com One Year PG Program structure

Year	Semester	Category	Description	Credit	Type
II	1	Major	1.1 Research Methodology	4	Core Course
		Major	1.2 Ethics, Corporate Governance and Sustainability	4	Core Course
		Major	1.3 Income Tax Laws and Compliance	4	Core Course
			1.4 Accounting and Finance-Group-1		Specialization
		Major Elective	1.4.1 Recent Advances in Accounting	4	Specialization course
		Major Elective	1.4.2 Business Analysis and Valuation	4	Specialization course
			1.5 HR & Marketing-Group-2		Specialization
		Major Elective	1.5.1 HR Analytics	4	Specialization course

2		Major Elec- tive	1.5.2 Advanced Marketing Management	4	Specialization course
		CVB	1.6 Service Learning	2	Mandatory for all (Theory and Field work)
		CVB	1.7 Constitution of India	P/NP	Mandatory for all (Theory and Field work)
			1.8 Dissertation-Phase-I	2	Research-
			Total Credit	24	
		Major	2.1 Production and Operation Management	4	Core Course
			2.2 Accounting and Finance-Group-1		Core Course
			2.2.1 Strategic Cost and Management Accounting	4	Specialization course
			2.2.2 Financial Analytics	4	Specialization course
			2.3 HR & Marketing-Group-2		Specialization
			2.3.1 Digital Marketing and E-Commerce	4	Specialization course
			2.3.2 Strategic Human Resource Management	4	Specialization course
		Major	2.4 Dissertation- Phase II	8	Major Research
		Total credit		20	

Total Credits: 44 Credits

Note: After the First semester examination (During Semester break) students will have to do service-learning field work for 60 hours. A report of the field survey is to be submitted along with a Viva voce examination. The maximum marks for the service learning is 100.

COURSE OUTCOMES MAPPING WITH POs/PSOs

Course	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4	PSO5
1.1	M				M	M	H	M	M	M	
1.2	L	L			L	M	L	L	L		L
1.3				H				M		M	
1.4.1		M			M	L		L			
1.4.2			M			H			L		
1.5.1			M							L	M
1.5.2				H				M			
1.6		L						H			
1.7				L						H	
1.8							M				
2.1	M				M	H	M		M		
2.2.1	M	L			L	M	L	L	L		M
2.2.2		L					M			H	
2.3.1	M	M	M				M	L	L		
2.3.2		M			M		L				H
2.4		H							H		M

DETAILED SYLLABUS

FIRST SEMESTER

1.1 MAJOR- RESEARCH METHODOLOGY (Course Code)

(4 credits-60 Hours) (3-0-1: L-T-P)

Course Objective: This course is designed to provide students with the necessary skills and knowledge to address an identified research problem (basic or applied) and, using this understanding, develop and use an actionable research proposal. In this process, the students will gain an understanding of relevant approaches and elements of undertaking a research enquiry specifically to provide insights to solving a relevant problem.

Course/Learning Outcomes

At the end of the course students will be able to:

- CO1: Define basics of research and its types. (Remembering)
- CO2: Explain research design. (Understanding)
- CO3: Explain survey methods for data collection, research instruments, best practices used and apply various data collecting techniques. (Applying)
- CO4: Classify, analyse and draw inferences from Data. (Analysing)
- CO5: Preparation of draft thesis and presenting research report (Creating)

Module I: Introduction to research (10 Hours)

Concept, objectives, types of research; approaches to research-qualitative and quantitative research, case study research, research methodology.

Module II Research Design (10 hours)

Research Design: Defining and developing a Research Problem, how to approach. Types of research approach and research design.

Module III Survey design & Measurement (15 hours)

Survey design & Measurement: Survey Design- Variables, design of research instruments and data preparation - Validity & Reliability, Best Practices.

Measurement & Scaling Types, Sampling – sample size and techniques

Module IV Research Analytics (15 hours)

Research Analytics: Hypotheses testing, Correlation and Regression overview and intro to SPSS, MS-Excel, Factor analysis, Cluster Analysis, MS-Excel

Module V Research Report writing - (10 hours)

Best practices, References and Bibliography, Ethics in Research.

Experiential Learning: (Any 2/3 experiential learning best practices will be done in one of the semester)

1. Assignment to prepare notes on introduction of research, its type, research methodology etc. Second- Group discussion among different groups and summary of the discussions will be presented by each group
2. Do some literature review from existing research publications and find out the research design and make note of it. Assignment on Research design and approach with example
3. Select any research topic and finalize it and make a survey related to research title framed and submit to the department
4. Analyze the research data collected through survey: Learn basics of SPSS Analytics tool; Analyze the data using excel MS office platform; Finally submit an analysis report.
5. Assignment on Bibliography, Plagiarism etc. and Also One assignment to submit style with example the references and Bibliography.

Suggested Readings

1. Kothari C.R, Research Methodology: Methods and Techniques, New Age International,
2. Srivastava, S. C. : Foundation of Social Research and Economics Techniques, Himalaya Publishing House, 1990.
3. Sharma H.D. and Mukherji S. P: Research Methods in Economics and Business, New York : The Macmillan Company, 1992.
4. Saunders M , Philip Lewis and Adrian Thornhill, Research Methodology for business students, Pearson Education
5. Michael V.P, Research Methodology in Management, Himalaya Publishing House

Digital Resources:

6. Research Methodology: <https://www.uou.ac.in/sites/default/files/slm/BHM-503T.pdf>
7. Types of research design: <https://emeritus.org/in/learn/types-of-research-design/>
8. Youtube Video Lectures on Research: <https://www.youtube.com/watch?v=51HnRTt4KeQ>
9. Youtube Video Lectures on Sampling: <https://www.youtube.com/watch?v=Yw9cctUHULo>
10. Thesis writing: <https://web.uri.edu/engineering/student-support/thesisguide/bibliography/>
11. Writing Bibliography: https://www.tezu.ernet.in/dener/programme/Bibliography_Style.pdf

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M		M	
CO 2	M	H	H		
CO 3		M			H
CO 4	M			H	
CO 5			M		H

1.2 ETHICS, CORPORATE GOVERNANCE AND SUSTAINABILITY (Course Code)**(4 credits-60 Hours) (4-0-0: L-T-P)**

Course Objective: To familiarize the students with the knowledge of ethics, good governance practices; Corporate Social Responsibility in the global and Indian context and Sustainability

Course/Learning Outcomes

At the end of the course students will be able to:

- CO1: Define ethics, different ethical theories, Code of Ethics, Ethical compliances
 CO2: Explain the conceptual framework of corporate governance
 CO3: Explain different committees involved and its structure
 CO4: Define whistle-blowing and its policy details
 CO5: Elaborate sustainability and role of corporate governance in sustainability

Module I: Business Ethics (15 Hours):

The concept of ethics; various approaches to business ethics; ethical theories; ethical governance; social responsibility-an extension of business ethics; ethical principles in business; role and functions of Board of Directors; addressing ethical dilemmas; code of ethics; standing committees, ad-hoc committees, task force committees, advisory committees; powers, functions and duties of board committees; enhanced performance of board committees; limitations of board committees; statutory committees of board- audit committee, remuneration committee, nomination committee, compliance committee, shareholders grievance committee, investors relation committee, investment committee, risk management committee, other committees.

Module II: Conceptual Framework of Corporate Governance (8 Hours)

Introduction, need and scope; Evolution of corporate governance; developments in India; regulatory framework of corporate governance in India; Developments in Corporate Governance- A Global Perspective;

Management vs. Governance; internal constituents of the corporate governance; key managerial personnel (KMP); chairman- qualities of a chairman, powers, responsibilities and duties of a chairman; green governance/e-governance

Module III: Board Committees: (8 Hours)

Role and Functions of Board Committees: Standing committees, ad-hoc committees, task force committees, advisory committees; powers, functions and duties of board committees; enhanced performance of board committees; limitations of board committees; statutory committees of board- audit committee, remuneration committee, nomination committee, compliance committee, shareholders grievance committee, investors relation committee, investment committee, risk management committee, other committees.

Module IV: Whistleblowing and Corporate Governance: (8 Hours)

The Concept of Whistle-Blowing; Types of Whistle-blowers; Whistle-blower Policy; the Whistle-Blower Legislation across Countries; developments in India.

Module V: Sustainability: (8 Hours)

Meaning and scope; Corporate Social Responsibility and Corporate Sustainability; Triple Bottom Line; Corporate Sustainability Reporting Framework; Global Reporting Initiative Guidelines; Sustainability Indices; Challenges in Mainstreaming Sustainability Reporting.

Module-VI: Navigating Legal Obligations for Your Company

- **Understanding Regulatory Frameworks:** Adhering to industry-specific laws and regulations governing operations.
- **Compliance Challenges:** Navigating evolving regulations to avoid legal consequences and financial penalties.
- **Compliance Programs and Policies:** Establishing compliance programs and policies to ensure adherence to relevant laws.
- **Compliance Monitoring and Reporting:** Implementing mechanisms to monitor compliance efforts and address violations promptly.
- **Compliance Training and Awareness:** Providing comprehensive training to educate employees about relevant laws, regulations, and company policies.

Suggested Readings and E-Resources

1. Business Ethics and Corporate Governance by Redshine Publications pvt Ltd by Dr. Indrajit Goswami, Dr. S. Saravanan, Dr. Sanjay Prasad Lalita, Babulal Malusare, Dr. Pankaj Choudhary
2. Corporate Governance and Business Ethics by K Sravana

Experiential Learning: (Any 2/3 experiential learning best practices will be done in one of the semesters)

1. Form a board committee and analyses through group discussions on the ethical considerations in business houses. Draw a road map out of the discussions.
2. Prepare a mini project on Corporate Governance: Indians Perspectives as well as in Global perspectives
3. Appoint the members in Board committee and do case study and analyses on the role of board committee members
4. Whistle-Blower Legislation across Countries; developments in India- Narrate through debate and open writing competition
5. Sustainability indices, Global Reporting Initiative Guidelines

Mapping of the COs

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	M		L		M	
CO2		L				L
CO3			M			
CO4	L			M		
CO5					H	H

1.3 INCOME TAX LAWS AND COMPLIANCE

(Credits: 4 – 60 hours) (L-T-P: 4-0-0)

Course Objective: To provide basic knowledge and equip the students with application of the principles of taxation and to acquaint them with the various provisions of Income-tax Act, 1961 and the relevant rules for filing of returns.

Course/Learning Outcomes

After learning this course, the students will be able to:

- CO1: Understand the various concepts and provisions related to direct tax laws. (Understanding)
- CO2: Execute the knowledge of the provisions of the direct tax laws to the various situations in actual practice. (Applying)
- CO3: Analyze the procedures related to filing of returns and TDS (Analysing)
- CO4: Evaluate the requirements of different assessee for filing tax returns under the income tax laws. (Evaluating)
- CO5: Develop the skill of creativity in the field of direct tax laws with regard to tax savings. (Creating)

Module I: Introduction (10 hours)

Basic concepts: Income, agricultural income, person, assessee, assessment year, previous year, gross total income, total income, Permanent Account Number (PAN) Residential status: Scope of total income on the basis of residential status, Exempted income under section-10

Module II: Computation of Income under different heads (18 hours)

Income from Salaries; Income from house property

Module III: Computation of Income under different heads (10 hours)

Profits and gains of business or profession; Capital gains; Income from other sources

Module IV: Total income and Tax Computation (12 hours)

Income of other persons included in assessee's total income; Aggregation of income and set-off and carry forward of losses; Deductions from gross total income; Rebates and reliefs,

Module V: Preparation of Return of Income (10 hours)

Computation of total income of individuals and firms; Tax liability of an individual and a firm; Filing of returns, TDS Provision & Procedures of Compulsory Online filing of returns for assessee with salaried income and/or business income

Suggested Readings and E resources:

1. Singhania, Vinod K. and Monica Singhania. Students' Guide to Income Tax, University Edition. Taxmann Publications Pvt. Ltd., New Delhi.
2. Ahuja, Girish and Ravi Gupta. Systematic Approach to Income Tax. Bharat Law House, Delhi. Journals
3. Income Tax Reports. Company Law Institute of India Pvt. Ltd., Chennai.
4. Taxman. Taxmann Allied Services Pvt. Ltd., New Delhi.
5. Singhania Vinod Kumar, e- filing of Income Tax Returns and Computation of Tax, Taxmann Publication Pvt. Ltd., New Delhi. Latest version
6. Excel Utility' available at incometaxindiaefiling.gov.in
7. https://onlinecourses.swayam2.ac.in/cec22_cm01/course

Experiential Learning:

- Real-life case studies, role-play scripts to enhance their ability to apply tax laws to different situations.
- Providing students with anonymous real-life salary slips and asking them to analyze different components.
- Assigning projects where students research specific deductions or tax strategies and present their

- findings. Students investigate various deductions and their eligibility criteria.
- Demonstration of online filing of Returns of Income

Mapping of COs to Syllabus:

	Module-1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2		M	M	M	
CO 3					H
CO 4		M	M	M	H
CO 5	L	M	M	H	

1.4 MAJOR ELECTIVE COURSES-GROUP 1 (ACCOUNTING AND FINANCE)**1.4.1 RECENT ADVANCES IN ACCOUNTING (Course Code)****(4 Credits-60 Hours) (L-T-P: 4-0-0)**

Objectives: The course "Recent Advances in Accounting" aims to provide students with a comprehensive understanding of the latest developments and emerging trends in the field of accounting.

Course/Learning Outcomes

At the end of the course the students will be able to:

- CO1: Identify and recall key concepts and recent developments in Indian Accounting Standards, International Financial Reporting Standards (IFRS), inflation accounting, environmental accounting, forensic accounting, behavioral accounting, social accounting and Human resource Accounting. (Remembering)
- CO2: Explain the fundamental principles and recent changes in accounting standards, as well as the processes and purposes of specialized accounting fields such as inflation, environmental, forensic, behavioral, and social accounting and Human resource Accounting (Understanding)
- CO3: Utilize advanced accounting techniques to prepare financial statements under various accounting frameworks, including inflation and environmental accounting. (Applying)
- CO4: Critically examine the impact of adopting new accounting standards and practices on financial reporting, business decision-making, and compliance. (Analyzing)
- CO5: Assess the effectiveness, benefits, and challenges of recent advances in accounting practices and standards. (Evaluating)
- CO6: Develop comprehensive financial and non-financial reports that incorporate advanced accounting practices and address contemporary issues in the field. (Creating)

Module I: Introduction to Indian Accounting standard (10 Hours)

Indian Accounting Standard, Indian reporting standard; Recent changes in Indian Accounting standard; International Financial Reporting Standards Framework (IFRS); Comparison of IFRS with other Reporting Standards.

Module II: Inflation Accounting (10 Hours)

Meaning; techniques of inflation accounting; determination of value of assets and liabilities under inflation accounting; accounts preparation under inflation accounting.

Module III: Social and Environmental Accounting (10 Hours)

Meaning; purpose of social accounting; scope & objectives of social accounting; benefits & challenges of social accounting; accounting under social accounting, Meaning; functions of environmental accounting; valuation process under environmental accounting, methods of evaluation under environmental accounting; accounts preparation under environmental accounting.

Module IV: Forensic Accounting (10 Hours)

Meaning; branches of forensic accounting; activities under forensic accounting; procedure of forensic accounting; stages of forensic accounting; application and consequences of forensic accounting.

Module V: Behavioral Accounting (10 Hours)

Meaning; process of behavioral accounting; application of behavioral accounting; techniques of behavioral accounting; influence of accounting information on behavior.

Module VI: Human Resource Accounting

Definition and objectives of HRA, Evolution and historical development, Importance and relevance in modern business, Methods of Human Resource Valuation- Cost-based methods (historical cost, replacement cost), Economic value methods (present value of future earnings, opportunity cost) Behavioral approaches to valuation, Human Capital Reporting Standards and Guidelines Global standards (e.g., International Accounting Standards - IAS) Reporting guidelines for human capital.

Experimental learning:

Experiential learning in this course involves a series of practical activities designed to deepen students' understanding of financial and accounting principles through real-world applications. Students will analyze case studies on IFRS adoption, identifying challenges and benefits while proposing transition plans, and engage with industry experts to discuss recent changes in accounting standards. They will participate in hands-on workshops to adjust financial statements for inflation and simulate the role of financial analysts in dynamic market scenarios. Environmental impact assessments and field trips to sustainable businesses will expose students to environmental accounting practices. Forensic accounting simulations and role-playing exercises will help them understand the procedures and perspectives involved in investigating financial fraud. Behavioral experiments and interactive workshops with psychologists will explore how accounting information influences decision-making. Lastly, case studies and workshops on human resource valuation will allow students to apply various methods to assess the impact of human resource accounting on financial statements.

Suggested Readings

1. Lal, Jawahar, Accounting Theory and Practice, Himalaya Publishing House, New Delhi
2. Pedneault, Stephen, Forensic Accounting and Fraud Investigation for Non-Experts, John Wiley & Sons; 3rd edition, New Delhi.
3. Pahuja, Shuchi, Environmental Accounting & Reporting: Theory, Law & Empirical Evidence, New Century Publications, New Delhi.
4. Hellmann, Andreas, Behavioral Accounting, Routledge; 1 edition, New Delhi.
5. Rao, P.M., Corporate Social Accounting and Reporting, Deep & Deep Publications Pvt.ltd , Delhi.

Digital Resources:

Module 1: Recent changes in Indian Accounting standard:

<https://kb.icai.org/pdfs/PDFFile5b2790f4a60cd2.23292873.pdf>

Module 2 : Inflation Accounting: <https://vitiyagyan.icai.org/wp-content/uploads/2023/01/Copy-of-Inflation-Accounting.pdf>

Module 3: Social and Environmental Accounting: https://www.caluniv.ac.in/dj/BS-Journal/2002-2004/social_and_environmental.pdf

Module 4: Forensic Accounting <https://egyankosh.ac.in/bitstream/123456789/80372/1/Unit-16.pdf>

Module 5: Behavioural Accounting : http://www.untag-smd.ac.id/files/Perpustakaan_Digital_1/ACCOUNTING%20Behavioral%20management%20accounting.pdf

Module 6: Human Resource Accounting: https://backup.pondiuni.edu.in/storage/dde/downloads/hrmiv_hra.pdf

Mapping of Course Outcomes

	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6
CO 1	H	M		M	M	M
CO 2	M	H	H			M
CO 3		M		M	H	M
CO4	M	M	H	M	H	M
CO5	M	M	H		M	
CO6	M	M		H	M	H

1.4.2 BUSINESS ANALYSIS AND VALUATION (Course Code)

(4 credits-60 Hours) (L-T-P: 4-0-0)

Objective: This course provides a comprehensive framework for using financial statements to evaluate a company's strategy execution, performance, financial prospects, and value. The objective of the course is to provide hands-on experience in financial statement analysis and valuation that enhances investment decisions. Students will be able to analyze complex financial statements to gain a richer understanding of firm performance and value.

Course/Learning Outcomes

At the end of the course students will be able to:

- CO2: Understand the critical valuation challenges of IPOs and M&As deals.
- CO3: Conduct fundamental analysis using real-world financial data.
- CO3: Detect the overall quality of financial reporting information provided by firms.
- CO3: Analyse credit risk and equity risk using financial statements.
- CO4: Use accounting information to assess past and current firm financial performance.
- CO4: Implement prospective analysis to forecast future earnings growth.
- CO4: Apply discounted cash flow and residual income valuation models to estimate equity and enterprise values.
- CO4: Apply relative valuation techniques.

Module I: Performance analysis (15 Hours)

Assessing performance through Financial Statements: Income statements, Balance sheets & Cash Flow Statement, analyzing the Chairman's statement; Directors' report, management discussion & analysis. Assessing current performance and its future sustainability; making forecasts of future profitability and risk; and valuing businesses using earnings and book value data.

Module II: Valuation (15 hours)

Assessing a firm's value proposition and identifying its key value drivers and risks; Basis and need for valuation, Approaches to valuation: DCF; CAPM; relative valuation and contingent valuation; Estimating discount rates- cost of equity and cost of capital, measuring cash flows, and forecasting cash flows. Equity discounted cash flows models. Firm valuation models; Valuing publicly traded firms and private businesses; Ratio analysis and bankruptcy detection.

Module III: Financial restructuring (15 hours)

Financial restructuring: Debt restructuring; Equity restructuring; reduction of capital; reorganization of share capital; buy back of shares –concept and necessity; procedure for buy back of shares; Equity-investment analysis, IPOs, mergers, M&As.

Module IV: Relative valuation (15 Hours)

Overview of relative valuation; application of relative valuation models; Reasons for popularity and potential pitfalls. Standardized values and multiples- Earnings multiples, book value multiples, revenue multiples, and sector-specific multiples; Equity and Value multiples; Basic steps to using multiples; Reconciling relative and discounted cash flow valuation.

Suggested Readings and E-Resources

1. Foster, George Financial Statement Analysis, Pearson Education Pvt Ltd.
2. Damodaran, A. Damodaran on Valuation, Security Analysis for investment and Corporate Finance (2nd ed.). Wiley India Pvt. Ltd.
3. K. G., CA, & Sehrawat, N. K. Handbook on Valuation- Concept & Cases. New Delhi, Bharat Law House Pvt. Ltd, ISBN: 978-93-5139-497-6
4. Damodaran, Investment Valuation, Tools and Techniques for determining the value of any asset, 3rd Edition, Wiley India Pvt. Ltd.
5. Damodaran, Corporate Finance (2000), Theory and Practical, 2nd Edition, Wiley India Pvt. Ltd.
6. Business Analysis Using Financial Statements | Sloan School of Management | MIT OpenCourseWare
7. Investments | Sloan School of Management | MIT OpenCourseWare

Experiential Learning

1. Module 1: Project work on analyzing firms' performance.
2. Module 2: Applied Valuation – valuation of a real company through DCF (matured company) using excel.
3. Module 3: Project work on detecting bankruptcy through financial ratios.
4. Module 4: Applied Relative Valuation – valuation of a real company through relative valuation method (matured company) using excel.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	M	M	M	M
CO 2	H	M	H	M
CO 3	M	H	M	H
CO4	M	H	H	H

1.5 MAJOR ELECTIVE- GROUP 2 (HR and Marketing)**1.5.1 HUMAN RESOURCE ANALYTICS (Course Code)****(Credit 4 - 60 Hours.) (L.T.P:4-0-0)**

Course Objective: The objective of this course is to encourage students' data-driven skills, empowering them to utilize analytical tools effectively for understanding employee behaviour in an organisation.

Course Outcomes: The successful completion of this course shall enable the student.

CO1: To understand role of analytics in Human Resource Management.

CO2: To develop knowledge about HR Metrics and types of analytics in HR

CO3: To critically analyse the HR effectiveness and its impact on employee life cycle & experience

CO4: To enable students to analyse data driven insights out of HR analytics

CO5: To help in implementation of predictive modelling and dashboards in HR

Module 1: Introduction to HR Analytics (15 hours): Evolution of HR Analytics, HR Analytics and Changing Role of HR Professionals, Importance and Scope of HR Analytics, challenges with HR analytics, strategic focus on HR analytics; Common pitfalls of HR analytics; HR analytics process, Key Influencers of HR Analytics Process. and skillset needed in HR analytics team.

Module 2: Approaches to Data Analytics(15hours): Current approaches to measuring HR; Strategic HR metrics versus bench marking; HR scorecards & workforce scorecards; Types of analytics in HR- descriptive, predictive and prescriptive; HR analytics framework, HR Analytics for Recruitment & Selection, Training & Development, Performance Appraisal, Talent Management, Employee Engagement, Compensation Management and Expatriate Management.

Module 3: Dynamics of HR Matrices (10 hours): People analytics cycle, employee lifecycles and employee experiences, performance and succession management; Agile framework; HR value chain; Metrics to measure HR effectiveness; Factors driving employee turnover; Link between engagement and performance; Competitive edge and HR analytics.

Module 4: Data Mining Techniques (10 hours): Data analysis, data visualization techniques and effective utilization using tools; Common pitfalls associated with data visualization; Driving insights out of HR analytics

Module 5: Decision Making Based on Analytics (10 hours): Data driven culture in an organization; Implementation of predictive modelling; Importance of predictability in fulfilling strategic objectives; Effective HR dashboards.

Experiential Learning

1. Hands-on exercises and case studies demonstrating the application of various approaches to real-world HR data.
2. Using HR analytics software tools (e.g., excel, R, Python, specialized HR analytics platforms) for analysis and visualization.
3. Group projects or assignments where students apply different approaches to solve specific HR challenges

Suggestive learning and E-Resources

1. Martin R. Edwards "Predictive HR Analytics: Mastering the HR Metric"
2. Linda Holbeche "HR Analytics Handbook"
3. Dr. Michael Walsh "HR Analytics Essentials"
4. Vinod Kumar Patel, Deepali Soni, Abhishek Singhal, Dinesh Gupta "Fundamentals of HR Analytics"

E-resources

[https://www.gartner.com/en/human-resources/glossary/hr-analytics#:~:text=HR%20analytics%20\(also%20known%20as,and%20promote%20positive%20employee%20experience.](https://www.gartner.com/en/human-resources/glossary/hr-analytics#:~:text=HR%20analytics%20(also%20known%20as,and%20promote%20positive%20employee%20experience.)
<https://www.aihr.com/blog/hr-metrics-examples/>
https://www.researchgate.net/publication/321376109_HR_Analytics-The_Data_driven_Human_Resource_Management_Applications_and_Challenges

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	L		M	
CO 2	M	H	H		
CO 3		M			H
CO 4			H	L	
CO 5			M		H

1.5.2 Major- Elective- Advance Marketing Management (Course Code) (4 credits-60 Hours) (L-T-P: 4-0-0)

Objective: This course delves into the intricacies of marketing management at an advanced level, focusing on strategic decision-making, innovative approaches, and the integration of emerging technologies. Students will analyze real-world case studies, engage in hands-on projects, and develop the skills needed to lead marketing efforts in dynamic business environments. Students acquire the knowledge and skills required to develop, implement, and control successful marketing strategies.

Course/Learning Outcomes

At the end of the course students will be able to:

- CO1: Articulate an in-depth understanding of a range of contemporary marketing issues, theories, practices, models and phenomena;
 CO2: Evaluate and critique contemporary marketing practices and understand the best methods of implementation to maximize business performance;
 CO3: Be proficient in presenting, analyzing, discussing, evaluating, persuading, and making decisions regarding contemporary marketing initiatives within an organization;
 CO4: Critically evaluate and synthesize advanced academic literature and other evidence
 CO5: Apply theoretical frameworks in relation to marketing literature and /or practice

Module I: Introduction to Marketing (10 Hours)

Introduction: Traditional view of marketing; Evolution of marketing concept; Modern concept of marketing; Marketing functions and role; Marketing Mix, Marketing management process- a strategic perspective;

Marketing Environment: Significance of scanning marketing environment; Economic, demographic, socio-cultural, technical, political and legal environment of marketing in India

Module II Consumer Behavior and Market Research (10 Hours)

Consumer market and buying behavior; Psychological factors influencing consumer behavior, Cultural, social, and demographic influences, Theories of Consumer Behavior Market research methodologies and data analysis techniques, Customer insights Market Segmentation, Targeting, Positioning, and segmentation strategies.

Module III Integrated Marketing Communications and Global Marketing (10 Hours)

Advertising, public relations, and sales promotions, Digital marketing and social media strategies, Content marketing and influencer partnerships, Measuring the effectiveness of integrated campaigns, Global market entry strategies, Cross-cultural marketing challenges and adaptations, Standardization vs. customization of marketing strategies, Managing international distribution channel

Module IV Green Marketing and Sustainable Development (10 Hours)

Meaning and concept, green marketing Mix, Three R's of Environmentalism, Green Consumer, Green packaging, green packaging symbols, FSSAI, Corporate Strategies of Environmental Marketing, Role of CSR and its approaches, sustainable development, role of NGO in protecting environment.

Module V Emerging Trends in Marketing (10 Hours)

Artificial intelligence, Augmented Reality Driven Marketing, Machine Learning, digital marketing Strategy, Marketing 4.0, Digital Business Model, E-business, Tele marketing, M-business, Social networked marketing, Viral marketing, Interactive Television, Relationship marketing, Customer Relationship Management.

Suggested Readings and E-Resources

1. Principles of Marketing: Philip Kotler, PHI.
2. Marketing Management: A South Asian Perspective – Philip Kotler and Kevin Lane Kotler, Pearson Education
3. Stanton WJ: Fundamental of Marketing
4. Marketing Management: A South Asian Perso
5. Marketing Management: Ramaswamy & Namakumari, Tata McGraw Hill
6. Marketing Planning and Strategy: Jain, Cengage learning. 8. Marketing Management: Gandhi IC, Tata McGraw Hill

Links for E-Resources:

3. [Marketing_Management.pdf](#)
4. <https://www.scribd.com/presentation/420124579/Chapter-1-Advanced-Marketing-Management>

Experiential Learning

Experiential learning in advanced marketing management involves students engaging in hands-on, practical activities that simulate real-world marketing challenges. This approach includes:

1. **Live Projects:** Collaborating with companies on actual marketing campaigns, allowing students to apply theoretical concepts to practical scenarios.
2. **Case Studies:** Analyzing and solving complex marketing problems based on real or hypothetical business situations.
3. **Simulations:** Participating in marketing simulations that mimic market conditions and competitive dynamics.
4. **Internships:** Gaining on-the-job experience by working with marketing teams in various organizations.
5. **Workshops and Seminars:** Attending sessions led by industry experts to gain insights into current marketing trends and practices.

These methods enhance students' strategic thinking, decision-making skills, and ability to adapt to dynamic marketing environments.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M		M	
CO 2	M	H	H		
CO 3		M			H

1.6 CVB- SERVICE LEARNING (Course Code) **(Credit: 2 Hours: 30)**

Objective: Service Learning will aim to support the development of basic skills among the students namely, critical and creative thinking, reflection, communication, collaboration, information literacy, and social skills. The emphasis will be on active civic participation. As the students will actively involved in a wide range of experiences, which will benefit both the community at large and the students in particular and in the process the goals of the curriculum shall be achieved

Course/ Learning Outcomes

After learning this course, the students will be able to:

CO1: Define and explain the Service-Learning framework (Remembering)

CO2: Explain the nature and types of community engagement work (Understanding)

CO3: Identify the need and importance of social responsibility (Applying)

CO4 Analyze the need for social intervention through community partners (Analyzing)

CO5: Evaluate the academic outcomes through Service Learning (Evaluating)

CO6: Elaborate upon the social understanding to the issues faced in the community (Creating)

Module I: Concept of Service Learning (3 Hours)

Service Learning – meaning, concept, definition; value based framework of Service Learning; Understanding the core standards of Service Learning such as respect, reciprocity, relevance, and reflection; Elements of Service Learning; Understanding Service Learning – Its philosophy, historical background, purpose, value and theoretical framework; Locating Service Learning within the University context; Principles of Service Learning; Classification of Service Learning Models; Experiential Learning; Reflective Learning;; Journaling; Service Learning Pedagogy; Difference between Service Learning and other community experiences

Module II: Community Engagement and Community Partnerships (3 Hours)

Community Engagement – concept, meaning, definition and principles; benefits of community engagement, models of community engagement; Civic Engagement, University Community Engagement, Community partnerships – meaning, benefits, Reflection – meaning, definition and implications; Critical inquiry - meaning, definition and implications; Engaged Research - meaning, definition and implications; Historical context of University Community Partnership; Understanding Community & Community Partnership; Ethical understanding of partnership; Understanding the agency of the Community – as co-educators; Community barriers

Module III: Social Responsibility and Communication Basics (3 Hours)

Social Responsibility – meaning, benefits, Socio-economic context – meaning, definition, Social issues – meaning, understanding of society & social issues ; Conflict – meaning, types, understanding various conflict resolution strategies; Community level partnerships – meaning, significance, types; Social Justice – meaning and implications; Communication – meaning, types, channels of communication, models of communication

Module IV: Identifying the Partners in the Community (3 Hours)

Partners in the community – meaning, types and functions of Community Partners namely, Corporate, Government and PSU Organizations, Panchayats, Community settings, Clinical settings, NGO's, Anganwadi Centers, Self Help Groups, Schools, Business Firms, Community Markets, Weekly Haats, Customer Relationship Management, etc.

Module V: Basics of Professional Skills (3 Hours)

Aspects of Professional Skills Development: Factors affecting individual behavior - personal, environmental and organizational, individual diversity –biographical and demographic characteristics, self-esteem, self-monitoring Individual decision-making process, rational decision-making, decision-making styles, common biases and judgment errors in decision-making, individual v/s group decision-making.

Basics of Planning and Organizing - Nature and purpose of planning, planning process, types of plans Types of groups, stages of group development, characteristics of effective teams, how group status influences individual behavior, leaders and their role in teams, characteristics of an effective leader.

Module VI: Service-Learning Projects (15 hours)

Service-Learning Projects – stages, investigation, preparation, action, reflection, demonstration and documentation. Areas of Study in Service Learning: Capacity building of youths, Single entry accounting system for small retailers, Preparation and benefits of maintain balance sheet, Financial Literacy, Financial

Planning for Business Organizations, Basic Marketing Techniques, Selling Skills, Insurance, Human Resource Management, MSME schemes, Entrepreneurship ideas, startup ventures, Feasibility studies, Undertaking New Business Ventures, Venture Funding, Angel Investors, Partnership, Business Communication skills, Soft Skills Development, Poverty, livelihood, Health, Education, Water, Sanitation, Disability, Children, Women, NGO Management Practices, Environment, SDG's - technological solutions/suggestions for development, etc.

Note: Emphasis on Group Work, Projects, Case Studies, Assignments, Journaling, Report Preparation, Presentations, Workshops, Group Conferences Individual Conferences etc.

Suggested Readings

1. Kaye Cathryn Berger, the complete Guide to Service Learning: Proven Practical Ways to Engage Students in Civic Responsibility, Academic Curriculum and Social Action, Free Spirit Publishing
2. Barbara Jacoby, Service Learning in Higher Education: Concepts and Practices
3. Patty H. Clayton, Robert G. Bringle and Julie A. Hatcher, Research on Service Learning: Conceptual Frameworks and Assessment
4. Barbara Jacoby, Service-Learning Essentials: Questions, Answers and Lessons Learned
5. Julie A. Hatcher and Robert G. Bringle, Understanding Service Learning and Community Engagement
6. Farber Katy, Change the World with Service Learning

1.7 CONSTITUTION OF INDIA (Course Code)

Credit – 1 (0-0-1) – 15 Hours

Course Outcomes

CO 1: At the end of this course, students will be able to explain the social, cultural and religious diversity of India and its impact on Indian psyche.

CO 2: At the end of this course, students will be able to evaluate the political and economic system of India.

Module 1: India and its Diversity (18 hours)

Overview of India's geography, diversity, demographics and development indicators □ A brief survey of India's history, highlighting key events, personalities and movements that shaped its identity and destiny □ An exploration of India's rich and varied cultural heritage, including its languages, religions, arts, literature and philosophy □ An overview of India's social structure, institutions, norms and values, with a focus on issues such as caste, gender, class and ethnicity

Module 2: Indian Political System (12 hours)

A study of India's political system, institutions, parties and ideologies India's role in regional and global affairs □ A review of India's economic performance; the challenges and opportunities for growth; □ An overview of sectors such as agriculture, industry, services, and trade. □ A discussion of India's environmental problems & the solutions for sustainable development □ A discussion on India's journey towards a developed nation.

Suggested Readings

1. Thapar, R. (2015). The Penguin History of Early India: From the Origins to AD 1300. India: Penguin Books Limited.
2. Kosambi, D. D. (2022). The Culture and Civilization of Ancient India in Historical Outline. United Kingdom: Taylor & Francis.
3. Zimmer, H. R. (2020). Philosophies of India. United States: Princeton University Press.
4. Mohanty, M. (2004). Class, Caste, Gender. India: SAGE Publications.
5. Mitra, S. K. (2017). Politics in India: Structure, Process and Policy. United Kingdom: Taylor & Francis.
6. Kothari, R. (1970). Politics in India. India: Orient Longman.
7. Balasubramanyam, V. N. (2019). The Economy of India. United Kingdom: Taylor & Francis.
8. Fisher, M. H. (2018). An Environmental History of India: From Earliest Times to the Twenty-First Century. United Kingdom: Cambridge University Press.

1.8 DISSERTATION-PHASE-1**(4 credits- 60 hours) (L-T-P: -0-0-4)**

Objective: The objective of the course would be to educate the students about the various dimensions of a research-based project work. The students will also be taught about the application of statistical tools through SPSS.

This phase of the Dissertation will comprise of the following:

1. Synopsis: Submission of a write up on a specific area/topic of study (10hours)
2. Review of Literature: Submission of a specified number of reviews to respective guide (15 hours)
3. Research Methodology: Lecture based on the topic of study. (10 hours)
4. Referencing Style: Lecture on referencing style to be followed while submitting report (5 hours)
5. Training on application of Statistical software used in research (20hours)
6. Submission of Progress Report after completion of Phase I: Report should comprise of Introduction, Review of Literature, Research Methodology and References.

Evaluation:

A diary will be maintained by every student to keep a record of meeting with his/her guide. A format of the diary will be circulated at the beginning with the semester. Evaluation at Phase I will be done by the respective guide based on timely submission of part-work and quality of work as follows:

Synopsis (30marks)

Review of Literature (30marks)

Research Methodology (30marks)

Referencing (10marks)

SECOND SEMESTER**2.1 MAJOR-. PRODUCTION AND OPERATION MANAGEMENT (Course Code)****(4 credits-60 Hours))(L-T-P: 4-0-0)**

Objective: One of the most critical areas for success in any business enterprise is how Production and Operations are managed. This course is designed to equip students with the necessary skills and knowledge required to excel in the field of production and operation. The students will gain an understanding of relevant approaches and principles of production and operation, recognize role and importance of operations in overall business strategy, manage projects effectively and make informed decisions on facility location and layout, utilize six sigma for process improvement and application of productivity improvement techniques.

COURSE/LEARNING OUTCOMES

At the end of the course students will be able to:

CO2: Develop an understanding of production & operations management in organisation.

CO3: Explain fundamental frameworks and techniques in production operations management.

CO4: Apply these frameworks and techniques to solve problems and analyse practical applications.

CO3: Identify operational issues and recommend solutions, and evaluate the suitability of alternative solutions.

Module I: Introduction to production and operation management (10 Hours)

Production System, Classification of Production System, Production Management, Objectives of Production Management, Operations management, Distinction between Manufacturing Operations and Service Operations, Objectives of Operations Management, Managing Global Operations, Scope of Production and Operations Management.

Module II: Plant location and layout (10 Hours)

Introduction, Need for Selecting a Suitable Location, Factors Influencing Plant Location/Facility Location, Location Theories, Location Models - Factor Rating Method, Weighted Factor Rating Method, Load-distance Method, Centre of Gravity, Break Even Analysis. Plant layout and design – product layout, process layout, service layout. Material Handling and management- relationship between material handling and plant layout.

Module III: Operations Research (20 Hours)

Applications of Operations Research, Introduction to Linear Programming- Graphical Method- Simplex Method - Duality. Transportation & Assignment Problem - Inventory Control - Introduction to Inventory Management - Basic Deterministic Models - Purchase Models - Manufacturing Models with and without Shortages. Game Theory- Two Person Zero-sum Games -Graphical Solution of (2 x n) and (m x 2) Games - LP Approach to Game Theory - Goal programming - Formulations - Introduction to Queuing Theory - Basic Waiting Line Models: (M/M/1):(GD/a/a), (M/M/C):GD/a/a).

Module IV: Productivity improvement & Quality management: (20 Hours)

Productivity Improvement Techniques: Work study; Method study; Work measurement: time study: stop watch time study; Work sampling. Maintenance: total productive maintenance (TPM); Quality characteristics of goods and services; Tools and techniques for quality improvement: check sheet, histogram, scatter diagram, cause and effect diagram, Pareto chart, process diagram, Total quality management (TQM) model, concept of Six Sigma and its application.

Suggested readings & e-resources:

9. Kanishka Bedi, PRODUCTION & OPERATIONS MANAGEMENT, Oxford, New Delhi.
10. Panneerselvam, R, OPERATIONS RESEARCH, Prentice-Hall of India, New Delhi.
11. G.Srinivasan, OPERATIONS RESEARCH, PHI Learning, NewDelhi.
12. Tulsian & Pandey, QUANTITATIVE TECHNIQUES, Pearson, NewDelhi.
13. Vohra, QUANTATIVE TECHNIQUES IN MANAGEMENT, Tata McGrawHill, NewDelhi, 2010
14. Production and Operations Management : With Skill Development, Caselets and Cases (ascdegreecollege.ac.in)
15. Resources | Introduction to Lean Six Sigma Methods | Aeronautics and Astronautics | MIT OpenCourseWare
16. Lecture Notes | Introduction to Operations Management | Sloan School of Management | MIT OpenCourseWare

Experiential Learning

3. Students are to pay visit to a nearby manufacturing unit and prepare a report on the suitability of plant location and layout of that manufacturing unit.
4. Students are to prepare a report on adoption of Six Sigma and its implication in business. For these students are to identify and select companies of their choice.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 2	H	M	M	M
CO 3	M	H	H	H
CO 4		M	M	H

2.2 MAJOR-ELECTIVE-GROUP 1 (ACCOUNTING AND FINANCE)**2.2.1 STRATEGIC COST & MANAGEMENT ACCOUNTING (Course Code)**

(4 credits- 60 hours) (L-T-P: 4-0-0)

Course Objectives:

- To provide understanding of various aspects in strategic cost and management accounting
- To elucidate the role of cost accounting for better managerial decision making
- To study the application of various techniques of Strategic Cost Management in the modern business environment.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: Remember the various tools and techniques used in the field of cost and management accounting to make strategic decisions.

CO2: Understanding of calculation and use of modern Strategic Cost Management Techniques required for analytical & decision-making skills in this current competitive environment.

CO3: Application of modern Cost Management Techniques for strategic decision-making in this current competitive environment.

CO4: It seeks to provide specialisation-level knowledge to financially motivated managers to be on the role of the management accounting in complex modern industrial organisations.

Module I: Cost Management (10 hours)

Developments in Cost Management- Life Cycle costing, Target costing, Kaizen Costing, Value Analysis and Value Engineering, Throughput Costing, Business Process Re-engineering, Back-flush Accounting, Lean Accounting, Socio Economic Costing, Cost Control and Cost Reduction – Basics, Process, Methods and Techniques of Cost Reduction.

Module II: Strategic cost management tools and techniques (15 hours)

Decision Making Techniques, Marginal Costing- Differential costing-CVP Analysis – Profit Volume Graphs – Contribution Approach, Decisions involving alternative choices – Optimum utilization of resources – Make or Buy – Evaluation of Orders – Multiple scarce resource problems- Product sales pricing, shut down decisions.

Module III: Budgetary control & Standard Costing (15 hours)

Variance Analysis - Investigation of Variances, Planning and Operating Variances, Controllable / Non-controllable Variances, Relevant Cost Approach to Variance Analysis; Variance analysis under marginal costing and absorption costing; Activity Ratios; Application of budgetary control and Standard Costing in Profit planning, Standard Costing Vs Budgetary Control, Reconciliation of Actual Profit with Standard Profit and /or Budgeted Profit.

Module IV: Activity Based Costing and Total Quality Management (20 hours)

a. Activity Based Costing- Concept, purpose, benefits, stages, relevance in decision making and its application in Budgeting, Responsibility accounting, Traditional Vs. ABC System – comparative analysis
b. Cost of Quality and Total Quality Management- TQM - Basics, Stages, Principles, Control, Corrective actions; PRAISE-Steps, Problems, implementation PARETO Analysis, Quality Costs, Application of Operation Research and Statistical Tools in Strategic Decision Making -Learning Curve, Linear Programming (Formulation only), Assignment, Transportation, Simulation, Network Analysis – CPM / PERT

Suggested Readings and E-Resources:

1. Atkinson, Kaplan, Matsumara, Yong, & Kumar. Management Accounting. Pearson Education.
2. Banerjee, B. Cost Accounting. Prentice Hall of India.
3. Banerjee, B. Financial Policy & Management Accounting. PHI.
4. Banerjee, B. Financial Policy and Management Accounting. Prentice Hall of India.
5. Basu, Banerjee, & Dandapat. Strategic Cost Management. University of Calcutta.
6. Blocher, Chen, Cokins, & Lin. Cost Management: A Strategic Emphasis. TMH.
7. Chandra, P. Financial Management. TMH.
8. Drury, C. Management and Cost Accounting. Thomson Learning and Taxman.
9. Horagren, Dabur, & Foster. Cost Accounting: A Managerial Emphasis. PHI and Persons Education.
10. Horne, V. Financial Management & Policy. Pearson Education.
11. Horne, V. Fundamentals of Financial Management. PHI.
12. Khan, M. Y., & Jain, P. K. Financial Management. TMH.
13. Kishore, R. M. Cost Management. Taxman.
14. Lucey, T. T. Management Accounting. ELBS.
15. Pandey, I. M. Financial Management. VIKAS.
16. Saxena, & Vashisht. Cost and Management Accounting. Sultan Chand.

E-Resources:

1. <https://www.caluniv.ac.in/academic/Commerce/Study/S-IV-CC-402-SCMA.pdf>
2. <https://icmai.in/upload/Students/Syllabus2016/Final/Paper-15-Oct-2020.pdf>
3. <https://www.distanceeducationju.in/pdf/Mcom%20Book.pdf>
4. https://www.icsi.edu/media/webmodules/publications/FULL_BOOK_PP-CMA-2017-JULY_4.pdf

Experiential Learning:

1. Prepare a project report considering real data to determine make or buy decision
2. Visit some manufacturing industries and experience the tools and techniques used.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		H	
CO 2		H	H	H
CO 3				H
CO 4		H		H

2.2.2 MAJOR ELECTIVE -GROUP-1 FINANCIAL ANALYTICS (Course Code)
(4 credits – 60 hours) (L-T-P: 4-0-0)

Course Objectives: The course "Financial Analytics" aims to equip students with the knowledge and skills necessary to effectively analyze financial data using various tools and techniques. By integrating theoretical concepts with practical applications, the course covers data management, descriptive and predictive analytics, and financial risk management. Students will gain hands-on experience with software like Excel, Python, R, Tableau, and Power BI, enabling them to clean, process, and visualize financial data. Through this comprehensive approach, the course fosters critical thinking and decision-making abilities, preparing students for advanced roles in finance and data analysis, and enhancing their capability to generate insightful financial reports and models.

COURSE/LEARNING OUTCOMES

CO1: Identify and recall the key concepts and tools in financial analytics, including data sources and software.

CO2: Explain the importance and applications of financial analytics in various financial contexts.

CO3: Utilize financial data management techniques to clean, process, and transform financial datasets.

CO4: Critically examine and interpret financial data using descriptive analytics and visualization tools.

CO5: Assess predictive models and their applications in finance, including stock price prediction and credit scoring.

CO6: Develop and implement predictive analytics models and risk management strategies using advanced analytical tools.

Module I: Introduction to Financial Analytics (10 hours)

Overview of Financial Analytics, Importance and Applications in Finance, Introduction to Financial Data Sources; Tools and Software for Financial Analytics (Excel, Python, R)

Module II: Financial Data Management and Cleaning (10 hours)

Data Collection Methods, Data Cleaning and processing, Handling Missing Data and Outliers Data Transformation Techniques Module

Module III: Descriptive Analytics and Data Visualization (15 hours)

Descriptive Statistics for Financial Data, Data Visualization Techniques, Creating Financial Dashboards, Tools: Tableau, Power BI, and Matplotlib /Seaborn in Python

Module IV: Predictive Analytics in Finance (15 hours)

Introduction to Predictive Analytics, Time Series Analysis and Forecasting, Regression Analysis and Machine Learning Models, Applications in Stock Price Prediction, Credit Scoring, etc.

Module V: Risk Management and Financial Analytics (10 hours)

Introduction to Financial Risk Management, Value at Risk (VaR) and Stress Testing Risk Analytics and Scenario Analysis, Tools for Risk Management: MATLAB, R, Python.

Experiential Learning:

This course immerses students in practical financial data analysis and management using advanced tools and techniques. Beginning with hands-on sessions utilizing Excel and Python, students gain foundational skills in data manipulation. They then progress to cleaning and managing financial datasets, addressing real-world data issues through case studies and projects with Python/Pandas and R. The course also emphasizes visualization, with workshops on creating financial dashboards and projects using Tableau, Power BI, and Python libraries. Students further explore predictive analytics, engaging in stock price prediction projects and machine learning exercises for financial forecasting. The course concludes with a focus on risk management, featuring case studies, practical sessions on calculating Value at Risk (VaR), conducting

stress tests, and risk analysis projects using MATLAB and Python, thus equipping students to tackle complex financial challenges.

Suggested Readings:

1. S. Christian Albright/Wayne L. Winston Business Analytics: Data Analysis and Decision Making with MindTap Paperback – 1 September 2022
2. Sanjiv Jaggia, Kevin Lertwachara, Alison Kelly, Leida Chen : Business Analytics: Communicating with numbers; MC Graw hill
3. U Dinesh Kumar: Business Analytics: The Science of Data - Driven Decision Making Paperback – 1 January 2017, Wiley publication

Digital Resources

Module 1: Introduction to Financial Analytics

https://ebooks.lpu.de.in/newscheme/arts/ma_math/sem_4/DEFIN526_FINANCIAL_ANALYTICS.pdf

Module II: Financial Data Management and Cleaning

https://www.aranca.com/assets/uploads/resources/special-reports/Financial_Data_Management%E2%80%93A_Detailed_Step-by-Step_Approach.pdf

Module III: Descriptive Analytics and Data Visualization

<https://02402.compute.dtu.dk/enotes/chapter1-DataVisualization.pdf>

Module IV: Predictive Analytics in Finance

https://www.predictiveanalyticsworld.com/book/pdf/Predictive_Analytics_by_Eric_Siegel_Excerpts.pdf

Module V: Risk Management and Financial Analytics

<https://core.ac.uk/download/pdf/43020566.pdf>

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	L	L		M	
CO 2	M	H	H		
CO 3		M			H
CO 4			H		
CO 5			M		H

2.3 MAJOR-ELECTIVE-GROUP 2(HR AND MARKETING)

2.3.1 DIGITAL MARKETING AND E-COMMERCE (Course Code)

(4 credits - 60 hours) (L-T-P: 4-0-0)

Objective: After studying this course, the students will be able to learn about the different knowledge and skills needed for effective digital marketing in the corporate sectors and entrepreneurial ventures.

Course/Learning Outcomes

At the end of this course students will be able to:

CO 1: Define the fundamentals of website marketing and basic knowledge of Electronic Commerce, Mobile Commerce, IoT Platforms and Social commerce (Remembering)

CO 2: Explain the fundamentals of search engine technology (Understanding)

CO 3: Interpret the various types of social media marketing. Digital Payments systems and methods (Applying)

CO 4: Analyze the models of digital marketing (Analyzing)

CO 5: Evaluate the web analytics and social media analytics (Evaluating)

Module I: Electronic Commerce, Mobile Commerce, Social Commerce, IoT (15 hours)

Definition, Benefits, Limitations, Ecommerce Platforms, Impact of E-Commerce on Business, government, customer and society. E-Business, E-Markets, Electronic Storefronts, Types of e transactions – B2B, B2C, C2C, C2B, Business Models. Affiliated and Hybrid Models. Digital Economy, Enterprise and online Communities. Mobile & Social Commerce - Meaning, Attributes, Applications and Benefits to customers, retailers, employees. Social Collaboration and its essentials. Concepts of Internet of Things (IoT) and its applications.

Module II: The E-Business Technology and E Security (15 Hours)

Understanding Networks - routing, switching and protocols, Web Presence – domain registration, website development and hosting, Web server hardware and software; Data centre services, Security – service providers, digital certificates, encryption, SSL, Digital signatures.

Module III: Digital Payments (10 Hours)

Smart Cards, Stored-Value Cards, EC Micropayments, Payment Gateways, Mobile Payments, Digital and Virtual Currencies, Security, Ethical, Legal, Privacy, and Technology Issues.

Module IV: Digital Business Applications (20 Hours)

Electronic Retailing, E-Tailing, Social Shopping, Fintech: E-Banking, Mobile Banking, Pure Virtual Banks, Insurance, and Stock Trading, Other Mobile Finance Applications. Digital Government: Government-to-Citizens, Government-to-Business, Government-to-Government, Government-to-Employees Models. E-Learning, E-Training, and E-Books, Distance Learning and Online Universities, Online Corporate Training, E-Learning Management Systems. Online Travel and Tourism, E-Employment: Online Job Market, Social Networks Based Job Markets, Social Recruiting, Virtual Job Fairs and Recruiting Events, E-Health, Electronic Medical Record Systems (EMR), Doctors' System, Patients Services, Medical Devices and Patients Surveillance. Entertainment, Media & Gaming: Service Industry Consumer Applications. Digital Products, Internet TV and Internet Radio, Social Television (TV) Mobile Entertainment, Mobile Marketing, Mobile Streaming Music and Video Providers, Entertainment in Cars; Gaming - Mobile Games, Social Games and Gamification, Business of Social Games, Educational Social Games; Mobile Gambling, Mobility and Sports; Social Entertainment.

Suggested Readings

1. Introduction to E Commerce & Social Commerce, Turban E , Whiteside J , King D, Outland J Springer
2. E-Business and E-Commerce Management- Strategy, Implementation and Practice, Dave Chaffey, Pearson Education.
3. Electronic Commerce – A Managerial Perspective, Efraim Turban, David King, Dennis Viehland, Jae Lee, Pearson Education.
4. E-Commerce: Strategy, Technologies and Applications Paperback – 2001 by David Whiteley
5. E-Commerce: An Indian Perspective Paperback – Import, 30 Nov 2015-by P. T. Joseph
6. One Click: Jeff Bezos and the Rise of Amazon.com Kindle Edition- by Richard L. Brandt
7. Ahuja V. Digital Marketing, Oxford University Press.
8. Dodson, I. (2016). The Art of Digital Marketing: The Definitive Guide to Creating Strategic.

e-Resources:

Module I: <https://www.scribd.com/document/514335334/Unit-2-Mobile-Commerce-Social-Commerce-IOT>

<https://www.geeksforgeeks.org/difference-between-e-commerce-and-m-commerce/>

Module II: <https://www.getastra.com/blog/knowledge-base/ecommerce-security/>

Module III: <https://www.betterthancash.org/define-digital-payments>

<https://razorpay.com/learn/digital-payments-india-definition-methods-importance/>

Module IV: <https://www.simplilearn.com/digital-business-article>

https://vikramuniv.ac.in/files/wp-content/uploads/BE_EE-EC_2nd_Sem_BCE_Computer_applications_in_E-Business_Pratibha_Saraf.pdf

Experiential Learning

1. Experimenting with various software tools and apps, data analysis and securities systems
2. Case study
3. Group discussions about the benefits and challenges of digital marketing.
4. Class Test, Assignment and practical know how and End Semester Examinations.

Mapping of COs to Syllabus					
	Module I	Module II	Module III	Module IV	Module V
CO I	H	H	M	M	M
CO II	H	H	H	M	L
CO III	H	L	H	H	M
CO IV	L	L	M	M	M
CO V	H	M	H	H	L

2.3.2 STRATEGIC HUMAN RESOURCE MANAGEMENT (Course Code)

(4 credits – 60 hours) (L-T-P: 4-0-0)

Objective: The objective of this course is to develop within the students the understanding of the student with relevant concepts, roles and challenges related to strategic human resource management practices

in the workplace and design the requisite skills to be competent contributors in the organization's strategic decision-making process and make them competent to for various managerial and administrative positions in different organizations.

Course/ Learning Outcomes:

After learning this course, the students will be able to:

CO 1: Define the hierarchy of strategy, classify between traditional HR and strategic HR. (Remembering)

CO 2: Explain the factors behind the emergence of strategic human resource management (Understanding)

CO 3: Choose the aims of strategic HRM, interpret the various approaches to strategic HRM and identify the barriers in implementing HR strategies (Applying)

CO 4: Analyze the concept of HR strategies, explain the approaches of developing HR strategies and analyses the ways in which HR strategies can be implemented (Analyzing)

CO 5: Analyze the strategic role of the HR director, determine the strategic role of the HR specialists and design the new mandate for HR

CO 6: Evaluate the various approaches to motivation, develop the retention strategy and flexibility strategy that should be adopted by an organization (Creating)

Module I: Introduction to Strategic Human Resource Management (12 hours)

Introduction, Strategy, Hierarchy of Strategy, Corporate Level Strategy, Business Level Strategy, Functional Level Strategy, Strategic HRM, Emergence of Strategic Human Resource Management (SHRM), The Evolutionary Stages of Strategic HRM, Difference Between Traditional HR and Strategic HR.

Module II: Concepts of Strategic Human Resource Management (12 hours)

Introduction, Trends in Strategic Human Resource Management, HR Practitioners Role, Human Resource as Competitive Advantage, Aims of Strategic HRM, Approaches to Strategic HRM, Formulation of HR Strategies, The Classical Sequential Approach, The Empirical Need-based Approach, Achieving Strategic Fit, Problems in Achieving Strategic Fit, Benefits of Strategic HRM, Barriers to Strategic HRM.

Module III: Human Resource Strategies and its Implementation (12 hours)

Introduction, HR Strategies, Types of HR Strategies, Overarching Strategies, Specific HR Strategies, Criteria for an Effective HR Strategy, Developing HR Strategies, Methodology for Formulating HR Strategies, Setting Out the Strategy, conducting a Strategic Review, Implementing HR Strategies Barriers to the Implementation of HR Strategies, Overcoming the Barriers.

Module IV: Roles in Strategic Human Resource Management (12 hours)

The Strategic Role of Top Management, The Strategic Role of Front-line Management, The Strategic Role of the HR Director, The Strategic Role of the HR Specialists, The New Mandate for HR, The Specific Strategic Roles of HR, Business Partner, The Innovation Role, The Change Manager Role, The Implementer Role.

Module V: Challenges in Strategic Human Resource Management (12 hours)

Introduction, The Challenges of Workplace Diversity, The Management of Workplace Diversity, Managing Diverse Workforce in an Organization, planning a Mentoring Program, Organizing Talents Strategically, Retention Strategy, Talent Management Strategy and its components, Approaches to Human Resource Planning, Managing Executive Information Systems, Challenges for HR Managers, HRM Strategic Challenges.

Experiential Learning:

Experiential learning in strategic human resource management (SHRM) involves students engaging in hands-on, real-world activities to understand and apply HR concepts and strategies. This approach includes:

1. Simulations and Role-Playing: Students participate in scenarios that mimic real HR challenges, such as negotiations, conflict resolution, and strategic decision-making.
2. Case Studies: Analysis of real or hypothetical business cases to identify and solve HR issues, allowing students to apply theoretical knowledge to practical situations.
3. Internships and Field Projects: Direct involvement in HR functions within organizations to gain practical experience and insights into HR practices and strategies.
4. Workshops and Seminars: Interactive sessions with HR professionals to discuss current trends, challenges, and innovations in the field.
5. Collaborative Projects: Team-based assignments where students develop HR strategies or solutions for specific organizational needs.

This method helps students develop critical thinking, problem-solving skills, and a deeper understanding of strategic HRM by connecting theory to practice.

Suggested Readings

1. Deb Tapomoy, Strategic Approach to Human Resource Management Concept, Tools and Application, Atlantic Publishers & Distributors Pvt Ltd.
2. Nayantara Padhi, Strategic Human Resources Management: Theory and Practice, Atlantic Publishers and Distributors Pvt. Ltd; 1 edition
3. Mello Jeffrey A., Strategic Management of Human Resources, Cengage Learning, 3rd edition
4. Sharma A, Khandekar A, Strategic Human Resource Management – An Indian Perspective, SAGE Publications
5. Schuler, R. S., & Jackson, S. E., 2009, Strategic Human Resource Management. 2nd ed., Wiley-India
6. Sharma, A and Khandekar, A., 2006, Strategic Human Resource Management: an Indian perspective. 1st ed., Response Books.

E- Resources:

<https://www.otaru-uc.ac.jp/~js/downloads/SP2005-PDF/SP2005-Chapter2SHRM.pdf>

<https://unicourse.org/wp-content/uploads/2020/10/U3-Human-Resource-Management.pdf>

https://www.fcs.uga.edu/docs/Managing_Diversity_in_the_Workplace.pdf

https://allcatsrgrey.org.uk/wp/download/management/human_resources/Talent-Management-Strategy-App-1.pdf

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	L			
CO 2		M	L	L
CO 3	M	M	M	
CO 4		H	H	M
CO 5				H

2.4 DISSERTATION- PHASE-II

(8 credits- 120 hours))(L-T-P: 0-0-8)

Objective: The objective of the course would be to develop analytical skills among the students for solving any research queries. The students will also be taught about the preparation of a project report.

This phase of the Dissertation will comprise of the following:

1. Field Work: Collection of data and validation with the respective guide (30 hours)
2. Analysis of Data: Analysis and presentation of the data collected through application of various statistical tools through SPSS and other statistical software packages. (10 hours)
3. Test of Plagiarism.
4. Submission of Project Report: Submission of the complete report in continuation from Phase I.
5. Presentation of work using PPT and Viva Voce Examination.

Evaluation:

Evaluation at Phase II will be done by a panel comprising an external and internal expert, along with the respective guide, based on the quality of work as follows:

Report (50marks)

Presentation (30marks)

Viva-Voce (10marks)

DISSERTATION GUIDELINES**Chapter I: INTRODUCTION**

- a. Broad introduction to thesis topic and method. Page or two. Write after the remainder of the proposal is completed.
- b. Research problem. State broadly, in question form. Give sub-questions. Explain carefully. In one sense, the problem is to expand the body of knowledge examined in the literature review.
- c. Need for the research. Who will benefit? Discuss applied and scientific contributions.
- d. Nominal definitions. Define central terms.
- e. Context. Add further info to clarify the research problem.

Chapter II: THEORY: LITERATURE REVIEW

Organize by idea; avoid stringing together abstracts of articles

- a. Overview. Theoretical foundations.
- b. Literature. Group articles by ideas. For a given idea, first discuss common strands in the literature, then departures.
- c. Model. Of a process, usually. Based on the lit review.
- d. Hypotheses (in the broad sense of the term; also called Propositions). For each, give a brief restatement of justification tied to earlier sections; explain derivation and implications. Include assumptions. Explicitly state plausible rival hypotheses (explanations of process) of a substantive nature
- e. Scope of the study. Theoretical assumptions: discuss the limitations they impose.

Chapter III: METHODS

Outline in a few pages.

- a. Introduction. General description of method and design
- b. Design. Experiment, quasi-experiment, survey, and so forth. Detailed description
- c. Sample. Universe, population, element, sample design, tolerance, probability.
- d. Measurement. Operational definitions include, as applicable, a detailed discussion of indexes/ scales. Specify methods used to assess validity and reliability.
- e. Analysis. Techniques to be used: justification. Nature of relationships expected (e.g., symmetrical, symmetrical, reciprocal; linear, monotonic, other curvilinear; necessary, sufficient, necessary and sufficient). Include dummy tables and worked examples of statistics.
- f. Validity. Design: Internal and external, with relevant subtypes.
- g. Methodological assumptions. Discuss the limitations they impose.

APPENDICES:

- a. Schedule. In Gantt Chart form.
- b. Facilities. Faculty and staff expertise, library and computer resources, and other special facilities contribute to a successful study
- c. Budget.
- d. Bibliographic essay. Sources searched (indexes, abstracts, bibliographies, etc.). Strengths and weaknesses of literature.

Chapter IV: FINDINGS

- a. Brief overview.
- b. Results of application of method; any unusual situations encountered. Nature of sample.
- c. Descriptive analysis. One-way frequency distributions on central variables.
- d. Validity/reliability analysis.
- e. Tests of hypotheses. ANOVAs, cross tabulations, correlations, and such, depending on techniques used; give in same order as hypotheses.

Chapter V: DISCUSSION

When discussing implications, deal with both the theoretical and the practical. Present only interpretations of the findings, not opinions.

- a. Brief overview.
- b. Discussion of results of application of the method. Implications.
- c. Discussion of descriptive analysis. Implications.
- d. Discussion of tests of hypotheses. Implications.
- e. post-hoc analysis. Implications.

Chapter VI: CONCLUSION

May include the writer's opinion

- a. Summary of entire thesis in a few pages.

- b. Conclusions. Refer to lit review.
 - c. Implications. Speculate about the broadest possible consequences, both theoretical and practical. Label speculation clearly.
 - d. Limitations. Theory, method
 - e. Suggestions for future research.
- APPENDICES, Bibliographic essay, Questionnaire, and coding manual, if any. Raw data.
- BIBLIOGRAPHY: include all relevant sources examined, whether cited or not.

Valued Added and Certificate Courses Offered by the Department of Commerce

Value added Course

Innovation and Entrepreneurship (2 Credits- 30 Hours)

Objectives

This course will enable the participants towards introducing participants to the fundamentals of innovation and entrepreneurship. It will also equip learners with tools to identify opportunities, create business plans, and launch ventures.

Module 1: Introduction to Innovation and Entrepreneurship (5 Hours)

Definitions and Importance of Innovation and Entrepreneurship, Characteristics of Successful Entrepreneurs, Types of Innovation: Product, Process, and Business Model Innovation.

Module 2: Ideation and Opportunity Identification (6 Hours)

Techniques for Creative Thinking and Idea Generation, Identifying Market Needs and Gaps, Evaluating Opportunities: Feasibility, Viability, and Desirability, Tools for Opportunity Evaluation: SWOT and PESTEL Analysis.

Module 3: Business Model Development (6 Hours)

Understanding the Business Model Canvas (BMC), Value Proposition and Customer Segments, Revenue Streams, Cost Structures, and Key Resources.

Module 4: Business Planning and Strategy (7 Hours)

Components of a Business Plan: Executive Summary, Market Analysis, Financial Projections, Market Research and Competitor Analysis, Go-to-Market Strategies and Sales Planning, Risk Management and Contingency Planning.

Module 5: Financing and Funding Strategies (6 Hours)

Basics of Business Financing: Bootstrapping, Loans, and Venture Capital, Understanding Investors: Angel Investors and VCs, Crowdfunding and Government Schemes for Startups, Preparing an Elevator Pitch and Investor Presentation.

Note: A Business Idea Generation and Business Plan competition will be organised among the takers of this course. Students will make a group consisting 4/5 members in a team and will present their business plan.

Course/Learning Outcomes

- CO1: Understand the principles of innovation and entrepreneurship.
- CO2: Develop skills to identify opportunities and evaluate their feasibility.
- CO3: Gain knowledge of creating and managing a start-up.
- CO4: Learn strategies to scale and sustain entrepreneurial ventures.

Suggested Readings:

The Lean Startup by Eric Ries, *Innovation and Entrepreneurship* by Peter F. Drucker, *Business Model Generation* by Alexander Osterwalder.

Web Resources:

TED Talks on Entrepreneurship and Innovation, Startup India (<https://www.startupindia.gov.in/>), Online tools for BMC and market research (Canvanizer, Google Trends).

Accounting Software Package

2 credit (Lectures: 10 Hours, Practical Lab: 20 Hours)

CO1: Define the basic accounting concept, computerized accounting system and Data Based Management system (Understanding).

CO2: Understand the Preparation of ledgers, Trial balance and other financial statements with SQL (Understanding).

CO3: Application of accounting software (Tally ERP 9) in Voucher entries, preparation of accounts and other financial statements (Application)

CO4: Application of Tally ERP 9 software in payroll and voucher entries with GST

Module 1: Basics of Accounting Concept. (5 hours Lectures)

Basic accounting concept; journal entries; preparation of books of accounts and ledgers; preparation of trial balance and final accounts of corporate entities; Accounting system; benefits of computerized accounting system and challenges associated with computerized accounting system.

Module 2: Application of SQL (5 hours practical Lab)

Preparation of ledgers; Trial Balance and Report with the help of SQL

Module 3: Tally ERP 9 Fundamentals (2 hours Lectures, 7 hours Practical Lab)

Introduction to Tally ERP 9; Features of Tally ERP 9; creating, selecting, altering, deleting and shutting up of company; creating, altering and deleting of group and ledgers, voucher entries; integrating accounts and inventory; Displaying the financial report .

Module 4: Application of Tally ERP 9 in advanced level (3 hours lectures, 8 hours Practical lab)

Activating payroll in Tally; understanding of payroll; pay heads and categories; Attendance entries; salary payment example; pay-sheet and pay-slips.

Activating Tally in GST; setting up GST (company level, ledger or inventory level); creating GST masters and generating reports.

Suggested Readings:

SQL For Beginners: SQL Made Easy; A Step-By-Step Guide to SQL Programming for the Beginner, Intermediate and Advanced User (Including Projects and Exercises) Craig berg

Tally.ERP 9 with GST in Simple Steps Paperback; Dreamtech press

Learning Tally ERP 9 with GST; Sajee Kurian, Blessing Inc

Database Management Systems (DBMS) Rajiv Chopra, S.Chand Publishing

Learning SQL ; Alan Beaulieu, O'Reilly Media

Ashok K Nadhani, GST Accounting with Tally.ERP9, BPB Publications, New Delhi

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	L			
CO 2		M		
CO 3			H	
CO 4				H

Course: Customer Relationship Management
(2 Credits: 30 hours) (L-T-P: 1-0-1)

COURSE Outcome

CO1 To make the students understand the organizational need, benefits and process of creating long term value for individual customers

CO2 To create awareness about formulation and implementation of various CRM

CO2 To make students recognize CRM impact on sales and marketing strategies

Module 1 Introduction to CRM (10 hours)

CRM meaning, About CRM Software, Origin of CRM, objectives, Component of CRM, benefits of CRM, Approaches, Relationship Based Pricing Schemes, Total Care Program, Reasons for losing Customer

Module 2 Building Custom Relationship (10 hours)

Customer Acquisition, inputs of customer acquisition, process, requisites for effective customer acquisition, Customer Interactive Management, routes of customer interaction management, factors of customer interaction, Customer Retention, C Retention Strategy, determinants,

Module 3 Customer Relationship Process (10 hours)

CRP meaning, objectives, CRM process Model, 4 C's, steps of CRM process, CRM business transformation, IT and Customer Relation, e-CRM, CRM vs e-CRM, , implementation and integration e-CRM Work

Assessment

Quizzes and assignments throughout the course to assess understanding and retention of key concepts. Assignment , Group Discussion and preparation of a project report based on the field visit

E-resource

Module1- <https://www.eresourceerp.com/blogs/eresource-innovates-business-centric-crm-software/>

Module2- <https://www.eresourcescheduler.com/>

Module3- <https://www.indiamart.com/proddetail/customer-relationship-management-software-15994554691.html>

Suggested Book

[Customer Relationship Management: Concepts and Technologies](#)

[Customer Relationship Management: The Foundation of Contemporary Marketing Strategy](#)

[Managing Customer Experience and Relationships: A Strategic Framework](#)

	Module 1	Module 2	Module 3
CO 1	L		
CO 2		H	
CO 3			M

Income Tax Return Filing**(2 credits: 30 hours) Lectures: 10 Hours, Practical Lab: 20 Hours****After completion of this course, student should learn to:**

- CO 1: Understand the basics of income tax laws and regulations.
 CO 2: Identify different sources of income and applicable tax deductions and exemptions.
 CO 3: Prepare and file income tax returns for individuals and businesses.

Module- 1: Introduction to Income Tax Laws and Regulations (4 hours)

Introduction to Income Tax, Brief about Various Sources of Income (with Illustration)

Module- 2: Introduction to Tax Return Filing (2 hours Lecture 4 hours lab)

Introduction of E Filing of Income Tax Returns, Generation of IT Forms like ITR 01(SAHAJ), ITR 02, ITR 03, ITR 04, ITR 4S(SUGAM), ITR 05 and ITR 06.

Module- 3: Tax Return Filing (2 hours Lecture 12 hours lab)Practical Exposure to www.incometaxindiaefiling.gov.in portal. How to file Return Electronically on portal with or without Digital Signature Certificate. How to Pay Tax online through Net Banking. How to Generate Challans online and Manual.**Module- 4: Tax Deducted at Source (2 hours Lecture 4 hours lab)**

Form 16 B, How to view Tax Credit through 26AS, E Filing TDS Salary Return form 24Q and Challan

Assessment:

Quizzes and assignments throughout the course to assess understanding and retention of key concepts.
 Final project: Prepare and file a mock income tax return for an individual or business, demonstrating proficiency in income tax return filing procedures.

Reference Books:

1. Self Preparation and Filing of Income Tax Returns by Individuals Third Edition: May 2019 by Swatantra Sethi.
2. How to File Salary Income Tax, AY 2019-2020 by CA Rahul Gupta.
3. Fast Track Quick Revision Income Tax for AY 2019-2020 by AS K K Agarwal.
4. Tax Saving & Investment guide : Income Tax of India by CA Shammi Prabhakar Singh.

	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	L	L
CO 2	H	M		
CO 3		M	H	

Course Code: Course Name Research Methodology (VAC)**(2 Credits-30 hours) (L-T-P: 1-1-0)****Objective: The course objectives are-**

- To develop a foundational understanding of the meaning, nature, and scope of research in commerce.
- To equip students with the ability to identify research problems, formulate objectives, and develop hypotheses.
- To provide knowledge of research design and sampling techniques for systematic investigation.
- To familiarize students with various data collection methods and theoretical principles of data analysis.
- To enhance students' academic writing skills through training in report writing and interpretation of findings.
- To promote research-oriented thinking and practical application of research skills.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Students will be able to recall and describe the fundamental concepts of research, its nature, scope, and importance in commerce.

CO 2: Students will be able to explain research problems, objectives, hypotheses, research designs, sampling techniques, and data collection methods with conceptual clarity.

CO 3: Students will be able to apply appropriate research design, sampling methods, and data collection tools to develop a basic research framework.

CO 4: Students will be able to examine and interpret collected data, identify patterns, and understand relationships within research findings.

CO 5: Students will be able to critically assess research reports, justify interpretations, and present findings in a structured and academically valid manner.

Module I: Introduction to Research (6 hours)

Meaning, nature, scope, and significance of research; characteristics of scientific inquiry; relevance of research in commerce; Review of Literature—purpose, identifying research gaps, and summarizing scholarly work.

Module II: Research Problem, Objectives & Hypotheses (6 hours)

Identification and selection of research problems; refining broad topics; formulating objectives and hypotheses; overview of research design; exploratory, descriptive, and causal designs; probability and non-probability sampling techniques.

Module III: Data Collection & Theoretical Aspects of Data Analysis (6 hours)

Primary and secondary data sources; data collection tools—questionnaires, interviews, observations; steps of data preparation—coding, classification, tabulation; basics of descriptive statistics and theoretical framework of data analysis.

Module IV: Interpretation & Report Writing (6hours)

Principles of interpretation; presenting research results; structure of a research report—introduction, methodology, analysis, discussion, conclusion; academic writing skills, clarity, and coherence.

Module V: Practical Application / Activity-Based Learning (6hours)

Hands-on engagement involving topic selection, objective formulation, drafting research questions, designing a data collection tool, and preparing a basic research outline.

Mini Research Project Task

Students will complete a small research project integrating concepts from all modules:

Select a research topic.

Formulate objectives and at least one hypothesis.

Prepare a short research design with sampling technique.

Develop a questionnaire/interview schedule.

Collect a small dataset (min. 10 respondents).

Code and tabulate data; apply basic descriptive statistics.

Write a 3–5 page research report (Intro–Conclusion).

Present findings in a brief class presentation.

Suggested Readings:

Kothari, C. R., & Garg, G. *Research Methodology: Methods and Techniques*. New Age International Publishers.

Kumar, R. *Research Methodology: A Step-by-Step Guide for Beginners*. SAGE Publications.

Cooper, D. R., & Schindler, P. S. *Business Research Methods*. McGraw-Hill Education.

Saunders, M., Lewis, P., & Thornhill, A. *Research Methods for Business Students*. Pearson Education.

Sekaran, U., & Bougie, R. *Research Methods for Business: A Skill-Building Approach*. Wiley.
 Bryman, A., & Bell, E. *Business Research Methods*. Oxford University Press.
 Zikmund, W. G., Babin, B., Carr, J., & Griffin, M. *Business Research Methods*. Cengage Learning.
 Thakur, D. *Research Methodology in Social Sciences*. Deep & Deep Publications.

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	M	M	L	L
CO2	M	H	H	M	M
CO3	L	M	M	M	H
CO4	L	L	M	H	M
CO5	L	L	L	H	M

According to the difficulties level

Proposed Value Added Courses

Course name: SPSS Power Analytics

Course code:

(2 Credits- 45 hours) (L-T-P: 1-0-1)

The course “Data Analysis and Interpretation Using IBM SPSS” aims to develop students’ analytical and practical skills in quantitative research using SPSS. It equips learners with the ability to manage datasets, perform statistical analysis, interpret outputs, and present results in a research-oriented format. The course covers descriptive and inferential statistics, regression, ANOVA, and non-parametric techniques commonly used in academic and industry research.

Course /Learning Outcomes

At the end of this course students will be able to:

CO2: Understand SPSS interface, data structures, and basic data management operations.

CO3: Apply appropriate statistical tools to real-world and research datasets for evidence-based decision-making.

CO4: Analyse datasets using appropriate statistical techniques in SPSS and interpret the results for informed decision-making.

Module I: Introduction to SPSS & Data Management (5 Hours)

SPSS interface: Variable view and Data view; Measurement scales; Importing datasets from Excel/CSV; Data cleaning—sorting, filtering, recoding, merging files; Creating computed variables; Handling missing values; Data validation.

Analytical Focus:

Prepare and clean real survey datasets for statistical analysis.

Identify variable types and appropriate statistical tools.

Module II: Descriptive Statistics (20 Hours)

Descriptive statistics: Frequency tables, Measures of central tendency (mean, median, mode), Measures of dispersion (range, variance, standard deviation), Measures of shape (skewness, kurtosis), Cross-tabulation, Graphical representation: bar charts, histograms, pie charts, box plots, Interpretation of descriptive outputs and Exporting tables and graphs

Analytical Focus:

Analyse demographic and socioeconomic characteristics of a dataset.

Compare distribution patterns across groups using graphical tools.

Summarise data patterns for research reporting and decision-making.

Module IV: Inferential Statistics (20 Hours)

Theory: Population and sample concepts; sampling distribution; estimation; hypothesis testing steps.

Parametric Tests: One-sample t-test, Independent samples t-test, Paired samples t-test, One-way ANOVA and post-hoc tests

Regression Analysis: Multiple Linear Regression: Assumptions (normality, multicollinearity, homoscedasticity), Interpreting coefficients, Model fit indicators (R^2 , Adjusted R^2 , F-test) **Diagnostics:** residual plots, VIF, checking outliers

Non-Parametric Tests: Chi-square test, Mann–Whitney U test, Kruskal–Wallis test

Analytical Focus:

Identify determinants of outcome variables.

Build simple and multiple regression models for real datasets.

Evaluate strength and direction of relationships using correlation.

Interpret model outputs for research and evidence-based decisions.

Assessment rubrics

Component	Marks
Lab Performance & Participation	30
Lab Assignments	40
Practical Lab Test	30
Total	100

Mapping of COs to Syllabus

Course outcome	Module I	Module II	Module III
CO1	M	L	L
CO2	H	M	M
CO3	H	H	H
CO4	L	H	H
CO5	L	L	L

Suggested Readings:

Field, Andy. (2017). *Discovering Statistics Using IBM SPSS Statistics* (5th ed.). Sage Publications Ltd. ISBN: 9781526419521.

Pallant, Julie. (2020). *SPSS Survival Manual: A Step by Step Guide to Data Analysis Using IBM SPSS* (7th ed.). McGraw-Hill Education. ISBN: 9781760875534.

Sweet, Stephen A., & Grace-Martin, Karen. (2012). *Data Analysis with SPSS: A First Course in Applied Statistics* (5th ed.). Pearson Education. ISBN: 9780205890821.

Video Learning Resources:

Field, Andy. (Various years). *Statistics Lectures and SPSS Demonstrations*. YouTube – Andy Field Official / University of Sussex.

URL: https://www.youtube.com/results?search_query=andy+field+statistics

Research Gyan. (2020–2024). *SPSS Complete Tutorial Series*. YouTube Channel: Research Gyan.

URL: <https://www.youtube.com/c/ResearchGyan/videos>

Course Code: Course Name Fundamental of Statistics (VAC)
(2Credits- 30hours) (L-T-P: 1-0-1)

Objective: The objectives of the course are-

Introduce fundamental statistical concepts essential for business and social science research.
Enable students to understand and apply descriptive and inferential statistics in research.
Develop skill in summarizing, analyzing and interpreting quantitative data.
Equip M.Com students with statistical tools required for project work, thesis writing, and data-driven decision-making.

Course /Learning Outcomes

At the end of this course students will be able to:

CO 1: Recall fundamental statistical terms, concepts, and types of data.

CO 2: Explain the principles of descriptive and inferential statistics used in research.

CO 3: Use appropriate statistical techniques such as measures of central tendency, dispersion, correlation, and regression.

CO 4: Examine research data using hypothesis testing and interpret statistical outputs.

CO 5: Assess and choose suitable statistical tools for different kinds of research problems.

Module I: Introduction to Statistics & Data Types (6hours)

Definition and importance of statistics; role of statistics in research; types of data—primary and secondary; qualitative vs. quantitative data; scales of measurement—nominal, ordinal, interval, ratio; classification and tabulation of data; frequency distribution; graphical representations (bar diagram, histogram, frequency polygon).

Module II: Measures of Central Tendency & Dispersion (6hours)

Mean, median, mode; quartiles and percentiles; measures of dispersion—range, quartile deviation, mean deviation, standard deviation, variance; coefficient of variation; applications in research for summarizing data.

Module III: Correlation & Regression Analysis (6Hours)

Concept of correlation; types of correlation; Karl Pearson's correlation coefficient; Spearman's rank correlation; simple linear regression—meaning, regression equations, prediction using regression; use of correlation and regression in commerce and research projects.

Module IV: Probability & Basic Probability Distributions (6hours)

Basics of probability; addition and multiplication rules; random variables; normal distribution—properties and applications; z-scores; importance of probability distributions in inferential statistics and sampling.

Module V: Hypothesis Testing & Research Applications (6hours)

Concept of hypothesis and errors; level of significance; p-value interpretation; parametric tests—t-test (one-sample, independent, paired), chi-square test (goodness of fit & independence); introduction to ANOVA; selecting the right test for a research problem; interpreting statistical outputs.

End-of-Course Practical Activity

Students will complete a Mini Statistical Analysis Assignment involving:

Collecting small sample data (at least 20 observations).

Summarizing using descriptive statistics.

Applying correlation/regression or hypothesis testing.

Interpreting results and writing a short analytical report (2–3 pages).

Suggested Readings:

Gupta, S. P. *Statistical Methods*. Sultan Chand & Sons.

Levin, Richard I., & Rubin, David S. *Statistics for Management*. Pearson Education.

Anderson, D. R., Sweeney, D. J., & Williams, T. A. *Statistics for Business and Economics*. Cengage Learning..

Sharma, J. K. *Business Statistics*. Pearson.

Spiegel, Murray R. *Schaum's Outline: Theory and Problems of Statistics*. McGraw-Hill.

Das, N. G. *Statistical Methods*. McGraw-Hill.

Field, Andy. *Discovering Statistics Using SPSS*. SAGE Publications.

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	M	L	L	L
CO2	M	H	M	M	M
CO3	L	M	H	M	H
CO4	L	L	M	M	H
CO5	L	L	M	M	H

Certificate Courses

Certificate Course

Eligibility: Class XII/UG pursuing students, Business owners, Professional

Intact: maximum 30 students in a batch

Duration: Six months

Platform: Blended Mode

Assessment: Assignment for 20 marks, 10 marks attendance and final evaluation in the form of written examination for 70 marks.

Documentation and Report Writing

(2 Credits- 30 Hours)

Objectives

This course will help to develop proficiency in documentation and report-writing techniques and enable participants to create clear, concise, and impactful reports. It is designed to familiarise learners with various documentation styles and formats.

Module 1: Introduction to Documentation and Report Writing (5 Hours)

Importance of Documentation and Reports in Professional Settings, Types of Reports: Informational, Analytical, Technical, and Academic, Stages of Report Writing.

Module 2: Understanding the Audience and Purpose (5 Hours)

Identifying Target Audiences, Writing with Purpose: Inform, Persuade, or Recommend, Tailoring Tone, Style, and Content

Module 3: Report Writing Techniques (8 Hours)

Structuring a Report: Title Page, Executive Summary, Body, and Appendices, Writing Clear and Concise Content, Formatting Techniques for Readability and Professionalism, Common Mistakes and How to Avoid Them

Module 4: Documentation Standards and Tools (5 Hours)

Documentation Formats: APA, MLA, Chicago, IEEE, and Others, Using Word Processors and Documentation Software, Creating Templates for Consistency

Module 5: Data Visualization and Presentation (7 Hours)

Using Charts, Graphs, and Tables to Support Data, Tools for Visualization: Excel, Google Sheets, Canva, and Others, Integrating Visuals Seamlessly into Report.

Course/Learning Outcomes

CO1: Understand the fundamentals of effective documentation and report writing.

CO2: Develop skills to create structured, professional, and audience-specific reports.

CO3: Master tools and techniques for editing, formatting, and presenting reports.

CO4: Learn skills to design and create efficient documentation and report writing.

Suggested Readings:

Report Writing Skills Training Course by Margaret Greenhal

The Elements of Style by William Strunk Jr. and E.B. White

Technical Writing and Professional Communication by Thomas Huckin and Leslie Olsen

Online Tools: MS Word, Google Docs, Grammarly, and Canva

Web Resources: Tutorials on APA, MLA, and other formatting styles.

Personal Finance

(2 Credits-30 Hours)

Objectives

This course will help participants with essential personal finance management skills and enable informed decision-making about saving, investing, and spending. It aims to enhance financial literacy for better financial independence and security.

Module 1: Basics of Personal Finance (5 Hours)

Understanding Personal Finance: Importance and Scope, Setting Financial Goals (Short-term, Medium-term, Long-term), Introduction to Budgeting and Expense Tracking

Module 2 Savings and Investments (8 Hours)

Importance of Savings and Emergency Funds, Investment Vehicles: Fixed Deposits, Mutual Funds, Stocks, Real Estate, Risk vs. Return: Understanding Diversification and Asset Allocation

Module 3: Debt Management and Credit Health (7 Hours)

Understanding Good vs. Bad Debt, Loan Types: Home Loans, Personal Loans, Student Loans, Credit Scores: Importance and How to Improve

Module 4: Insurance and Risk Management (5 Hours)

Types of Insurance: Health, Life, Vehicle, and Property, Understanding Policies: Premiums, Riders, and Exclusions, Managing Financial Risks

Module 5: Tax Planning and Retirement (5 Hours)

Basics of Income Tax and Tax-Saving Strategies, Introduction to Retirement Planning: Provident Fund, NPS, Pensions, Wealth Transfer and Estate Planning Basics

Course/Learning Outcomes

CO1: Develop a personal financial plan, including budgeting and goal setting.

CO2: Understand investment options and assess risk.

CO3: Manage debt effectively and build credit health.

CO4: Plan for retirement, insurance, and tax-saving strategies.

Suggested Readings:

Books: *Rich Dad Poor Dad* by Robert Kiyosaki, *The Intelligent Investor* by Benjamin Graham, *I Will Teach You to Be Rich* by Ramit Sethi.

Online Tools: Mint, YNAB (You Need a Budget), Zerodha Varsity.

Web Resources: Financial Literacy Courses by SEBI, RBI, and NSE.

Certificate Course (Duration 6 months)

Course name: Stock Market Mastery

Course code:

(3 Credits- 45 hours) (L-T-P: 1-0-1)

Course Objectives:

The course aims to equip learners with a strong foundational understanding of the stock market and its functioning while developing their analytical skills for informed investment decisions. It introduces participants to the structure of capital markets, financial instruments, and regulatory frameworks, enabling them to appreciate how market systems operate. The course also focuses on examining the macroeconomic environment and its influence on market behaviour, helping learners interpret key indicators that drive market trends. Through systematic fundamental analysis, learners will gain the ability to evaluate industries and companies using financial statements, valuation ratios, and analytical models. Additionally, the course provides practical exposure to technical analysis tools and charting techniques, enabling participants to identify market patterns, evaluate price movements, and make data-driven entry and exit decisions.

Course Outcomes (COs)

After completing this certificate course, learners will be able to:

CO1: Explain the structure, functioning, instruments, and regulatory framework of capital markets.

CO3: Perform comprehensive fundamental analysis of industries and companies using financial statements, valuation ratios, and analytical frameworks such as EIC and Porter's Five Forces.

CO3: Apply technical analysis tools—including trends, indicators, and chart patterns—to identify entry and exit points for informed trading decisions

CO4: Analyse macroeconomic indicators and evaluate their influence on stock market movements, sector performance, and investor behaviour.

Module I: Introduction to Capital Market: (5 hours)

Structure of Indian financial markets (NSE, BSE, SEBI), Instruments: Equity, Bonds, Mutual Funds, ETFs, Derivatives, Primary & Secondary market, Investment vs speculation, Order types: Market, Limit, Stop-loss, Market participants and basics of risk & return

Analytical Focus:

Understanding how markets work and how investors participate.

Module II: Macro Environment & Market Dynamics (10 hours)

Economic cycles and market cycles, Inflation, interest rates, unemployment, Monetary & fiscal policy impact, Exchange rates, FII/FPI flows, Global macro factors (oil prices, US markets, geopolitics)

Analytical Focus:

Use macro indicators to assess market direction and sector opportunities.

Module III: Fundamental Analysis – Industry & Company (15 hours)

Industry Analysis: EIC Framework, Porter's Five Forces, Industry life-cycle and Emerging industries.

Company Analysis: Financial statements- Balance Sheet, P&L, Cash Flow, Key ratios (ROE, ROCE, P/E, P/B, EBITDA), Liquidity & solvency, Intrinsic valuation- DCF & Dividend models, Evaluating management quality and governance.

Analytical Focus:

Selecting fundamentally strong companies for long-term investment.

Module IV: Technical Analysis (15 hours)

Price behaviour & market psychology, Charts: Line, Bar, Candlestick, Trendlines, support & resistance, breakouts, Indicators: RSI, MACD, Moving Averages, Bollinger Bands, Chart patterns and risk management, Trading simulation practice.

Analytical Focus:

Identifying entry/exit points and predicting short-term price movements.

Mapping of COs to Syllabus

Course outcome	Module I	Module II	Module III	Module IV
CO1	H	M	L	L
CO2	H	M	M	M
CO3	L	H	H	H
CO4	L	H	H	H
CO5	L	M	M	M

Assessment Rubrics

Component	Marks
Lab Participation	20
Assignments	30
Final Test (MCQ)	50
Total	100

Suggested readings:

Graham, Benjamin. (2006). *The Intelligent Investor: The Definitive Book on Value Investing* (Revised Edition), Harper Business, ISBN: 9780060555665

Bodie, Zvi., Kane, Alex., & Marcus, Alan J. (2014). *Investments* (10th ed.), McGraw-Hill Education, ISBN: 9780077861674

Damodaran, Aswath. (2012). *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset* (3rd ed.), Wiley Finance, ISBN: 9781118011522.

Murphy, John J. (1999). *Technical Analysis of the Financial Markets*, New York Institute of Finance. ISBN: 9780735200661

Pring, Martin J. (2002). *Technical Analysis Explained* (4th ed.), McGraw-Hill Education. ISBN: 9780071381932

**SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES DEPARTMENT OF CHEMISTRY MASTER
OF SCIENCE IN CHEMISTRY – MSc Chemistry**

SEMESTER I				
Type of Course/Category	Course Code	Course Name	Credits L-T-P	Page
Theory/DC	CHIC0003	Fundamentals of Inorganic Chemistry	4-0-0	1758
Theory/DC	CHOC0004	Fundamentals of Organic Chemistry	4-0-0	1759
Theory/DC	CHPC0005	Fundamentals of Physical Chemistry	4-0-0	1760
Theory/DC	CHQT0029	Introduction to Quantum Chemistry and Group Theory	4-0-0	1783
Lab/DC	CHIQ6002	Inorganic Qualitative and Quantitative Analyses and Preparations Lab	0-0-3	1787
Audit Course	CHSL0200	Elements of Service Learning	NC	1786
Value Added Course	CHPC6137	Petroleum Chemistry	NC	1789
Total Credits			19	
SEMESTER II				
Theory/DC	CHIR0007	Advanced Inorganic Chemistry I	4-0-0	1761
Theory/DC	CHOG0008	Advanced Organic Chemistry I	4-0-0	1763
Theory/DC	CHAP0009	Advanced Physical Chemistry I	4-0-0	1764
Theory/DC	CHF0030	Fundamentals of Spectroscopy	4-0-0	1784
Theory/DC	CHGC0011	Introduction to Green and Environmental Chemistry	3-0-0	1765
Lab/DC	CHEQ6003	Experimental Physical Chemistry - Lab	0-0-3	1787
Value Added Course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	1790
Total Credits			22	
SEMESTER III				
Theory/DC	CHAI0012	Advanced Inorganic Chemistry II	4-0-0	1766
Theory/DC	CHAO0013	Advanced Organic Chemistry II	4-0-0	1767
Theory/DC	CHAP0014	Advanced Physical Chemistry II	4-0-0	1768
Theory/DC	CHSP0015	Special Topics in Biochemistry	3-0-0	1769
Theory/DC	CHAP0031	Applied Spectroscopy	3-0-0	1785
Theory/DC	CHRM0017	Research Methodology for Chemistry	3-0-0	1770
Lab/DC	CHQA6004	Organic Qualitative Analysis and Synthesis Lab	3-0-0	1788
Value Added Course	CHPC6137	Petroleum Chemistry	NC	1789
Total Credits			24	
SEMESTER IV				
Theory/ DE	CHMC0018	Materials Chemistry	3-0-0	1771
Theory/ DE	CHCC0019	Computational Chemistry	3-0-0	1773
Theory/ DE	CHFC0020	Food Chemistry	3-0-0	1774
Theory/ DE	CHIC0021	Industrial Chemistry	3-0-0	1775
Theory/ DE	CHMD0022	Medicinal Chemistry	3-0-0	1776
Specialization I: Inorganic Chemistry				
Theory/ DE	CHOC0027	Organometallic Chemistry	3-0-0	1781
Theory/ DE	CHIP0028	Inorganic Rings, Clusters and Polymers	3-0-0	1782
Specialization II: Physical Chemistry				
Theory/ DE	CHRC0023	Recent Advances in Catalysis	3-0-0	1777
Theory/ DE	CHBC0032	Biophysical Chemistry	3-0-0	1778
Specialization III: Organic Chemistry				
Theory/ DE	CHHC0025	Heterocyclic Chemistry	3-0-0	1779
Theory/ DE	CHNP0026	Natural Products Chemistry	3-0-0	1780

Project/DC	CHRP6005	Research Project	12	1789
Value Added Course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	1790
Audit Course	EDCI0200	Constitution of India	NC	
Total Credits			21	
Total Programme Credits			86	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

DEPARTMENT OF MATHEMATICS

MASTER OF SCIENCE IN MATHEMATICS – MSc Mathematics

SEMESTER I				
Type of course/ Category	Course Code	Course Name	Credits L-T-P	Page No
DC	MARA0014	Real Analysis	4-0-0	1795
DC	MALA0015	Linear Algebra	4-0-0	1796
DC	MAAB0016	Abstract Algebra	4-0-0	1797
DC	MADE0017	Differential Equations	4-0-0	1797
DC	MAMT0018	Mathematical Methods I	4-0-0	1798
Mandatory Course	MASL0200	Community Engagement and Service Learning	NC	1832
Value Added Course	MAFG0154	Fractal Geometry and Applications	NC	1829
Value Added Course	MACM6004	Computational Skill Development: MATHEMATICA		1834
Total Credits			20	
SEMESTER II				
DC	MATF0019	Topology and Functional Analysis	4-0-0	1799
DC	MACA0020	Complex Analysis	4-0-0	1800
DC	MAMP0021	Measure Theory and Probability Theory	4-0-0	1800
DC	MAMD0022	Mathematical Methods II	4-0-0	1801
DC	MACL0023	Classical Mechanics	4-0-0	1802
Mandatory	EDCI0200	Constitution of India	NC	
Value Added Course	MAML0152	Essential Mathematics for Machine Learning	NC	1831
Value Added Course	MACS6005	Computational Mathematics with SAGE MATH		1835
Total Credits			20	
SEMESTER III				
DC	MADS0030	Discrete Mathematics	4-0-0	1803
DC	MACP0031	Computer Programming in C	2-0-0	1804
DC	MACP6002	Computer Programming in C Lab	0-0-1	1833
DC	MARM0032	Research Methodology for Mathematical Sciences	3-0-0	1805
DC	MARS6001	Research Seminar	2-0-0	1833
	Specialization I: Theoretical			

DE	MAFA0033	Field theory & commutative Algebra	4-0-0	1806
DE	MANT0034	Number Theory		1807
DE	MAML0035	Mathematical Logic		1808
DE	MAFS0036	Fuzzy sets and Applications		1808
Specialization II: Applicable				
DE	MAFD0037	Fluid Dynamics I	4-0-0	1809
DE	MARC0038	Riemannian Geometry & Tensor Calculus		1810
DE	MADS0059	Dynamical Systems and Chaos		1823
DE	MACO0060	Convex Optimization		1824
DE	MANS0039	Numerical solution of PDE	4-0-0	1811
Specialization III: Computational				
DE	MACN0040	Computational Number Theory	4-0-0	1812
DE	MASC0041	Scientific Computing		1813
DE	MASF0042	Special Functions		1813
DE	MAGT0061	Introduction to Game Theory		1825
Value Added Course	MACM6004	Computational Skill Development: MATHEMATICA		1834
Total Credits			20	
SEMESTER IV				
Specialization I: Theoretical				
DE	MAAS0046	Advanced Analysis	4-0-0	1814
DE	MAGY0047	Graph Theory	4-0-0	1815
DE	MACA0048	Multivariable calculus	4-0-0	1816
DE	MAAY0049	Algebraic Number Theory	4-0-0	1816
	MAAN0062	Algebraic Geometry	4-0-0	1826
Specialization II: Applicable				
DE	MAFL0050	Fluid Dynamics II	4-0-0	1817
DE	MACM0051	Continuum Mechanics	4-0-0	1818
DE	MATR0052	Theory of Relativity	4-0-0	1819
DE	MANO0063	Numerical Optimization	4-0-0	1826
DE	MAPD0065	Plasma Dynamics	4-0-0	1828
Specialization III: Computational				
DE	MADN0054	Design and Algorithms Analysis	4-0-0	1821
DE	MAML0064	Machine Learning	4-0-0	1827
DE	MAFE0053	Finite Elements Methods	4-0-0	1820
DE	MAIC0055	Introduction to Cryptography	4-0-0	1822
Project DC	MARP6003	Research Project	8	1834
Value Added Course	MAMR0153	Statistical Methods & Software in Research	3-0-0	1830
Value Added Course	MACS6005	Computational Mathematics with SAGEMATH		1835

Total Credits	20	
Total Programme Credits	80	

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

DEPARTMENT OF PHYSICS

MASTER OF SCIENCE IN PHYSICS - MSc Physics

Semester I				
Type of Course/ Category	Course Code	Course Name	Credits	Page No
Theory/DC	PSCM0020	Classical Mechanics	4	1838
Theory/DC	PSQM0021	Quantum Mechanics I	4	1839
Theory/DC	PSMP0055	Mathematical Physics-I	4	1859
Theory/DC	PSEL0049	Electronics I	4	1854
Theory/DC	PSPL6009	Physics Laboratory I	4	1863
Mandatory	PSPS0200	Physics and Service Learning		1861
Value Added Course	PSCP6120	Computational Physics using PYTHON	2-0-0	1868
Total Credits			20	
Semester II				
Theory/DC	PSQM0024	Quantum Mechanics II	4	1840
Theory/DC	PSMP0056	Mathematical Physics -II	4	1860
Theory/DC	PSED0026	Electrodynamics	4	1842
Theory/DC	PSNP0050	Nanophysics I	4	1855
Theory/DC	PSPL6003	Physics Laboratory II	4	1862
Total Credits			20	
Semester III				
Theory/DC	PSCP0025	Condensed Matter Physics	4	1841
Theory/DC	PSNP0054	Nuclear and Particle Physics	4	1858
Theory/DC	PSRM0051	Research Methodology	2	1856
Theory/DC	PSCN0030	Computer Oriented Numerical Methods	2	1844
Theory/DC	PSCN6010	Computer Oriented Numerical Methods Laboratory	4	1864
Theory/DC	PSPP6017	Project Phase I	2	1868
	Specialisation: High Energy Physics			
Theory/DE	PSHP0052	High Energy Physics I	4	1857
	Specialisation: Astrophysics			
Theory/DE	PSPL0036	Plasma Physics I	4	1846
	Specialisation: Plasma Physics			
Theory/DE	PSPL0036	Plasma Physics I	4	1846
	Specialisation: Electronics			

Theory/DE	PSEC0037	Electronics II	4	1847
	Specialisation: Nanophysics			
Theory/DE	PSNS0041	Nanophysics II	4	1848
Mandatory	EDCI0200	Constitution of India		
Total Credits			23	
Semester IV				
Theory/DC	PSSM0034	Statistical Mechanics	4	1845
Theory/DC	PSAM0028	Atomic and Molecular Physics	4	1843
Theory/DC	PSPR6018	Project Phase II	3	1868
Theory/DC	PSST6016	Study Tour	P/NP	1868
	Specialisation: High Energy Physics			
Theory/DE	PSEP0053	High Energy Physics II	4	1858
Theory/DE	PSGR0044	General Theory of Relativity and Cosmology	4	1849
	Specialisation: Astrophysics			
Theory/DE	PSAR0045	Astrophysics	4	1850
Theory/DE	PSGR0044	General Theory of Relativity and Cosmology	4	1849
	Specialisation: Plasma Physics			
Theory/DE	PSPM0046	Plasma Physics II	4	1851
Theory/DE	PSPM6013	Plasma Physics Laboratory	4	1866
	Specialisation: Electronics			
Theory/DE	PSER0047	Electronics III	4	1851
Theory/DE	PSEL6014	Electronics Laboratory	4	1866
	Specialisation: Nanophysics			
Theory/DE	PSNY0048	Nanophysics III	4	1853
Theory/DE	PSNY6015	Nanophysics Laboratory	4	1867
Total Credits			19	
Total Programme Credits			81	

SCHOOL OF FUNDAMENTAL AND APPLIED SCIENCES

DEPARTMENT OF CHEMISTRY

MASTER OF SCIENCE IN CHEMISTRY – MSc Chemistry

SEMESTER I				
Type of Course/Category	Course Code	Course Name	Credits L-T-P	Page No
Theory/DC	CHIC0003	Fundamentals of Inorganic Chemistry	4-0-0	1758
Theory/DC	CHOC0004	Fundamentals of Organic Chemistry	4-0-0	1759
Theory/DC	CHPC0005	Fundamentals of Physical Chemistry	4-0-0	1760
Theory/DC	CHQT0029	Introduction to Quantum Chemistry and Group Theory	4-0-0	1783
Lab/DC	CHIQ6002	Inorganic Qualitative and Quantitative Analyses and Preparations Lab	0-0-3	1787
Audit Course	CHSL0200	Elements of Service Learning	NC	1786
Value Added Course	CHPC6137	Petroleum Chemistry	NC	
Total Credits			19	
SEMESTER II				
Theory/DC	CHIR0007	Advanced Inorganic Chemistry I	4-0-0	1761
Theory/DC	CHOG0008	Advanced Organic Chemistry I	4-0-0	1763
Theory/DC	CHAP0009	Advanced Physical Chemistry I	4-0-0	1764
Theory/DC	CHF0030	Fundamentals of Spectroscopy	4-0-0	1784
Theory/DC	CHGC0011	Introduction to Green and Environmental Chemistry	3-0-0	1765
Lab/DC	CHEQ6003	Experimental Physical Chemistry - Lab	0-0-3	1787
Value Added Course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	
Total Credits			22	
SEMESTER III				
Theory/DC	CHAI0012	Advanced Inorganic Chemistry II	4-0-0	1766
Theory/DC	CHAO0013	Advanced Organic Chemistry II	4-0-0	1767
Theory/DC	CHAP0014	Advanced Physical Chemistry II	4-0-0	1768
Theory/DC	CHSP0015	Special Topics in Biochemistry	3-0-0	1769
Theory/DC	CHAP0031	Applied Spectroscopy	3-0-0	1785
Theory/DC	CHRM0017	Research Methodology for Chemistry	3-0-0	1770
Lab/DC	CHQA6004	Organic Qualitative Analysis and Synthesis Lab	3-0-0	1788
Value Added Course	CHPC6137	Petroleum Chemistry	NC	1789
Total Credits			24	
SEMESTER IV				
Theory/ DE	CHMC0018	Materials Chemistry	3-0-0	1771
Theory/ DE	CHCC0019	Computational Chemistry	3-0-0	1773
Theory/ DE	CHFC0020	Food Chemistry	3-0-0	1774
Theory/ DE	CHIC0021	Industrial Chemistry	3-0-0	1775
Theory/ DE	CHMD0022	Medicinal Chemistry	3-0-0	1776
Specialization I: Inorganic Chemistry				
Theory/ DE	CHOC0027	Organometallic Chemistry	3-0-0	1781
Theory/ DE	CHIP0028	Inorganic Rings, Clusters and Polymers	3-0-0	1782
Specialization II: Physical Chemistry				
Theory/ DE	CHRC0023	Recent Advances in Catalysis	3-0-0	1777
Theory/ DE	CHBC0032	Biophysical Chemistry	3-0-0	1778
Specialization III: Organic Chemistry				
Theory/ DE	CHHC0025	Heterocyclic Chemistry	3-0-0	1779
Theory/ DE	CHNP0026	Natural Products Chemistry	3-0-0	1780
Project/DC	CHRP6005	Research Project	12	1789
Value Added Course	CHPA6138	Pharmaceutical Chemistry and its applications	NC	1790

Audit Course	EDCI0200	Constitution of India	NC	
Total Credits			21	
Total Programme Credits			86	

DETAILED SYLLABUS DEPARTMENT OF CHEMISTRY

VISION:

To produce competent chemistry graduates through dedicated teaching in classrooms, through labs and research, who can contribute meaningfully to society while fulfilling their ambitions in academia, research or industry.

MISSION:

The objective of the department is to provide dedicated guidance and support to students to equip them with a sound understanding of the fundamentals of chemistry

to enable them to explore the diverse and hitherto unexplored resources of the north-eastern region

to make significant contributions to fundamental and socially relevant research in the frontiers of chemistry to help them generate their ideas and provide them the knowhow to convert them into reality

PROGRAM OUTCOMES – MSC PROGRAMME

- PO 1: **Critical Thinking:** Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
- PO 2: **Knowledge Skill:** Equip the student with skills to analyse problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems , rather than replicate curriculum content knowledge .
- PO 3: **Scientific Communication Skills:** Imbibe effective scientific and / or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.
- PO 4: **Ethics:** Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned .Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective , unbiased and truthful actions in all aspects .
- PO 5: **Enlightened Citizenship:** Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges
- PO 6: **Analytical Reasoning:** Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
- PO 7: **Multicultural Competence:** Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is , "welcoming for all students" .
- PO 8: **Lifelong Learning:** Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling .
- PO 9: **Leadership Qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.

PO 10: **Research Skills:** Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations, problem solving and interpretation

PROGRAMME SPECIFIC OUTCOMES FOR MSC CHEMISTRY

PSO 1: **Scientific Problem solving skills:** Deep knowledge of the topic which can develop the problem solving skills using chemical principles.

PSO 2: **Analytical skills:** Develop analytical skills such as synthesizing, separating, characterizing chemical compounds and chemical reaction with the help of sophisticated instruments.

PSO 3: **Research skills:** Develop research skills through dissertation/Project work in different fields of chemistry such as organic, nanoscience, analytical, physical etc.

PSO 4: **Learning skills on life processes:** Acquire advanced level of knowledge in natural products as well as biological system from the chemistry point of view.

COURSES OFFERED IN MSC CHEMISTRY

Sl. No.	Course Name
1.1	Fundamentals of Inorganic Chemistry
1.2	Fundamentals of Organic Chemistry
1.3	Fundamentals of Physical Chemistry
1.4	Introduction to Quantum Chemistry and Group Theory
1.5	Inorganic Qualitative and Quantitative Analyses and Preparations - Lab
1.6	Value Added Course
2.1	Advanced Inorganic Chemistry I
2.2	Advanced Organic Chemistry I
2.3	Advanced Physical Chemistry I
2.4	Fundamentals of Spectroscopy
2.5	Introduction to Green and Environmental Chemistry
2.6	Experimental Physical Chemistry - Lab
2.7	Service learning
2.8	Value Added Course
3.1	Advanced Inorganic Chemistry II
3.3	Advanced Organic Chemistry II
3.3	Advanced Physical Chemistry II
3.4	Special Topics in Biochemistry
3.5	Applied Spectroscopy
3.6	Research Methodology for Chemistry
3.7	Organic Qualitative Analysis and Synthesis Lab
3.8	Value Added Course
4.1.1	Materials Chemistry
4.1.2	Computational Chemistry
4.1.3	Food Chemistry
4.1.4	Industrial Chemistry
4.1.5	Medicinal Chemistry
4.2.1	Organometallic Chemistry
4.2.2	Inorganic Rings, Clusters and Polymers
4.3.1	Recent Advances in Catalysis
4.3.2	Biophysical Chemistry
4.4.1	Heterocyclic Chemistry
4.4.2	Natural Products Chemistry
4.5	Research Project
4.6	Value Added Course

MSC Chemistry- Mapping of Courses to PO/PSO

Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PSO1	PSO2	PSO3	PSO4
1.1	H	H	H	M		H		H			H		L	
1.2	H	H	H			H		H			H		L	
1.3	H	H	H			H		H			H		L	
1.4	H	H	H			H		H			H		L	
1.5	H	M	H	H		H		M		M	H	H	H	
1.6		L				M		M	M	H	M	H	M	
2.1	H	H	H	M		H		H			H		L	

2.2	H	H	H	M		H		H			H		L	
2.3	H	H	H	M		H		H			H		L	
2.4	H	H	H	M		H		H		L	H	L	M	
2.5	H	M	H	M	M	M		H			M	L	L	
2.6	H	M	H	H		H		M		M	H	H	H	
2.7	M	M	H	L	H		H	H	H		L		L	
2.8		L				M		M	M	H	M	H	M	
3.1	H	H	H	M		H		H			H		L	M
3.2	H	H	H	M		H		H			H		L	M
3.3	H	H	H	M		H		H			H		L	L
3.4	H	H	H	M		H		H			H		L	H
3.5	H	H	H	H		H		H		M	H	L	H	L
3.6	H	H	H	H	L	H		H		H	M		H	
3.7	H	M	H	M		H		M		M	H	H	M	
3.8		L				M		M	M	H	M	H	M	
4.1.1	H	H	H	M		H		H			M		M	
4.1.2	H	H	H	M		H		H			M	M	M	
4.1.3	H	H	H	M		H		H			M		M	L
4.1.4	H	H	H	M		H		H			M		M	
4.1.5	H	H	H	M		H		H			M		M	L
4.2.1	H	H	H	M		H		H		M	M		H	
4.2.2	H	H	H	M		H		H		M	M		H	
4.3.1	H	H	H	M		H		H		M	M		H	

4.3.2	H	H	H	M		H		H		M	M		H	H
4.4.1	H	H	H	M		H		H		M	M		H	H
4.4.2	H	H	H	M		H		H		M	M		H	H
4.5	H	H	H	H	M	H		H		H	M	H	H	M
4.6		L				M		M	M	H	M	H	M	

THEORY COURSES

CHIC0003: Fundamentals of Inorganic Chemistry

(4-0-0)

(NHEQF: 6.5)

Course Outcomes

CO 1: Recall the fundamental concepts associated with hard and soft acids and bases. (Remembering)

CO 2: Explain the general characteristics and applications of coordination compounds. (Understanding)

CO 3: Make use of the electronic spectra to understand the electronic transition in coordination complexes. (Applying)

CO 4: Analyse the Metal-ligand bonding in transition metal complexes. (Analysing)

CO 5: Explain the Magnetic properties of transition metal complexes. (Evaluating)

CO 6: Design complexes of transition metal and predict their electronic and magnetic properties. (Creating)

Module I: Concepts of Acids and bases (10 lectures)

Hard and soft acid-base concept, non-aqueous solvents, redox chemistry.

Module II: Transition Metal Chemistry (8 lectures)

Descriptive chemistry of transition metals including lanthanides and actinides, coordination chemistry - coordination number and geometry, isomerism, thermodynamic stability - successive and overall stability constants, Irving-William series, chelate and macrocyclic effects.

Module III: Bonding in Inorganic and Coordination Compounds (20 lectures)

VBT (hybridization), CFT and their limitations, ligand field theory, d-orbital wave functions, d-orbital splitting in octahedral, square planar, square pyramidal, trigonal bipyramidal, and tetrahedral complexes; Jahn-Teller distortion, CFSE for d1 to d10 systems, pairing energy, low-spin and high-spin complexes and molecular orbital (MO) theory of selected octahedral, tetrahedral complexes and other geometries, Walsh Diagram.

Module IV: Electronic Spectra of Transition Metal Complexes (12 lectures) d-d transition, charge transfer transition, color, intensity and origin of spectra, interpretation, term symbols and splitting of terms different geometries, selection rules for electronic transitions, correlation, Tanabe-Sugano and Orgel diagrams, calculation of Dq , B and C , nephelauxetic ratio.

Module V: Magnetic Properties of Transition Metal Complexes (10 lectures)

Magnetic properties of free ions, types of magnetic behavior: dia-, para-, ferro- and antiferro-magnetism, temperature independent paramagnetism, magnetic susceptibility - Van Vleck equation, experimental measurement, magnetic moment - orbital contribution, quenching of contribution, effect of spin orbit coupling, spin crossover, temperature dependence of magnetic susceptibility, exchange coupling effects, magnetic properties of second and third transition series and lanthanides.

Suggested Readings

Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter and R. L. Keiter, Pearson Education.

Ligand Field theory and its Applications, B. N. Figgis and M. A. Hitchman, Wiley India.

Inorganic Chemistry, G. L. Miessler and D. Tarr, Pearson Education.

Inorganic Chemistry, P.W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Oxford University Press.

Fundamental Concepts of Inorganic Chemistry, Vols. 1-7, A. K. Das and M. Das, CBS Publishers and Distributors.

Essentials of Nuclear Chemistry, H. J. Arnikar, Wiley Eastern, New Delhi.

Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Wiley.

Inorganic Chemistry, C. E. Housecroft and A. G. Sharpe, Prentice Hall.

Chemical Applications of Group Theory, F. A. Cotton, Wiley.

Lanthanide and Actinide Chemistry, S. A. Cotton, John Wiley.

Nuclear and Radiochemistry, G. Fridlander, J.W. Kennedy, E. S. Macias and J. M. Miller, John Wiley,

New York.

Inorganic Chemistry, M. Weller, F. Armstrong, J. Rourke and T. Overton, Oxford University Press.

Elements of Magnetochemistry, R. L. Dutta and A. Syamal, Affiliated East-West Press Pvt. Ltd.-New Delhi.

Magnetism and Transition Metal Complexes, F. E. Mabbs and D. J. Machin, Dover Pub. Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	M	L	
CO 3				H	
CO 4			H		
CO 5		L			H
CO 6				H	M

CHOC0004: Fundamentals of Organic Chemistry

(4-0-0)

(NHEQF: 6.5)

Course Outcomes

CO 1: Recall various concepts associated with the kinetics of organic reaction mechanisms. (Remembering)

CO 2: Explain the generation and application of different reaction intermediates in organic synthesis. (Understanding)

CO 3: Analyse Point group of organic molecules and their connection with optical activity. (Analysing)

CO 4: Determine the absolute or relative configuration of chiral organic molecules and design asymmetric synthesis. (Evaluating)

CO 5: Predict the stereochemistry of the product of different reactions. (Creating)

Module I: Kinetics and Energetics of Reaction Mechanism (15 lectures)

Transition state theory of reaction rates - kinetics and thermodynamics of activation, reaction profiles for multistep reactions, Hammond postulate, Curtin-Hammett Principle, kinetic and thermodynamic control, Linear free energy relationships (LFER), Hammett equation - substituent and reaction constants, the Taft treatment of polar and steric effects in aliphatic compounds, kinetic isotope effects in organic reactions, effects of conformation on reactivity, stereoelectronic effects, neighbouring group participation, anomeric effect.

Module II: Reaction Mechanisms and Intermediates (Structure and Reactivity) - I (15 lectures)

Carbanions: enolates and enamines, kinetic and thermodynamic enolates, lithium and boron enolates in Aldol and Michael reactions, alkylation and acylation of enolates, name reactions under carbanion chemistry - Claisen, Dieckmann, Knoevenagel, Stobbe, Darzen, Acyloin condensations, Shapiro reaction, Julia olefination, Brook rearrangement, Sakurai reaction, Henry reaction, Kulinkovich reaction, Nef reaction, Baylis-Hillman reaction.

Ylids: Chemistry of phosphorous and sulfur ylids - Wittig and related reactions, Peterson olefination.

Carbocations: structure and stability of carbocations, classical and non-classical carbocations, neighbouring group participation and rearrangements including Wagner-Meerwein, pinacol-pinacolone, semi-pinacol rearrangement, C-C bond formation involving carbocations, oxymercuration, halolactonisation, Tishchenko reaction, Ritter reaction, Prins reaction.

Module III: Reaction Mechanisms and Intermediates (Structure and Reactivity) – II (15 lectures)

Carbenes and Nitrenes: Structure of carbenes, generation of carbenes, addition and insertion reactions, rearrangement reactions of carbenes such as Wolff rearrangement, generation and reactions of ylids by carbenoid decomposition (existence of O and N based ylids), Structure of nitrene, generation and reactions of nitrene and related electron deficient nitrogen intermediates, Curtius, Hoffmann, Schmidt, Beckmann rearrangement, structure and reactivity of benzyne.

Radicals: Generation of radical intermediates and its addition to alkenes, alkynes (inter & intramolecular) for C-C bond formation and Baldwin's rules, name reactions involving radical intermediates such as Barton deoxygenation and decarboxylation, Mc Murry coupling.

Module IV: Stereochemistry (15 lectures)

Classification of organic molecules into different Point Groups, R and S, E and Z nomenclature in C, N, S, P containing compounds, concept of absolute and relative configuration, chirality in molecules devoid of chiral centres - allenes, spiranes and biphenyls.

Concepts of stereogenic centres – chirotopic and achirotopic centres, homotopic and heterotopic ligands and faces, optical purity and enantiomeric excess, conformation of acyclic organic molecules, cyclohexane and decalins.

Dynamic stereochemistry, stereoselective synthesis, classification of stereoselective synthesis, diastereoselective, enantioselective and double stereo-differentiating reactions, nucleophilic addition to aldehyde and acyclic ketones, Prelog's rule, nucleophilic addition to cyclic ketones.

Enantioselective synthesis, use of chiral reagent, chiral catalyst and chiral auxiliary, stereospecific and stereoselective reactions.

Suggested Readings

Advanced Organic Chemistry, Part A and B, F. A. Cary and R. I. Sundberg, Springer.

Stereoelectronic Effects, A. J. Kirby, OUP.

Modern methods of Organic Synthesis, W. Carruthers and I. Coldham, Cambridge University Press.

Mechanism and Theory in Organic Chemistry, T. H. Lowry and K. S. Richardson.

Organic Chemistry, J. Clayden, N. Greeves and S. Warren.

Modern Physical Organic Chemistry, E. V. Anslyn and D. A. Dougherty, University Science Books.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	H	
CO 3				H
CO 4				H
CO 5		H	H	L

CHPC0005: Fundamentals of Physical Chemistry (4-0-0)

(NHEQF: 6.5)

Course Outcomes

CO 1: Explain the laws of thermodynamics. (Understanding)

CO 2: Explain the methods to determine the properties of polymers. (Understanding)

CO 3: Explain the various terms involved in data analysis. (Understanding)

CO 4: Apply the laws of thermodynamics and kinetics of polymerization to solve problems. (Applying)

CO 5: Distinguish between different types of systems, polymers and various statistical parameters. (Analysing).

CO 6: Calculate the sizes of polymer molecules and analyses the results of different chemical experiments from the statistical point of view. (Evaluating)

Module I: Equilibrium and Non-Equilibrium Thermodynamics (22 lectures)

Laws of thermodynamics, state and path functions and their applications, Maxwell 's relations, spontaneity and equilibria, Le Chatelier principle.

Non-ideal system - thermodynamics of real gases and gas mixtures, fugacity and its determination, non-ideal solutions, activity and activity coefficient, different scales of activity coefficient, electronic activity coefficients.

Phase equilibrium - thermodynamic criteria of phase equilibrium, Gibbs phase rule and its application to three component systems- triangular plots - water-acetic acid-chloroform system and ammonium chloride-ammonium sulphate-water system.

Non-equilibrium thermodynamics - forced flows and entropy of production, coupled flows and phenomenological relations, Onsager reciprocal relations, thermodynamic effects-Seebeck, Peltier and Thomson effects.

Module II: Statistical Thermodynamics (22 lectures)

Statistical mechanics of systems independent particles - Maxwell Boltzmann distribution, entropy and probability, calculation of thermodynamic properties for independent particles, molecular partition functions, evaluation of translational, rotational and vibrational and nuclear partition functions.

Thermodynamic properties of monatomic and diatomic gases (Sackur Tetrode equation), calculation of partition functions, thermodynamic function, principles of equipartition, heat capacities (Einstein model and Debye modification), residual entropy, equilibrium constant.

Module III: Polymer Chemistry (8 lectures)

Molecular weight of polymers, determination of molecular weight, kinetics of polymerization reaction, copolymerization, average dimension of polymer molecules, size exclusion chromatography.

Module IV: Sampling and Data Analysis (8 lectures)

Sampling of solid, liquid and gaseous samples, mean and standard deviation, absolute and relative errors, linear regression, covariance and correlation coefficient.

Suggested Readings

Physical Chemistry, P. Atkins and J. Paula, Oxford University Press.

Physical chemistry, I. R. Levine, McGraw Hill Education.

Physical Chemistry: A Molecular Approach, D. A. McQuarrie and J. D. Simon, Viva Student Edition.

Physical Chemistry, R. S. Berry, S. A. Rice and J. Ross, Oxford University Press.

Statistical Mechanics, D. A. McQuarrie, University Science Books, California.

Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas and B. Sivasankar, Pearson.

Polymer Science, V. R. Gowarikar, N. V. Viwanathan and J. Sreedhar, New age International Publishers.

Principles of Polymerization, G. Odian, Wiley Student Edition.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2	M		M	
CO 3				H
CO 4	M	H	M	
CO 5		H	M	
CO 6			H	

CHIR0007: Advanced Inorganic Chemistry I (4-0-0)

(NHEQF: 6.5)

Course Outcomes

CO 1: Recall the concepts of organometallic chemistry. (Remembering)

CO 2: Illustrate the photochemistry of different inorganic compounds. (Understanding)

CO 3: Select the inorganic compounds for their suitable analytical and industrial use. (Applying)

CO 4: Analyse the structure, bonding and synthesis of some inorganic compounds. (Analysing)

CO 5: Explain the bonding in solid-state chemistry. (Evaluating)

CO 6: Discuss the mechanism of Inorganic reactions. (Creating)

Module I: Descriptive Inorganic Chemistry (20 lectures)

Structure and bonding in polyhedral boranes and carboranes, styx notation, Wade's rules, electron count in polyhedral boranes, synthesis of polyhedral boranes, isolobal analogy, boron halides, phosphine-boranes, boron heterocycles, borazine.

Silanes, silicon halides, silicates, silicones, silanols, zeolites, germanium, tin and lead organyls, silenes, germenes, stannenes, phosphorous halides, phosphazenes, sulphur halides, structural features and reactivity of S-N heterocycles.

Synthesis and reactivity of organo-lithium, beryllium and magnesium compounds, calixarines, cryptands and crown ethers in complexation chemistry.

Preparation and reactivity of aluminium organyls, carbalumination, hydro aluminatation, chemistry of Ga (I) and In (I), reduction of Al, Ga and In organyls, Metal organic framework structures (MOFs).

Module II: Introduction to Solid State Chemistry (10 lectures)

Structure of simple solids – metals, alloys and compounds; common structure types; synthesis of solid state compounds - ceramic method, microwave synthesis, sol-gel, precursor method, hydrothermal synthesis, CVD and intercalation; characterization of solids, bonding in solids – free-electron and molecular orbital theory; bands in solid state compounds, properties of solids – optical, magnetic and electrical properties of solids.

Module III: Organometallic Chemistry (15 lectures)

Valence electron count (16/18 electron rules), synthesis, structure, bonding and reactivity of mono and polynuclear

metal carbonyls, substituted metal carbonyls, vibrational spectra of metal carbonyls, metal-metal bonding. Types of M-C bonds, synthesis and reactivity of metal alkyls, carbenes, alkenes, alkynes, and arene complexes, metallocenes and bent metallocenes, isolobal analogy.

Reactions of organometallic complexes: Substitution, oxidative addition, reductive elimination, insertion and de insertion, catalysis, hydrogenation, hydroformylation, Monsanto process, Wacker process, alkene polymerization.

Module IV: Mechanism of Inorganic Reactions (10 lectures)

Substitution in octahedral and square planar complexes, lability, trans-effect, conjugate base mechanism, racemisation, electron transfer reactions - inertness and lability, inner sphere and outer sphere mechanism, Marcus theory, solid state reactions – topotactic and epitactic mechanisms.

Module V: Inorganic Photochemistry (5 lectures)

Photosubstitution and photoredox reactions of chromium, cobalt and ruthenium compounds, Ligand field and charge transfer state (Thexi and DOSENCO states), cis-trans isomerization, photocatalysis and solar energy conservation by ruthenium complexes.

Suggested Readings

Advanced Inorganic Chemistry, F. A. Cotton, G. Wilkinson, C. A. Murillo and M. Bochmann, Wiley.

Chemistry of elements, N. N. Greenwood and E. A. Earnshaw, Butterworth-Heinemann.

Inorganic Chemistry: Principles of Structure and Reactivity, J. E. Huheey, E. A. Keiter and R. L. Keiter, Pearson Education.

Inorganic Chemistry, G. L. Miessler and D. Tarr, Pearson Education.

Inorganic Chemistry, P.W. Atkins, T. Overton, J. Rourke, M. Weller and F. Armstrong, Oxford University Press.

Concepts and Models of Inorganic Chemistry, B. E. Douglas, D. H. McDaniel and J. J. Alexander, John Wiley.

Inorganic Chemistry, G. Wulfsberg, University Science Books.

Solid State Chemistry: An Introduction, L. Smart, E. Moore, Nelson Thorns Ltd.

Fundamental Concepts of Inorganic Chemistry, A. K. Das and M. Das, CBS Publishers and Distributors.

Organometallic Chemistry of the Transition Metals, R. H. Crabtree, John Wiley.

Mechanisms of Inorganic Reactions, F. Basalo and R. G. Pearson, John Wiley

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1			H		
CO 2					H
CO 3	L	L	M		
CO 4	H			L	
CO 5		H			
CO 6				H	

CHOG0008: Advanced Organic Chemistry-I (4-0-0)**(NHEQF: 6.5)****Course Outcomes**

CO 1: Recall nucleophilic and electrophilic substitution reactions and the factors related to the rate of these reactions. (Remembering)

CO 2: Explain the stereo chemical aspects and mechanism of elimination reactions. (Understanding)

CO 3: Apply the practical utility of metal and metal-free oxidising agents in organic synthesis. (Applying)

CO 4: Compare various kinds of reducing agents in chemo selective and stereo selective synthesis. (Analysing)

CO 5: Select name reactions for constructing compounds having industrial and academic importance. (Evaluating)

Module I (15 lectures)

Nucleophilic Substitution: S_N1 , S_N2 and related mechanisms; Factors influencing reaction rates; Neighboring group participation by π - and σ -bond; Anchimeric assistance; Aromatic Nucleophilic Substitution: The S_NAr , S_N1 , benzyne and S_N1 mechanisms. Reactivity; effect of substrate structure, leaving group and attacking nucleophile; The S_Ni mechanism. Nucleophilic substitution at an allylic, aliphatic trigonal and a vinyl carbon. Aromaticity, antiaromaticity and homoaromaticity.

Electrophilic Substitution: Aliphatic: Bimolecular mechanisms: $SE1$, $SE2$ and SEi . The $SE1$ mechanism, electrophilic substitution accompanied by double bond shifts. Effect of substrates, leaving group and the solvent polarity on the reactivity. Aromatic: The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems.

Module II (15 lectures)

Elimination reactions: Mechanism and stereochemistry of different types of elimination reactions; Effects of substrate structure, attacking base, leaving group and medium; Formation of other double bonds ($C=N$, $C=O$) and triple bonds by elimination reactions; Mechanism and orientation in pyrolytic elimination.

Miscellaneous Reactions: Biginelli reaction, Passerini reaction, Nazarov cyclisation, Pd-catalyzed reactions, Vilsmeier-Hack reaction, Ugi reaction, Robinson annulations, Mitsunobu reaction, Appel reaction, Favorskii rearrangement.

Module III: Oxidation Reactions (15 lectures)

Metal and non-metal based oxidations (Cr, Mn, Al, Ag, Os, Ru, Se, DMSO, hypervalent iodine), reagents (Fremy's salt, silver carbonate, peroxides/per-acids), Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation, Sharpless asymmetric dihydroxylation, Baeyer-Villiger oxidation, Wacker oxidation, hydroboration-oxidation, Prevost reaction and Woodward modification.

Module IV: Reduction Reactions (15 lectures)

Catalytic hydrogenation (Pd/Pt/Rh/Ni), Wilkinson catalyst, Noyori asymmetric hydrogenation, metal based reductions using Li/Na/Ca in liquid ammonia, Sodium, Magnesium, Zinc, Titanium and Samarium (Birch, Pinacol formation, McMurry, Acyloin formation, dehalogenation and deoxygenations), Hydride transfer reagents from Group III and Group IV in reductions

(NaBH_4 triacetoxyborohydride, L-selectride, K-selectride, Luche reduction, LiAlH_4 , DIBAL-H, and Red-Al, Trialkylsilanes and Trialkylstannane, Meerwein-Ponndorf-Verley reduction), stereo/enantioselective reductions (Chiral Boranes, Corey-Bakshi-Shibata).

Suggested Readings

Advanced Organic Chemistry, Part A and B, F. A. Carey and R. I. Sundberg, Springer.

Organic Synthesis, M. B. Smith, Academic Press.

Modern Methods of Organic Synthesis, W. Carruthers and I. Coldham, Cambridge University Press.

Organic Chemistry, J. Clayden, N. Greeves and S. Warren. Oxford University Press.

Organic Chemistry, S. H. Pine, McGraw-Hill Book.

Advanced Organic Chemistry: Reactions, Mechanisms and Structure (4th edn.), J. March, Wiley Student Edition, John Wiley & Sons Asia Pte. Ltd.

Modern Synthetic Reaction, H. O. House, W. A. Benjamin Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H
CO 5	L	H	H	H

CHAP0009: Advanced Physical Chemistry I

(4-0-0)

(NHEQF: 6.5)

Course Outcomes

CO 1: Recall the kinetics of different types of chemical reactions. (Remembering)

CO 2: Explain the interactions of ionic species with solvent molecules. (Understanding)

CO 3: Apply the knowledge of chemical kinetics to some important types of reactions. (Applying)

CO 4: Analyse the application of electrochemistry in different fields. (Analysing)

CO 5: Calculate the rate of different types of chemical reactions. (Evaluating)

Module I: Chemical Kinetics (15 lectures)

Theories of unimolecular reactions: Lindemann theory, drawbacks of Lindemann theory- Hinshelwood modification, RRK theory, Slaters treatment, RRKM theory. Steady state approximation and its applications, oscillating reactions, chemical chaos, Belousov-Zhabotinski reaction, straight chain reactions - hydrogen-halogen reactions, alkane pyrolysis, Branching- chain reactions - the hydrogen-oxygen reaction, explosion limits, Enzyme catalyzed reactions, Michaelis-Menten mechanism- Lineweaver-Burk and Eadie plots, enzyme inhibition.

Module II: Study of Fast Reactions (5 lectures)

Stopped flow technique, temperature and pressure jump methods, NMR studies in fast reactions, shock tube kinetics, relaxation kinetics, Linearized rate equation, relaxation time in single step fast reactions, determination of relaxation time.

Module III: Molecular Reaction Dynamics (15 lectures)

Collisions of real molecules- trajectory calculations, Laser techniques, reactions in molecular beam, reaction dynamics, estimation of activation energy and calculation of potential energy surface- the transition state theory (TST) of bimolecular gaseous reactions, statistical and thermodynamic formulations. Comparison between TST and hard sphere collision theory, theory of unimolecular reactions- Lindemann theory and its limitations, kinetics of reactions in solution-diffusion controlled and chemically controlled reactions, TST of reactions in solution- Bronsted and Bjerrum equation, effect of ionic strength, kinetic salt effect.

Module IV: Electrochemistry - I (10 lectures)

Ion-solvent interaction- the Born model, Thermodynamic parameters of ion solvent interactions- structural treatment, the ion-dipole model-its modifications, ion-quadrupole and ion-induced dipole interactions.

Primary solution- determination of hydration number, compressibility method and viscosity-mobility method, Debye- Huckel theory of ion-ion interactions, derivation, validity and limitations, extended Debye-Huckel-Onsager equation, random walk model of ionic Diffusion-Einstein Smoluchowski reaction.

Module V: Electrochemistry – II (15 lectures)

Theories of Electrical Interface: Electrocapillary phenomena - Lippmann equation, electron transfer at interfaces, polarizable, non-polarizable and non-polarisable interfaces, Butler-Volmer equation, Tafel plot.

Electro-analytical Techniques: Potential step methods, potential sweep methods, Polarography and Pulse voltammetry, controlled current techniques, techniques based on impedance.

Systems for Electro-Chemical Energy Storage and Conversion: Types of Batteries, Lead- acid batteries, Nickel- cadmium batteries and Li-ion batteries, electrical double layer capacitor, pseudo-capacitor, fuel cells.

Suggested Readings

Physical Chemistry, P. Atkins and J. Paula, Oxford University Press, Oxford.

Physical chemistry, I. R. Levine, McGraw Hill Education.

Chemical Kinetics, K. J. Laidler, Pearson.

Modern Electrochemistry Part 1, 2A and 2B, J. O. Bockris and A. K. N. Reddy, Springer.

Electrochemical Methods Fundamentals and Applications, J. Bard and L. R. Faulkner, Wiley India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2				H	M
CO 3	H	M	M		
CO 4				L	H
CO 5	M	M			

CHGC0011: An Introduction to Environmental and Green Chemistry (3-0-0)

(NSQF: 5)

Course Outcomes

CO 1: Recall the basic concepts of green chemistry. (Remembering)

CO 2: Explain the principles of green chemistry, green reaction conditions, renewable sources of energy etc. (Understanding)

CO 3: Apply the concept of green chemistry in the applied research field. (Applying)

CO 4: Analyse and solve the problems related to the environment. (Analysing)

CO 5: Identify the causes of environmental degradation and find solutions for its protection. (Applying)

Module I: Environmental pollution (15 lectures)

Chemistry and environmental pollution: Chemical hazards, chemical disasters, Water pollution, air pollution and soil pollution; agricultural pollution, pollution by plastics; environmental biochemistry, toxicological chemistry, e-pollution and nuclear hazard. Environmental analysis: Analysis of water and wastewater, solid-wastes and air pollution.

Module II: Environmental protection (10 lectures)

Environmental protection: pollution prevention, green chemistry, biodegradation, water and wastewater purification – removal of arsenic, iron, fluoride, etc.; air purification, waste minimization, industrial and municipal waste treatment and soil remediation.

Module III: Principles and concepts of Green Chemistry (10 lectures)

Green chemistry: Principles of green chemistry, development of green chemistry; atom economy reactions – rearrangement reactions, addition reactions; atom uneconomic reactions–sublimation, elimination; toxicity measures, need of green chemistry in day-to-day life.

Module IV: Emerging Green Technology and alternative energy sources (10 lectures)

Design for energy efficiency, photochemical reactions – advantages, disadvantages; microwave technology in chemistry - microwave heating, microwave assisted reactions, ultrasound assisted reactions, reactions in organic liquids, reactions in aqueous media, electrochemical synthesis- examples. Supercritical solvents, ionic liquids, green catalyst, auto-exhaust catalyst and clean technology. Real world examples.

Suggested Readings

Environmental Chemistry, S. E. Manahan, CRC Press, Boca Raton.
 Green Chemistry: Theory and Practice, P. T. Anastas and J. C. Warner, Oxford University Press.
 Environmental Chemistry, J. W. Moore and E. A. Moore, Academic Press, London.
 Green Chemistry: An Introductory Text, M. Lancaster, RSC.
 Handbook of Environmental Chemistry, O. Hutzinger, Springer-Verlag.
 M. C. Cann and M. E. Connelly, Real World Cases in Green Chemistry, ACS.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1			H	M
CO 2			H	H
CO 3			M	H
CO 4	H	H		
CO 5	H	H		

CHAI0012: Advanced Inorganic Chemistry II

(4-0-0)

(NHEQF: 7)**Course Outcomes**

Recall the concepts of analytical techniques used in inorganic analysis. (Remembering)
 Illustrate the role of metal ions in the function of biological macromolecules. (Understanding)
 Apply the special Analytical Techniques for the characterization of inorganic compounds. (Applying)
 Analyse the principles and application of Nuclear and Radiochemistry. (Analysing)
 Explain the nature of supramolecular interactions. (Evaluating)
 Develop a fundamental knowledge of nanomaterials. (Creating)

Module I: Special Analytical Techniques (25 lectures)

Principles and applications of Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS/EDX), Transmission Electron Microscopy (TEM), Selected Area (Electron) Diffraction (SAED), Thermal methods of analysis – thermogravimetric analysis (TGA), Differential Thermal Analysis (DTA), Differential Thermogravimetry (DTG), Differential Scanning Calorimetry (DSC), Powder X-ray Diffraction, Single crystal X-ray diffraction.

Principles and applications of atomic absorption spectroscopy, atomic emission spectroscopy, Infrared and Raman Spectroscopy, Magnetic Resonance Spectroscopy- Electron Spin Resonance (ESR) of d^1 and d^9 transition metal ions in cubic and tetragonal ligand fields, applications of ^{31}P , ^{19}F , ^{119}Sn and ^{195}Pt nuclear magnetic resonance (NMR) spectroscopy.

Module II: Bioinorganic Chemistry (15 lectures)

Role of metal ions in biology and their toxic effects; Iron management in biological systems– siderophores, ferritin and transferrin; Dioxygen storage and transport – structure of myoglobin and haemoglobin, cooperativity of O_2 binding in haemoglobin, Bohr effect and Hill coefficients; Electron transfer proteins (structure and function) - Fe-S proteins, cytochromes and plastocyanines; Structure of nitrogenase and its role in di-nitrogen fixation; Structure and function of vitamin B_{12} and mechanism of 1,2-shift reaction; Inorganic therapeutics - chelate therapy, metal based drugs.

Module III: Introduction to Supramolecular Chemistry (5 lectures)

Supramolecular chemistry: Definition, supramolecular host-guest compounds, macrocyclic effect, nature of supramolecular interactions.

Module IV: Introduction to Nanomaterials (5 lectures)

Fabrication of nanomaterials – top-down and bottom-up approaches; solution-based synthesis of nanoparticles; other methods of nanomaterial synthesis – brief overview. Carbon fullerenes and nanotubes. Applications of nanoparticles.

Module V: Nuclear and Radiochemistry (10 lectures)

Radioactive decay and equilibrium. Mass defect and binding energy, packing fraction, stability of nucleus, neutron-proton ratio, Artificial radioactivity. Nuclear reactions; Q value, cross sections, types of reactions, Chemical effects of nuclear transformations; fission and fusion, fission products and fission yields. Radioactive techniques; nuclear reactors, separation of isotopes; tracer technique, neutron activation analysis, counting techniques such as G.M. ionization and proportional counter. Application of radio-isotopes in agriculture, medicine and industry. Radiocarbon dating.

Suggested Readings

Fundamentals of Light Microscopy and Electronic Imaging, D. B. Murphy and M. W. Davidson, Wiley.
Transmission Electron Microscopy a Textbook for Materials Science, D. B. Williams, C. B. Carter, Springer.
Principles of Biochemistry, D. Nelson, A. L. Lehninger and M. M. Cox, W. H. Freeman & Co.
Biochemistry, R. H. Abeles, P. A. Frey and W. P. Jencks, Jones and Bartlett Publishers, Boston
Fundamentals of Biochemistry: Life at the Molecular Level, D. Voet, J. G. Voet and C. W. Pratt.
Bioinorganic Chemistry, I. Bertini, H. B. Gray, S. J. Lippard and J. S. Valentine, Viva books Pvt. Ltd.
Inorganic Biochemistry: An introduction, J. A. Cowan, Wiley.
Supramolecular chemistry, J. W. Steed and J. L. Atwood, John Wiley
Supramolecular Chemistry: Concepts and Perspectives, J. M. Lehn, Wiley-VCH.
Nanostructures and Nanomaterials: Synthesis, Properties and Applications, C. G. Zhong, Imperial College Press. 11.
Nuclear and Radiochemistry, G. Friedlander, J.W. Kennedy, E. S. Macias and J. M. Miller, John Wiley, New York.
Perspectives in Supramolecular Chemistry and Molecular Recognition, G. R. Desiraju, Wiley.
Nanotechnology: A Gentle Introduction to the Next Big Idea, M. Ratner and D. Ratner, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				
CO 2		H			
CO 3	H				
CO 4					H
CO 5			H		
CO 6				H	

**CHAO0013: Advanced Organic Chemistry-II
(4-0-0)****(NHEQF: 7)****Course Outcomes**

CO 1: Recall the principles of organic photochemistry, pericyclic reactions. (Remembering)
CO 2: Explain the theories related to pericyclic reactions. (Understanding)
CO 3: Apply the knowledge of different reactions in research and industrial field. (Applying)
CO 4: Analyse the problems related to photochemistry and synthetic strategy. (Analysing)
CO 5: Demonstrate different theories in pericyclic reaction and photochemistry to check the feasibility of chemical reactions. (Understanding)

Module I: Organic Photochemistry (15 lectures)

Introduction to organic photochemical-photophysical processes, chemiluminescence, photosensitization. Photochemistry of carbonyl compounds - α -cleavage, β -cleavage, intramolecular H-abstraction, addition to π -systems- Paterno-Buchi reaction, electron transfer reactions, Photochemistry of olefins – photo stereomutation of cis-trans isomers, optical pumping, cycloaddition, photochemistry of conjugated polyenes. Photochemistry of enones, photorearrangement reactions- di- π -methane rearrangement, Photo-rearrangement of cyclohexadienones, Barton rearrangement, singlet oxygen photochemistry.

Module II: Pericyclic Reactions (15 lectures)

Main features of pericyclic reactions; Woodward-Hoffman rules, correlation diagram and FMO approaches; Electrocyclic reactions – conrotatory and disrotatory motions for $4n$ and $4n+2$ systems; Cycloadditions – antarafacial and suprafacial additions, [2+2] and [4+2] reactions ($h\nu$ and Δ), 1,3-dipolar cycloadditions and chelotropic reactions; Sigmatropic[i,j] shifts of CH and C-C bonds; Sommelet-Hauser, Claisen, thio-Claisen, Cope and aza-Cope rearrangements.

Module III: Introduction to Heterocyclic chemistry (15 lectures)

Nomenclature of heterocyclic compounds. Structure, reactivity, synthesis and reactions Pyridine, quinoline, Isoquinoline, Indole, Benzofuran, Benzothiophene, pyrazole, Imidazole, oxazole, Isoxazole, Thiazole, Isothiazole, pyridazine, pyrimidine and pyrazine.

Module IV: Synthetic Strategies (15 lectures)

Synthons and synthetic equivalents, disconnection approach, functional group inter-conversions, importance of order of events in organic synthesis, one group and two group C-X disconnections, chemo selectivity, reversal of polarity, cyclisation reactions, amine synthesis.

One group C-C disconnections – alcohols and carbonyl compounds, regioselectivity, alkene synthesis, use of acetylenes and aliphatic nitro compounds in organic synthesis.

Two group C-C disconnections – Diels-Alder reaction, 1,3-difunctionalised compounds, α , β -unsaturated carbonyl compounds, control in carbonyl condensations, 1,5-difunctionalised compounds, Michael addition and

Robinson annelation. Principle of protection of alcohol, amine, carbonyl and carboxyl groups; Common protecting groups.

Suggested Readings

Organic Chemistry, J. Clayden, N. Greeves and S. Warren, Oxford University Press.

Principles of Organic Synthesis, R. O. C. Norman and J. M. Coxon, Blackie Academic and Professional.

Strategies and Tactics in Organic Synthesis 4 & 5, M. Harmata, Academic Press.

Modern Heterocyclic Chemistry, L. A. Paquette, John Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		H		
CO 3	M	H	H	L
CO 4	H			H
CO 5	H	H		

CHAP0014: Advanced Physical Chemistry II (4-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the basic structure and properties of solids. (Remembering)

CO 2: Explain the electrical properties in terms of semiconductor, superconductor etc. (Understanding)

CO 3: Interpret the results of problems related to adsorption processes and electro kinetic phenomena of surfaces. (Applying)

CO 4: Analyse the process of surface adsorption and types of different catalysed reactions. (Analysing)

CO 5: Apply the properties of solids to interpret the conducting behaviour of different types of materials. (Applying)

Module I: Solid state (18 lectures)

Structures of solids - crystal planes and Miller indices, Bragg's law and applications, Debye-Scherrer powder method, nanoparticles and nanotechnology, defects in solids, thermodynamics of Schottky and Frenkel defect formation, thin films, Langmuir-Blodgett film. Electrical properties of solids, intrinsic and extrinsic semiconductors, doping of semiconductors, p-n junction, superconductors, conducting polymers, organic conductors, molecular electronic devices, nonlinear optical materials, optical reflectance, photoconduction, ionic conductors, Meissner effect, BCS theory.

Module II: Surface Chemistry (22 lectures)

Electrical aspects of surface chemistry, Electrokinetic phenomena, the structure of electrical double layer, Zeta potential and colloidal stability, Measurement of zeta potential. Surfactants – definition and classification, micelle formation and determination of critical micelle concentration.

Reverse micelle and its application, solubilization, microemulsion.

Adsorption of gases on solid surfaces – Langmuir's theory and its limitations. Derivation of BET equation – determination of surface area of an adsorbent, thermodynamics of adsorption processes. Capillary condensation – adsorption in micropores, Kinetics of heterogeneous catalysis – Langmuir-Hinshelwood model and Eley-Riedel mechanism.

Module III: Catalysis and Photochemistry (20 lectures)

Catalysts, classification of catalysts. Characterization of catalysts: Methods of surface analysis, surface area, pore size, void fraction, particle size, mechanical strength, surface chemical composition, surface acidity and reactivity. Rates of homogeneously catalysed reactions, turnover number and frequency.

Photochemistry - kinetics of photophysical and photochemical processes, complex photochemical processes.

Suggested Readings

Solid State Chemistry and its Applications, A. R. West, John Wiley.

Solid State Chemistry, D.K. Chakrabarty, New Age Publishers.

New Directions in Solid State Chemistry, C.N. R. Rao and J. Gopala Krishnan.

Catalytic Chemistry, B. C. Gates, John Wiley & Sons.

Fundamentals of Industrial Catalytic Processes, C. H. Bartholomew and R. J. Furrauto, Wiley Interscience.

Surfactants and Interfacial Phenomena, M. J. Rosen, John Wiley.

Physical Chemistry, J. P. Atkins, Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	H		
CO 3		H	
CO 4		H	M
CO 5	H		

CHSP0015: Special Topics in Biochemistry

(3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the characteristic properties of carbohydrates. (Remembering)

CO 2: Explain the synthesis and biosynthesis of different biomolecules. (Understanding)

CO 3: Distinguish between the physical, chemical and biochemical properties of amino acids, proteins, peptides, enzymes etc. (Analysing)

CO 4: Explain the chemistry of nucleic acids. (Understanding)

CO 5: Explain the importance of vitamins for a living being. (understanding)

Module I: Carbohydrates (9 lectures)

Characteristics and properties of carbohydrates – nomenclature and stereochemistry of monosaccharides, typical carbohydrates, sweetening agents; chemistry of monosaccharides – cyclic structures, Haworth and conformational representations, oxidation, determination of ring size, structure of correlations, synthesis, glycosides; Oligosaccharides and Polysaccharides – sucrose and other oligosaccharides, starch, cellulose and other polysaccharides.

Module II: Lipids (9 lectures)

Glycerol derivatives- fats and oils, fatty acid biosynthesis, phospholipids, glycolipids, properties of lipid aggregates, micelles, bilayers, liposomes and biological membranes.

Steroids – structural characteristics, synthesis and biosynthesis, steroid hormones; prostaglandins – structural characteristics, synthesis and biosynthesis.

Pheromones – structure and origin, synthesis.

Module III: Nucleosides, Nucleotides and Nucleic acids (9 lectures)

Nucleosides and Nucleotides: The structure of nucleosides, chemistry of nucleosides, nucleotides; sunlight, carbohydrates and energy – photosynthesis, glycolysis and metabolic energy.

Nucleic acids: Structure and function of DNA, RNA (m-RNA, t-RNA, r-RNA), an overview of gene expression (replication, transcription and translation), genetic code (origin, Wobble hypothesis and other features), genetic errors, carcinogenesis and recombinant DNA technology.

Module IV: Amino acids, Peptides and Proteins (9 lectures)

Amino Acids – structural characteristics, acid-base properties, synthesis.

Peptides – amino acid analysis, terminal group analysis, the amino acid sequence, synthesis; I Proteins, enzymes and biosynthesis – the alpha-helix, other secondary and tertiary structural characteristics, enzymes; protein synthesis.

Module V: Vitamins (9 lectures)

Vitamins: Classification; occurrence; chemistry of Vitamins – structure elucidation and synthesis; biochemical functions; deficiency syndromes.

Suggested Readings

Organic Chemistry, S. H. Pine, J. B. Hendrickson, D. J. Cram and G. S. Hammond, McGraw Hill.

Organic Chemistry, J. Clayden, N. Greeves, S. Warren and P. Wothers, Oxford University Press.

Biochemistry, J. M. Berg, J. L. Tymoczko, G. J. Gatto and L. Stryer, W. H. Freeman & Co.

Biochemistry, D. Voet and J. G. Voet, John Wiley and Sons Berg.

Principles of Biochemistry, D. Nelson, A. L. Lehninger, M. M. Cox, W. H. Freeman & Co.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H		M	M
CO 3				H	
CO 4			H		
CO 5					H

CHRM0017: Research Methodology for Chemistry

(3-0-0)

(NHEQF: 7)**Course Outcomes**

CO 1: Explain the different methods of scientific Research. (Understanding)

CO 2: Explain how to use e-resources for research. (Understanding)

CO 3: Explain the analysis and presentation of data. (Understanding)

CO 4: Apply the knowledge of chemical safety and handle chemicals safely in the lab. (Applying)

CO 5: Construct a proposal for project funding. (Creating)

Mode of Assessment:

Modules I-II will be assessed based on a written examination (2 credits) while Module III will be assessed on the basis of a seminar (1-credit).

Module I: Methods of Scientific Research and Chemical Safety (15 lectures)

Print resources, digital resources, information technology and library resources, reporting practical and project work, writing literature surveys and reviews, organizing a poster display, giving an oral presentation, writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publication of scientific work; writing ethics – avoiding plagiarism. Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals, overview of chemical regulations in India.

Module II: Data Analysis (15 lectures)

The Investigative Approach: Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments.

Analysis and Presentation of Data: Descriptive statistics. Choosing and using statistical tests. Chemometrics, Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, r and its abuse. Basic aspects of multiple linear regression analysis.

Module III: Project Proposal Writing (Seminar Module) (15 lectures)

In this module, students will be reviewing scientific articles, writing reports on the papers they have read and finally prepare a research proposal.

Suggested Readings

Practical skills in chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A. Jones, Prentice-Hall, Harlow.

Data analysis for chemistry, D. B. Hibbert and J. J. Gooding, Oxford University Press.

Errors of observation and their treatment, Fourth Ed., J. Topping, Chapman Hall, London.

Quantitative chemical analysis, D. C. Harris, Freeman.

How to use Excel in analytical chemistry and in general scientific data analysis, R. de Levie, Cambridge Univ. Press.

Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.

OSU safety manual 1.01.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	H		L
CO 3		H	
CO 4	H		
CO 5			H

CHMC0018: Materials Chemistry

(3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the knowledge of the basic structure of materials. (Remembering).

CO 2: Explain how molecular structure affects the properties of materials. (Understanding)

CO 3: Explain the properties of different materials based on their structures. (Applying)

CO 4: Analyse the application of different types of materials in a different field. (Analysing).

CO 5: Predict and control material properties. (Creating)

Module I: Solid state ionic conductors (11 lectures)

Structure, physico-chemical principles, applications of Ferrous alloys, Fe-C phase transformations in ferrous alloys, non-ferrous alloys, properties and applications of ferrous and non-ferrous alloys, magnetic alloy, metallic glass, ceramics, nano-materials and optical materials.

Module II: Polymeric materials and inorganic Polymers (12 lectures)

Molecular shape, structure and configuration, crystallinity, stress-strain behaviour, thermal behaviour, polymer types and their applications, conducting and ferro-electric properties.

Polysiloxanes, polysilanes, polyphosphazenes, polymeric sulphur - synthesis, structure, properties and applications, coordination polymers and organometallic polymers.

Module III: Liquid crystals and high-temperature superconductors (High-T_c or HTS) materials (12 lectures)

Nematic, smectic, cholesteric - properties and applications, high T_c materials, defect perovskites, high T_c superconductivity in cuprates, 1-2-3 and 2-1-4 materials, anisotropy, temperature dependence of electrical resistance, optical phonon modes, superconducting state, heat capacity, coherence length, elastic constants, position lifetimes, micro-wave absorption pairing and multi gap structure in high T_c materials, applications of high T_c materials.

Module IV: Organic solids and molecular devices (10 lectures)

Conducting organics, organic superconductors, magnetism in organic materials, fullerenes, doped fullerenes as superconductors.

Molecular rectifiers and transistors, artificial photosynthetic devices, sensors, clay-polymer and carbon composites, phosphor and laser materials.

Suggested Readings

Principles of the Solid State, H. V. Keer, Wiley Eastern.

Material Science and Engineering- An Introduction, W. D. Callister, Wiley, New York.

Materials Science, K. D. Lever, J. M. Alexander and R. D. Rawlings, J.C. Senderson, ELBS.

Inorganic Polymers, J. E. Marck, H. R. Allcock and R. West, Prentice Hall.

Solid State Physics, N. W. Ashcroft and N. D. Mermin, Saunders College.

Thermotropic Liquid Crystals, G.W. Gray, John Wiley.

Handbook of Liquid Crystals, K. V. Chemie Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H	M	H
CO 2	H		H	
CO 3	M	M		
CO 4	M			H
CO 5		M	M	M

CHCC0019: Computational Chemistry**(3-0-0)****(NHEQF: 7)****Course Outcomes**

CO 1: Recall the programming and some numerical methods in Chemistry. (Remembering)

CO 2: Explain the molecular mechanics methods. (Understanding)

CO 3: Apply QM/MM methods in organic, inorganic and organometallic systems. (Applying)

CO 4: Explain the quantum mechanical methods. (understanding)

Module I: Programming and some numerical methods in chemistry (10 lectures)

Introduction to Linux/UNIX and shell scripts; programming in C /python; Least squares fit; root finding; numerical differentiation; integration and solution of ODE; matrix multiplication, inversion and diagonalization; interpolation; pattern recognition techniques and molecular graphics.

Module II: Molecular Mechanics (MM) Methods (10 lectures)

Basic geometrical description of molecules; force field energy, force field parameterization, differences between force fields, computational considerations, validation of force fields, advantages and limitations of force field methods, transition structure modelling, hybrid force field – electronic structure methods.

Module III: Electronic structure (or Quantum Mechanical, QM) Methods (15 lectures)

Many electron systems, Hartree-Fock method, basis sets, electron correlation and its treatment, basics of density functional theory, DFT based reactivity descriptors. Introduction to popular softwares (like Gaussian, DMol, GAMESS). Applications to simple molecular systems. Monte Carlo and molecular dynamics simulations.

Module IV: Combined QM/MM methods (10 lectures)

Implications of the choice of QM and MM methods; Application of QM/MM methods in organic, inorganic and organometallic systems including bio-organic and bio-inorganic molecules.

Quantitative structure activity relation (QSAR): Early approaches, topological indices, fragmental models; quantum mechanical descriptors.

Suggested Readings

Modelling Molecular Structure, A. Hinchcliffe, John Wiley and Sons.

Molecular Modeling Basic Principles and Applications, H. D. Holtje, W. Sippl, D. Rognan and G. Folkers, Wiley-VCH.

Molecular Modeling: Principles and Applications, A. R. Leach, Pearson Education.

Introduction to computational chemistry, F. Jensen, John Wiley and Sons Press.

Numerical Recipes in Fortran/C, S. A. Tenkolsky, W. T. Vetterling and P. Flannery, Cambridge University Press.

Python programming for the absolute beginner, Course Technology, M. Dawson, CENGAGE learning.

C Programming for the absolute beginner, M. Vine, Thomson Course Technology.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2		H		
CO 3		M	M	H
CO 4			H	

CHFC0020: Food Chemistry
(3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the relationship between food, nutrition and health. (Remembering)

CO 2: Explain the nutritional needs during the life cycle and nutritional deficiency and their prevention. (Understanding)

CO 3: Apply the knowledge of food chemistry for entrepreneurial development. (Applying)

CO 4: Explain the sources, functions of major nutritional constituents. (Analysing).

CO 5: Outline the changes in nutrition during cooking, ripening, storage of different categories of food. (understanding)

CO 6: Explain nutritional perspectives of diets. (understanding)

Module I: Basic idea of food and nutrients (2 lectures)

Relationship between food, nutrition and health; functions of food: physiological and social.

Module II: Major nutritional constituents (12 lectures)

Functions, sources, deficiency/excess diseases of the following major nutrients: (a) Carbohydrates; (b) Amino acids and proteins; (c) Lipids, sterols, metabolite; (d) Mineral; (e) Vitamins: A, D, E, K.

Module III: Different categories of food (7 lectures)

Selection, nutritional contribution and changes during Cooking/Ripening/storage of the following categories of food: (a) Cereals; (b) Pulses; (c) Fruits and vegetables; (d) Milk and milk products; (e) Egg, meat, poultry and fish; (f) Fats and oils.

Module IV: Nutritional needs during life cycle (6 lectures)

Body composition, Influence of Nutrition, Physical Activity, Growth and Aging; Maternal Nutrition, Nutritional Requirement during Infancy, Childhood; Diet, Nutrition and Adolescence; Nutrition in the Elderly.

Module V: Prevention and management of deficiencies (6 lectures)

Causes, symptoms, treatments and preventions of the following: Protein-Energy malnutrition among children; Vitamin A deficiency; Iron deficiency; Fluorosis: Over nutrition, obesity, coronary heart diseases, Diabetes (Type I & II); Diet, Nutrition and cancer.

Module VI: Dietary goals & guidelines (10 lectures)

National Perspectives; nutritional perspectives of vegetarian diets; Social Health Issues – Smoking, Alcoholism, Drug Addiction, AIDS and AIDS Control Programs; Food Preservation & Food Additives & Colorants.

Module VII: Entrepreneurship Development (2 lectures)

Scope of Food based items for Entrepreneur Development in North East India & Identification of Resources; Development of a Project Plan.

Suggested Readings

Fundamentals of Foods, Nutrition and Diet Therapy, S. R. Mudambi and M. V. Rajagopal, New Age International.

Nutrition Science, B. Srilakshmi, New Age International.

Handbook of Food and Nutrition, M. Swaminathan, BAPPCO.

Perspectives of Nutrition, G. M. Wardlaw and J. S. Hanpl, McGraw Hill.

Food Science, Nutrition and Food Safety, S. Sari, A. Malhotra, Pearson India Ltd.

Nutritive Value of Indian Foods, NIN, ICMR, C. Gopalan, B.V. Rama Sastri and S. C. Balasubramanian.

Textbook of Human Nutrition, M. S. Bamji, Oxford & IBH Pub Co Pvt Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII

CO 1	H	M	M	M	M		
CO 2				H	H		
CO 3							H
CO 4		H	L				
CO 5				H			
CO 6						H	

**CHIC0021: Industrial Chemistry
(3-0-0)**

(NHEQF: 7)

Course Outcomes

CO 1: Recall the origin, importance of elastomers. (Remembering)

CO 2: Recall the classification, limitations of synthetic fibers. (Remembering)

CO 3: Illustrate the classification and utility of fertilizers and pesticides. (Understanding)

CO 4: Compare and Analyse different chemical reactions and procedures adopted in different industries. (Analysing)

CO 5: Evaluate the challenges existing in the tea and sugar industries and suggest ways to overcome them. (Evaluating)

CO 6: Explain the classes, manufacturing of different paints. (Understanding)

Module I: Elastomers (7.5 lectures)

Rubbers: origin, importance, types of rubber, natural rubber, gutta-percha, guayle rubber, balata. Refining of crude rubber, drawbacks of natural rubber, vulcanization, technique of vulcanization. Synthetic rubber, poly butadiene, buna –S or SBR rubber, neoprene, nitrile rubber, butyl rubber, silicone rubber, & poly urethane.

Module II: Synthetic Fibres (5 lectures)

Introduction, natural and artificial fibres characteristics and limitations. Study of following synthetic fibres- Rayon (nitro cellulose) cupra ammonium rayon, acetate rayon, nylon 66, nylon-6, terylene (Dacron) Teflon & Saran.

Module III: Fertilizers and Pesticides (10 lectures)

Fertilizers: Plants nutrients, need for fertilizers, qualities of fertilizers, NPK ratio, classification of fertilizers, straight and mixed fertilizers. Nitrogenous fertilizers, manufacture of ammonium nitrate, urea, ammonium sulphate, phosphate fertilizers manufacture of triple phosphate and super phosphate, potassium fertilizers. Pesticides: Introduction, classification, Study of the following types: - Organo chlorine pesticides like DDT, BHC and Aldrin. Organo phosphorous pesticides, malathion & parathion. Rodenticides, fungicides, herbicides, fumigants and repellants (one example each).

Module IV: Sugar and Fermentation Industries (10 lectures)

Sugar: Importance of sugar industry, manufacture of raw and refined sugar with flow sheet, estimation of sugar (physical and chemical methods).

Fermentation: Definition of fermentation, importance of various fermentation industries, basic requirements for fermentation, steps in fermentation process. Manufacture of alcohol from molasses, distillation, coffee still, preparation of absolute alcohol, various useful fractions and their uses, proof spirit, denatured spirit.

Module V: Tea Industry (7.5 lectures)

Chemical composition - an overview, Polyphenols in tea- Mechanism of theaflavin formation, biochemistry of tea - Biosynthesis of caffeine, Cinnamate, flavonoids, Chemical properties of tea- Polyphenols as Anti-oxidants.

Module VI: Paints (5 lectures)

Introduction, classification of paints, constituents of paints in brief. Manufacture of paints, qualities of good paint, emulsion paints, paint removers, varnishes enamels, lacquers, thinners in brief.

Suggested Readings

Industrial Chemistry, B. K. Sharma, Goel Publishing House Meerut, India.

Shreeve's Chemical Process Industries, G. T. Austin, Mc Graw Hill.

Organic Chemistry Vol I, I. L. Finar.

Organic Chemistry Vol II, I. L. Finar.

Introduction to Paint Chemistry and Principles of Technology, J. Bentley and G. P. A. Turner, Springer Science.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H			
CO 4			L	H	H	M
CO 5				H	H	
CO 6						H

CHMD0022: Medicinal Chemistry

(3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the definition of drugs and pro drugs and history of drug development. (Remembering)

CO 2: Explain the mechanisms and theoretical aspects of drug action. (Understanding)

CO 3: Explain the properties and synthetic methods of antibiotics, antiviral, antimalarials etc. (Understanding)

CO 4: Explain the classes of neurotransmitters, drugs affecting cholinergic and adrenergic pathways. (Understanding)

CO 5: Recall about antihistamines, anti-inflammatory drugs, analgesics, anticancer gene therapy etc. (Remembering)

Module I: Introduction and History of Drug Development (5 lectures)

Definition of drug and prodrugs; need of drugs; germ theory of diseases; history of sulpha drugs and their mode of action; antibacterial agents.

Module II: Mechanisms and Theoretical aspects of drug action, drug discovery, design and delivery (10 lectures)

Receptors – two-state model of receptor theory, drug-receptor interaction and Clark's Occupancy Theory; physiological response; drug agonist and antagonist – classification; Need of quantification of drug action; definition of chemotherapeutic index and therapeutic index; factors affecting bioactivity of drugs; pharmacokinetics and pharmacodynamics; QSAR; Lead compounds in drug discovery; importance of SAR and molecular modification; importance of combinatorial library and molecular modelling in drug discovery; drug delivery – controlled drug delivery methods.

Module III: Antibiotics, Antivirals and Antimalarials (15 lectures)

General introduction to antibiotics – their sources and classification; causes and concerns of bacterial resistance to antibiotics; definition and need of broad Spectrum Antibiotics. Mechanism of action of lactam antibiotics, non-lactam antibiotics and quinolones.

Antivirals – difficulty in developing clinical solutions to viral diseases, introduction to antiviral agents, AIDS –its cause and prevention.

Antimalarials – classification of human malaria and plasmodia responsible for human malaria; discovery of quinine and its structure-activity-relationship (SAR), importance of quinine as a lead to the discovery of

low cost antimalarials, artemisinin and its derivatives – their SAR and importance in dealing with chloroquine resistant malaria, mode of action.

Module IV: Neurotransmitters (5 lectures)

Classes of neurotransmitters, drugs affecting cholinergic and adrenergic pathways.

Module V: Miscellaneous topics (10 lectures)

Antihistamines, anti-inflammatory drugs, analgesics, anticancer and antihypertensive drugs, gene therapy, anti-sense and antigene strategies and drug resistance.

Suggested Readings

Medicinal Chemistry: An Introduction, G. Thomas, John Wiley & Sons.

An Introduction to Medicinal Chemistry, G. L. Patrick, Oxford University Press.

Introduction to Medicinal Chemistry, A. Gringauz, Wiley India Pvt Ltd.

Medicinal Chemistry, D. Sriram and P. Yogeeswari, Pearson Education. (Dorling Kindersley India).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H	M	M	M
CO 3			H		
CO 4				H	
CO 5					H

CHRC0023: Recent Advances in Catalysis (3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the kinetics of heterogeneous catalysis. (Remembering)

CO 2: Explain the preparation and characterization of industrial catalysts. (Understanding)

CO 3: Explain the synthesis and properties of Zeolite and clays. (Understanding).

CO 4: Explain the environmental catalyst and role of catalyst in the petroleum industry. (Understanding)

Module I: Kinetics of heterogeneous catalysis (10 lectures)

Adsorption and catalysis, mechanism of heterogeneous catalysis, kinetics of heterogeneous catalytic reactions, volcano principle, shape and size selectivity of catalysts, characterization of catalysts and their surfaces, methods of surface analysis, surface area, pore size, void fraction, particle size, mechanical strength, surface chemical composition, surface acidity and reactivity.

Module II: Preparation and characterization of industrial catalysts (8 lectures)

Catalyst design methods, catalyst support and preparation of industrial catalyst, supported and unsupported metal catalysts, bimetallic catalysts, Electron microscopy, XPS and PES, ESCA, IR and magnetic resonance spectroscopy, temperature programmed desorption (TDP), and DTA and TGA.

Module III: Zeolite and clays (15 lectures)

Synthesis of some selected important zeolites, modification of zeolites, ion exchange, metals supported on zeolites, dealumination and desilication of zeolites, shape selective catalysis in zeolites. Properties of pillared clays, use of coordination and organometallic compounds as pillaring, pillaring of acid activated clays, mesoporous materials, ordered mesoporous materials, synthesis of silica molecular sieve materials, characterization of mesoporous molecular sieves, catalytic properties of mesoporous materials, catalytic applications of zeolite, clays and mesoporous materials.

Module IV: Catalysis in petroleum industry and environmental catalysts (12 lectures)

Design of catalytic reactors, promotion and promoters, catalytic processes in petroleum industry, reforming, cracking and hydrotreating, hydrogenation, hydrodesulphurization, Fischer-Tropsch process, Catalytic deactivation and reactivation, control of pollution from automobile exhaust, catalytic converters, abatement of nitrogen oxides and odours, cleaning of industrial effluents.

Suggested Readings

Fundamentals of Industrial Catalytic Processes, C. H. Bartholomew and R. J. Furrauto, Wiley Interscience.
 Heterogeneous Catalysis, D. K. Chakrabarty and B. Viswanathan, New Age Int.
 Catalytic Chemistry, B. C. Gates, John Wiley & Sons.
 Heterogeneous Catalysts for Synthetic Chemists, R.L. Augustine, Marcel-Dekker.
 Catalysis and zeolites – fundamentals and applications, J. Weitkamp and L. Puppe, Springer-Verlag.
 Handbook of Heterogeneous Catalysis, Vol 4 and 5, G. Ertl, H. Knozinger and J. Weitkamp, Wiley-VCH.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

CHBC0024: Biophysical Chemistry
(3-0-0)

(NHEQF: 7)**Course Outcomes**

CO 1: Recall the fundamentals of biological macromolecules. (Remembering)
 CO 2: Explain the molecular modelling and conformational analysis of biological macromolecules. (Understanding)
 CO 3: Explain different methods for analysis and separation of biomolecules. (Understanding)
 CO 4: Explain different techniques for the structural determination of biomolecules. (Understanding)
 CO 5: Explain different optical methods in biological systems. (Understanding)

Module I: Fundamentals of biological macromolecules (5 lectures)

Chemical bonds in biological systems; properties of water; thermodynamic principles in biological systems; properties and classification of amino acids; protein structure and function; properties of nucleosides and nucleotides; composition of nucleic acids; structure of nucleic acids.

Module II: Molecular modelling and conformational analysis (10 lectures)

Complexities in modelling macromolecular structure; polypeptide chain geometries and internal rotation angles; Ramachandran plots; Molecular mechanics; stabilizing interactions in biomolecules; simulating macromolecular structure; energy minimization; molecular dynamics.

Module III: Methods for analysis and separation of biomolecules (10 lectures)

General principles, chromatography; analytical centrifugation – basic principles, sedimentation velocity, sedimentation equilibrium, density gradient sedimentation – isopycnic and rate- zonal centrifugation; electrophoresis, isoelectric focussing; capillary electrophoresis, MALDI-TOF, calorimetry – introduction, isothermal titration calorimetry, differential scanning calorimetry.

Module IV: Structural determinations: Physical Methods (10 lectures)

Ultracentrifugation and other hydrodynamic techniques; light scattering – fundamental concepts, scattering from a number of small particles, Rayleigh scattering, scattering from particles that are not small compared to the wavelength of radiation, dynamic light scattering, low angle X-ray scattering, neutron scattering, Raman scattering.

Module V: Optical Methods and Applications (10 lectures)

Optical techniques in biological systems – refraction, evanescent waves and plasmons-surface plasmon resonance; absorption spectroscopy, fluorescence spectroscopy, linear and circular dichroism, single and multidimensional NMR spectroscopy.

Suggested Readings

Biophysical Chemistry Parts I-III, C. R. Cantor and P. R. Schimmel, Macmillan.
 Principles of Biochemistry, A. L. Lehninger, D. L. Nelson, L. Lehninger and M. M. Cox, W. H. Freeman.

Biophysical Chemistry the Royal Society of Chemistry, A. Cooper, UK.
Biophysical Chemistry, J. P. Allen, Blackwell Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H		L	M	
CO 2		H			
CO 3			H		
CO 4		L		H	
CO 5					H

CHHC0025: Heterocyclic Chemistry (3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the systematic nomenclature of heterocyclic compounds. (Remembering)

CO 2: Explain the synthesis and properties of azoles and condensed five-membered rings. (Understanding)

CO 3: Explain the synthesis and properties of three and four-membered heterocyclic compounds. (Understanding)

CO 4: Explain the importance and chemistry of natural heterocyclic compounds. (Understanding)

CO 5: Explain synthesis and properties of Diazines, bicyclic heterocycles & seven-membered heterocycles. (Understanding)

Module I: Introduction & Small Ring Heterocycles (10 lectures)

Hantzsch-Widman nomenclature for monocyclic, fused and bridged heterocycles; General approaches to heterocyclic synthesis; Aliphatic and aromatic heterocycles; Basicity and aromaticity of heterocycles. Syntheses of aziranes, oxiranes & thiiranes; Ring openings and heteroatom extrusion; Synthesis & reactions of azetidines, oxetanes & thietanes; Strain.

Module II: Azoles and condensed five membered Rings (15 lectures)

Physical and chemical properties; Synthesis of pyrazole, isothiazole and isoxazole; Synthesis of imidazoles, thiazoles & oxazoles; Nucleophilic and electrophilic substitutions; Ring cleavages; Benzofused analogues.

Synthesis of indole, benzofuran and benzo-thiophene; Nucleophilic, electrophilic and radical substitutions; Addition reactions; Indole rings in biology.

Module III: Diazines, bicyclic heterocycles & seven membered heterocycles (10 lectures)

Physical & chemical properties and synthesis of pyridazines, pyrimidines, pyrazines; Nucleophilic and electrophilic substitutions.

Synthesis of quinolines, isoquinolines, benzofused diazines, acridines, phenothiazines, carbazoles and pteridines; Substitution reactions.

Synthesis & reactions of azepines, oxepines, thiepinines & diazepines.

Module IV: Natural heterocycles (10 lectures)

Porphyrins: Classification and synthesis of porphyrin rings.

Nucleic Acids: Primary, secondary and tertiary structure of DNA; DNA replication and heredity; Structure and function of mRNA, tRNA and rRNA.

Proteins: Acid-base properties of amino acids; polypeptides; primary, secondary, tertiary and quaternary protein structures; classification of proteins on basis of structure and biological function; Merrifield peptide synthesis.

Suggested Readings

Modern Heterocyclic Chemistry, L. A. Paquette, W. A. Benjamin.

Organic Chemistry, Vol. II, I. L. Finar, ELBS.

Heterocyclic Chemistry, T. L. Gilchrist, Longman.

Biochemistry, A. L. Lehninger, Kalyani Publishers.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3	H			
CO 4				H
CO 5			H	

CHNP0026: Natural Products Chemistry (3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the chemistry of medicinal compounds of natural origin. (Remembering)

CO 2: Explain the role of co-enzyme during Bio-synthesis of natural products. (Understanding)

CO 3: Illustrate the biosynthesis and total synthesis of terpenoids and alkaloids. (understanding)

CO 4: Analyse the presence of isoprene units in the natural product. (Analysing)

Module I: Natural Products and their Biosynthetic Pathways (15 lectures)

General classification of natural products, sources and their isolation, characterisation and biosynthesis of common plant products; Extraction and Separation of Natural Products Biosynthesis pathways for natural products using co-enzymes and enzymes, general biogenesis and synthesis of cis-jasmone, methyl jasmonate, prostaglandins, exaltone and muscone.

Module II: Terpenoids and Alkaloids (15 lectures)

Terpenes and the Isoprene Rule; General biosyntheses of mono- and sesquiterpenes, trans-chrysanthemic acid, cyclo-pentato monoterpene lactones; Synthesis of α -vetinone and total synthesis of β -eudesmol; Synthesis of hirsutene, abietic acid, cis juvenile hormone, trans annular cyclisation of caryophyllene; Synthesis of caryophyllene and isocaryophyllene; Rearrangements of santonic acid and thujospene; Synthesis and rearrangement of longifolene; Structure, synthesis and biosynthesis of common alkaloids: reticuline, yohimbine and tylophorine.

Module III: Steroids (15 lectures)

Nomenclature of steroids and synthesis of squalene; Lanosterol and caretonoids; Synthesis of equenins; Estrogens and total synthesis of non-aromatic steroids (progesterones); Corticosteroids; Degradation of diosgenin to progesterone and its synthesis; Miscellaneous transformations of steroid molecules.

Suggested Readings

Natural Products Chemistry, Vols. I and II, K. Nakanashi, Academic Press, New York and London.

Natural Products Chemistry, sources, separations and structures, R. Cooper and G. Nicola, CRC Press, Taylor & Francis Group.

Chemistry of Natural Products, S. V. Bhat, B. A. Nagasampagi and M. Sivakumar, Springer Science & Business Media.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	H	L	L
CO 3		H	
CO 4		H	

CHOC0027: Organometallic Chemistry
(3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the fundamentals of organometallic compounds and their reactions. (Remembering)

CO 2: Explain the physical techniques required for the characterization of Organometallic compounds. (Understanding)

CO 3: Explain the synthesis and application of the main group organometallic compounds. (Understanding)

CO 4: Analyse the function of transition metal-based organometallic compounds. (Analysing)

Module I: Introduction to organometallic compounds and reaction mechanisms (7 lectures)

History of Organometallic Chemistry, 18 electron rule, Electronic structure, Ligand substitution, oxidative addition, reductive elimination, migratory insertion, hydride elimination, trans-metallation, nucleophile and electrophilic attack on the ligands coordinated to metals.

Module II: Physical methods in organometallic chemistry (8 lectures)

Characterization of organometallic compounds using NMR, EPR, Mossbauer, IR, Mass spectroscopy and X-ray crystallography; Isotope effect; Fluxionality of organometallic complexes.

Module III: Main group organometallic compounds (8 lectures)

Synthesis and reactions of main group organometallic compounds including organo lithium, organo magnesium, organo boron, organo aluminium, organosilicon and organotin compounds.

Module IV: d-block organometallic compounds (8 lectures)

Structure, Preparation, and Chemistry of Transition metal carbene and π -carbyne complexes. N-Heterocyclic Carbene complexes; Transition metal compounds with M-H bonds (classical and non-classical metal-hydrides), Agostic interaction.

Module V: Organometallic catalysis and application of organometallic chemistry to organic synthesis (14 lectures)

Synthetic applications of metathesis reactions, ring opening, ring closing metathesis in organic synthesis, macrocycle synthesis. Asymmetric hydrogenation, Hydrosilylation, Hydrocyanation, Palladium in Homogenous catalysis- Heck coupling, Stille coupling, Suzuki coupling, Negishi coupling, Sonogashira coupling and Buchwald-Hartwig coupling reactions. Synthetic utility of organotitanium, organochromium, organonickel, organocopper, organorhodium compounds.

Suggested Readings

Organometallics, C. Elschenbroich, Wiley.

The Organometallic Chemistry of the Transition Metals, R. H. Crabtree, Wiley-Blackwell.

Organometallics and Catalysis: An Introduction, M. Bochmann, Oxford University Press.

Organometallic Chemistry, G. O. Spessard and G. L. Miessler, Oxford University Press, New York.

Transition Metal Organometallic Chemistry, F. Mathey, Springer.

Organic Synthesis, M. B. Smith, McGraw Hill Higher Education.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H		L	L	M
CO 2		H			
CO 3			H		
CO 4				H	

CHIP0028: Inorganic Rings, Clusters and Polymers
(3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall the knowledge of inorganic rings, clusters and inorganic polymers with respect to their structural diversity. (Remembering)

CO 2: Illustrate different theories to predict the structure of metal clusters. (Understanding)

CO 3: Make use of isolobal analogy in the understanding of structure and bonding of heteroboranes. (Applying)

CO 4: Analyse the concept of electron deficiency and sufficiency of Polyhedral boranes.

Module I: Boranes and Heteroboranes (13 lectures)

Polyhedral boranes, concept of electron deficiency and sufficiency, types and IUPAC nomenclature of polyhedral boranes. Polyhedral skeleton electron pair theory (PSEPT). W. N. Equivalent and resonance structures. Wade's vs Lipscomb's methods of studying higher boranes.

Heteroboranes: types and IUPAC nomenclature, structure and bonding of heteroboranes with special reference to carboranes,

Metallaboranes, Metallocarboranes, metal σ and μ bonded borane/carborane clusters. Resemblance of Metallaboranes/Metallocarboranes with ferrocene and related compounds. Applications of Metallaboranes/Metallocarboranes as drug delivery system. Applications of PSEPT over heteroboranes.

Module II: Isolobility (6 lectures)

Concept of isolobility and isolobal groups with examples. Its application in the understanding of structure and bonding of heteroboranes.

Module III: Metal Clusters (11 lectures)

Metal-metal bonding, quadrupolar bond and its comparison with a C-C bond; Types of metal clusters and multiplicity of M-M bonds. Simple and condensed metal carbonyl clusters. Applications of PSEPT and Wade's-Mingos and Lauher's rule over metal carbonyl clusters. Metal halide and metal chalcogenide clusters, polyatomic Zintl ions, Bloomington shuffle.

Module IV: Inorganic Polymers (15 lectures)

Inorganic polymers, classification of inorganic polymers, comparison with organic polymers, Boron-oxygen and boron-nitrogen polymers, silicones, polysilanes, polyphosphazenes, coordination polymers, sulphur-nitrogen, sulphur-nitrogen-fluorine compounds, preceramic inorganic polymers.

Suggested Readings

Advanced Inorganic Chemistry, F. A. Cotton and G. Wilkinson, John Wiley & Sons, New York.

Inorganic Chemistry, J. E. Huheey, Addison Wesley Pub. Co., New York.

Chemistry of the Elements, N. N. Greenwood and A. Earnshaw, Butterworth Heinemann, London.

Inorganic polymers, J. E. Mark, H. R. Allcock and R. West, Oxford University Press, New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	L	H	H
CO 2			H	
CO 3		H		
CO 4	H			

CHQT0029: Introduction to Quantum Chemistry and Group Theory (4-0-0)**(NHEQF: 6.5)****Course Outcomes**

CO 1: Recall the postulates and principles of quantum chemistry. (Remembering)

CO 2: Explain the Schrodinger equation. (Understanding)

CO 3: Solve the problems related to wave functions. (Applying)

CO 4: Distinguish one approximation method from another, one molecular point group from another. (Analysing)

Module I: Quantum Chemistry I (20 lectures)

Planck's theory, wave-particle duality, uncertainty principle, operators, eigen functions and eigen values in quantum mechanics, postulates of quantum mechanics, Schrodinger equation, free particle, particle in a box, degeneracy, harmonic oscillator, rigid rotator, the hydrogen atom, angular momentum, electron spin, spin-orbit coupling.

Module II: Quantum Chemistry II (20 lectures)

Approximate methods in quantum mechanics - the variation theorem, linear variation principle and perturbation theory (first order and non-degenerate), application of variation method and perturbation theory to the Helium atom, anti-symmetry, Slater determinant, term symbols and spectroscopic states, Huckel approximation for small pi-conjugated molecules.

Module III: Chemical Applications of Group Theory (20 lectures)

Symmetry elements and operations, equivalent symmetry elements and equivalent atoms, identification of symmetry point groups with examples, groups of very high symmetry, molecular dissymmetry and optical activity, systematic procedure for symmetry classification of molecules and illustrative examples, brief review of matrix representation of groups, reducible and irreducible representations, rules about irreducible representations as derived from great orthogonality theorem, relationship between reducible and irreducible groups, character tables.

Suggested Readings

Molecular quantum Mechanics, P. Atkins and R. Friedman, Oxford University Press.

Quantum Chemistry, I. N. Levine, PHI Learning Pvt. Ltd.

Introduction to Quantum mechanics, D. J. Griffiths, Pearson Education Ltd.

Chemical Applications of Group Theory, F. A. Cotton, Willey India Pvt. Ltd.

Molecular Symmetry and Group Theory, R. L. Carter, John Wiley & Sons.

Molecular Symmetry and Group Theory, A. Vincent, Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	L	
CO 2	H		
CO 3	H	L	
CO 4	M	H	H

CHF0030: Fundamentals of Spectroscopy

(4-0-0)

(NHEQF: 6.5)

Course Outcomes

CO 1: Recall the fundamental aspects of absorption and emission spectroscopy.

(Remembering)

CO 2: Explain the basic concepts of rotational and vibrational spectroscopy. (Understanding)

CO 3: Illustrate basics and applications of electronic spectra. (Understanding)

CO 4: Explain theories and applications of NMR, ESR and Mossbauer spectroscopy. (Understanding)

CO 5: Identify unknown molecules with the help of different spectroscopic techniques. (Applying)

Module I: Interaction of light with matter (5 lectures)

Fundamental aspects of absorption and emission spectroscopy, probability of transition, oscillator strength, dipole strength, Spontaneous and stimulated emission, origin of selection rules.

Module II: Rotational and Vibrational Spectroscopy (15 lectures)

Degrees of freedom of molecules, rigid rotor model, rotational spectra of diatomics and polyatomics, effect of isotopic substitution and non-rigidity, selection rules and intensity distribution, Vibrational spectra of diatomics, effect of anharmonicity, Morse potential, Vibrational-rotational spectra of diatomics, P, Q, R branches, normal modes of vibration, overtones, hot bands, Raman spectroscopy – Origin, rotational and vibrational Raman spectra of diatomics.

Module III: Electronic Spectroscopy (15 lectures)

Electronic spectra of diatomic molecules, Frank-Condon principle, vibronic transitions, Spectra of organic compounds, $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$ transition, Photoelectron Spectroscopy – basic principle, photoelectron spectra of simple molecules, X-ray photoelectron spectroscopy (ESCA), Auger electron spectroscopy, Lasers – Laser action, population inversion, properties of laser radiation, examples of simple laser systems.

Module IV: Magnetic Resonance Spectroscopy (15 lectures)

Nuclear Magnetic Resonance: Nuclear spin and nuclear spin states in magnetic field, resonance phenomenon, relaxation process, NMR line shapes and saturation, shielding and de-shielding of magnetic nuclei, chemical shift, spin-spin interactions, spectra of two-spin system (A_2 , AB and AX cases), ^{13}C , ^{19}F and ^{31}P NMR spectroscopy.

Electron Spin Resonance: Basic principles, factors affecting g values, hyperfine coupling, spin densities and McConnell relationship, Zero field splitting.

Module V: Mass spectrometry and Mossbauer spectroscopy (10 lectures)

Mass spectrometry: Basic principles, ionization techniques, isotope abundance, molecular ion, fragmentation processes of organic molecules, deduction of structure through mass spectral fragmentation

Mossbauer spectroscopy: Principles, instrumentation and applications.

Suggested Readings

Fundamentals of Molecular Spectroscopy, C.N. Banwell and E. M. McCash, Tata McGraw Hill.

Introduction to Spectroscopy, D.L. Pavia, G. M. Lampman and G. S. Kriz, Brooks/Cole Cengage Learning.

Physical Methods in Chemistry, R.S. Drago, Saunders, Thomson Learning.

Spectrometric Identifications of Organic Compounds, R.M. Silverstein, F. X. Webster, D. J. Kiemle and D. L. Bryce, Wiley India Pvt. Ltd.

Organic Spectroscopy, W. Kemp, Palgrave Macmillan.

Organic Structures from Spectra, L. D. Field, S. Sternhell and J. R. Kalman, John Wiley and Sons.

Structural Methods in Molecular Inorganic Chemistry, D. W. H. Rankin, N. Mitzel and C. Morrison, Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	H
CO 5	L	L	M	H	H

CHAP0031: Applied Spectroscopy (3-0-0)

(NHEQF: 7)

Course Outcomes

CO 1: Recall various principles involved in UV-Visible spectroscopy. (Remembering)

CO 2: Explain the theories and applications of IR and mass Spectrometry. (Understanding)

CO 3: Apply the NMR spectroscopy for structural elucidation of simple and complex molecules. (Applying)

CO 4: Explain the role of various spectroscopic tools required for analysing the structure of unknown molecules. (Analysing)

Module I: Ultraviolet and visible spectroscopy (10 Lectures)

Electronic transitions, chromophores, auxochromes, red and blue shift, applications of UV spectroscopy, spectrum shifts with solvents, isolated and conjugated double bonds, Woodward Fieser rules, Analytical uses of UV spectroscopy in polyenes, carbonyl compounds and aromatic systems.

Module II: IR and Mass Spectrometry (15 lectures)

Infrared Spectroscopy: Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols, amines; Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acid anhydrides, lactones, lactams, conjugated carbonyl compounds); Effects of H-bonding and solvent effect on vibrational frequency, extension to various organic molecules for structural assignment.

Mass Spectrometry: Mass spectral fragmentation of organic compounds, common functional groups; molecular peak, McLafferty rearrangements, examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

Module III: NMR spectroscopy (20 lectures)

Nuclear Magnetic Resonance Spectroscopy: Approximate chemical shift values of various chemically non-equivalent protons and correlation to protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic); Protons bonded to other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides, SH); Chemical exchange, effect of deuteration; complex spin-spin interaction between two, three, four and interacting nuclei (first order spectra); Complex interaction, virtual coupling, stereochemically hindered rotation, Karplus curve, variation of coupling constant with dihedral angle, nuclear magnetic double resonance, simplification of complex spectra using shift reagents, Fourier transform technique and nuclear Overhauser effect (NOE).

C-13 NMR Spectroscopy: Chemical shift (aliphatic, olefinic, alkynes, aromatic, hetero-aromatic, carbonyl carbon); Coupling constants, two-dimensional NMR spectroscopy, NOESY, DEPT and INEPT terminologies.

Applications: IR, NMR and Mass spectroscopy for structure elucidation of organic compounds.

Suggested Readings

Spectroscopic Identification of Organic Compounds, R. M. Silverstein, G. C. Basseler and T. Morill, C. John Wiley.

Organic Spectroscopy, W. Kemp, McMillan Press Ltd.

Spectroscopic Methods in Organic Chemistry, W. Williams, I. Fleming, McGraw Hill.

Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash, Tata McGraw- Hill, New Delhi.

Introduction to Spectroscopy, D.L. Pavia, G. M. Lampman and G. S. Kriz, Harcourt College Publisher NY.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3			H
CO 4	L	H	H

CHSL0200: Elements of Service

(2-0-0)

(NHEQF: 7)

Course Outcomes

Understanding social responsibility of higher educational institutes. (Understanding)

Identifying problems in the community and where students originated. (Applying)

Influence to get involved in the local community to gain insight into local issues. (Evaluating)

Adopt strong leadership skills which allow students to work well in a team. (Creating)

Module I (6 lectures)

Understanding social responsibility of higher educational institutes; community university engagement (CUE) and its importance, engaged teaching, engaged research. Community Based Participatory Research (CBPR). Statutory bodies of higher educational institutions and social responsibility.

Module II (9 lectures)

Service learning and active learning.; principles of service learning; classification of service learning models; service learning vis a vis other community experiences; historical context of university community partnership; chemistry and service learning; service Learning for a postgraduate chemistry student and its scope in research.

Module III (15 lectures)

Conceptualisation of the idea of service learning through their practical implementations (any two): (i) demonstrating experiments to inoculate scientific temper for nearby communities, (ii) organising awareness programmes for school children to eradicate the fear of pursuing higher studies in science, (iii) engaging with communities to find out various possibilities of providing the solutions to societal problems from chemistry point of view, (iv) providing consultancy to school students for various inter school science competitions.

Suggested Readings

Service-Learning Essentials: Questions, Answers, and Lessons Learned, B. Jacoby, Jossey-bass.

Where's the Learning in Service-Learning? J. Eyler, and D. E. Giles Jr., Jossey-bass.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		M	H
CO 3			M
CO 4	M		

LABORATORY COURSES**CHIQ6002: Inorganic Qualitative and Quantitative Analysis – Lab****(0-0-3)****(NSQF: 5)****Course Outcomes**

CO 1: Recall the procedures followed to carry out the qualitative and quantitative analysis. (Remembering)

CO 2: Explain the reason behind each step for Analysing mixtures and preparing compounds and metal nanoparticles. (Understanding)

CO 3: Apply different spectroscopic methods to characterize coordination compounds. (Applying)

CO 4: Design protocols for Analysing inorganic mixtures and synthesizing nanoparticles. (Creating)

Experiments:

Qualitative analysis (tertiary mixtures, alloys, ores).

Quantitative analysis (binary mixtures, alloys, ores).

Inorganic preparation (crystallization, precipitation, calcination).

Coordination compounds through ligand synthesis and spectroscopic characterization, magnetic properties.

Metal Nanoparticle synthesis and characterization.

Suggested Readings

Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R. C. Denney, J. D. Barnes, M. Thomas, and B. Sivasankar, Pearson.

Vogel's Qualitative Inorganic Analysis, G. Svehla and S. Mittal, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H			
CO 2	H	H	H	L	H
CO 3				H	
CO 4	M	M			M

CHEQ6003: Experimental Physical Chemistry – Lab**(0-0-3)****(NSQF: 5)****Course Outcomes**

CO 1: Recall the theoretical concepts of experiments related to chemical kinetics and electrochemistry etc. (Remembering)

CO 2: Explain the principles and the procedures for spectrophotometry based experiments. (Understanding)

CO 3: Apply the theoretical knowledge for determination of rate constant, pH, emf etc. (Applying)

CO 4: Analyse the practical utility of different theories of chemical kinetics, electrochemistry, adsorption etc. (Analysing)

Experiments:

Chemical Kinetics based experiments.

Electrochemistry based experiments.

Spectrophotometry based experiments.

pH-metric Titrations.

Adsorption on porous materials - equilibrium, kinetic and thermodynamic studies.

Suggested Readings

1. Advanced Practical Physical Chemistry, J. B. Yadav, Goel Publishing House.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c	Exp d	Exp e
CO 1	H	H			
CO 2			H		
CO 3	H	H		H	
CO 4	M	M			M

CHQA6004: Organic Qualitative Analysis and Synthesis Lab

(0-0-3)

(NSQF: 5)

Course Outcomes

CO 1: Recall the procedures for qualitative analysis, separation of binary mixtures of organic compounds. (Remembering)

CO 2: Explain the chemistry behind the preparation of some important organic compounds. (Understanding)

CO 3: Apply different chromatographic techniques for the identification and purification of organic compounds. (Applying)

CO 4: Analyse practical utility of chromatographic techniques. (Analysing)

CO 5: Identify and extract different types of natural products. (Applying)

a. Qualitative analysis of binary mixtures of organic compounds

Separation of binary mixture into individual components.

Qualitative analysis of individual components by

Detection of extra elements N, S, Halogens.

Test for functional groups by systematic analysis.

Solubility, melting point.

Preparation of a derivative and determination of its melting point.

b. Preparation of organic compounds by using single and multistep process.

Chromatographic techniques

Qualitative TLC separation and identification.

Column chromatographic separation of a mixture of compounds.

c. Extraction of natural products.

Suggested Readings

Vogel's Textbook of Practical Organic Chemistry, Including Qualitative Organic Analysis (5th Edition).

Practical Organic Chemistry, F. G. Mann and B. C. Saunders, Pearson Education.

Practical Organic Chemistry, B. S. Furniss, A. J. Hannaford, P. W. G. Smith and A. R. Tatchell, 2012, Pearson.

Comprehensive Practical Organic Chemistry, V. K. Ahluwalia and S. Dhingra, University Press.

Mapping of COs to Syllabus

Course Outcomes	Exp a	Exp b	Exp c	Exp d
CO 1	H			
CO 2		H		
CO 3			H	

CO 4			H	
CO 5				H

CHRP6005: Research Project**(0-0-12)****(NHEQF: 7)****Course Outcomes**

This will be a research-based module, whereby, students will carry out either theoretical or wet lab experiments and present their findings in a thesis and perhaps as a paper in a conference or a journal.

CO 1: Learn to carry out experiments to fulfil their research objectives and will in the process learn a wide range of techniques both scientific and statistical, and also probably add to the existing body of scientific knowledge. (Remembering)

CO 2: Develop an understanding of the methods they use to carry out their research and why a certain set of methods is chosen. (Understanding)

CO 3: Apply their understanding to steer their research in the right direction. (Applying)

CO 4: Troubleshoot when a chosen approach does not yield the expected result. (Analysing)

CO 5: Critically analyse the results they obtain to decide whether the data obtained proves or disproves a stated hypothesis. (Evaluating)

CO 6: Learn to choose a methodology or approach to fulfil a set of objectives or prove or disprove a hypothesis. (Creating)

In this course, each student undertakes research on a topic that he/she chooses in project phase I or on a topic assigned to him/her by the concerned mentor.

To this end, the student will first review the current status of research on the selected topic, state a hypothesis or a set of objectives and then carry out experiments (either wet-lab or theoretical) to gather data, which he/she will then analyse, draw conclusions and finally present in a dissertation at the end of the semester.

The format for the final dissertation will be as prescribed by the department. There will be a viva voce examination on the dissertation by an expert committee comprising external and internal members of the department. The mode and components of the evaluation and the weightages attached to them shall be published by the department at the beginning of the semester.

CHPC6137: Petroleum Chemistry**(1-0-1)****(NSQF: 5.5)****Course Outcomes**

CO 1: To gain knowledge about the composition of crude petroleum and the refining process. (Remembering)

CO 2: To correlate the quality of fuels with various parameters. (Understanding)

CO 3: Determination of different types of water testing parameters required in thermal power plant. (Applying)

CO 4: Analysing of chemical impurities and their separation techniques. (Analysing)

Module I: Oil Section (15 Lectures)

Renewable and non-renewable source of energy, Petroleum, Composition of crude petroleum, Hydrocarbon, Distillation (Upper distillation, middle distillation, Residue distillation), crude distillation unit, Fractional distillation, petroleum refining applications of various fractions, Cracking, Reforming, Petrol, Diesel, aviation turbine fuel, Kerosene, LPG, CNG, LNG, clean fuels, Octane number, Cetane number, Flash point, calorific value, knocking and antiknocking, isomerization, smoke point, Lubricants, viscosity index, cloud point, pour point, Density, Gas chromatography, HPLC.

Module II: Water section (15 Lectures)

Thermal power plant station, concept of zero discharge refinery, Oil content, Effluent treatment plant, boiler, demineralization, uses of cationic and anionic resin during neutralization reaction, requirement of pH determination, BOD, COD, TDS, TSS, DO, Microbiological treatment, Scavenger, alkalinity, corrosion monitoring, permanent alkalinity, Total hardness, temporary hardness, silica and phosphate removal process, removal of sulphate, sulphite, ammonia, cyanide, water testing.

Suggested Readings

Engineering Chemistry, P. C. Jain and M. Jain, Dhanpat Rai & Sons, Delhi.

Industrial Chemistry, B. K. Sharma, Goel Publishing House, Meerut

Fundamentals of Petroleum and Petrochemical Engineering, U.R. Chaudhuri, CRC Press, Taylor & Francis group.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H

CHPA6138: Pharmaceutical Chemistry and its applications

(1-0-1)

(NSQF: 5.5)

Course Outcomes

CO 1: Explanation of the preliminary concept of drug and their classification.

(Remembering)

CO 2: To understand the mode of action of different kinds of drugs. (Understanding)

CO 3: Synthesis of simple drug molecules and their purification techniques. (Applying)

CO 4: Extraction of the medicinally active component from a plant source and their characterization techniques. (Analysing)

Module I: Introduction and importance of drug Chemistry (15 Lectures)

Definition of drug, pro-drug, host-receptors interactions in connection to biological response, pharmacokinetics and mechanism of drug action-absorption, distribution, metabolism, and excretion (ADME), Structure activity relationship (SAR and QSAR), drug classification based on mode of action, analgesics and anti-inflammatory drug, COX-2 inhibitors, mode of action of NSAID and SAID, anti-histamine drugs, anti-depressant drugs, narcotics, sedative-hypnotics and their mechanism of action, antibiotics, antiviral drugs, anti-bacterial drugs, anti-neoplastic drug, drugs derived from natural origin including plants and bacteria, chemotherapy, nano-drug delivery systems, toxicology, positive and negative aspect of drug chemistry, future scope of drug chemistry.

Module II: Hands on experience on drug chemistry (15 Lectures)

Experimental aspect of drug chemistry: Synthesis of simple drug molecules, various techniques used for purification including crystallization / recrystallization, acid-base purification, column chromatography,

quality control / purity determination of drugs using GC-MS, HPLC etc., extraction of active ingredient from various plants in North-eastern region having medicinal importance, procedure for bioactivity test.

Theoretical feature of drug chemistry: Application of computational chemistry in designing of drug molecule, computer simulation to assist in solving chemical problems, drug-DNA interaction study, drug-delivery study.

Suggested Readings

An Introduction to Medicinal Chemistry, G. L. Patrick, Oxford University Press.

Introduction to Medicinal Chemistry, A. Gringauz, Wiley India Pvt Ltd.

Medicinal Chemistry, A. Kar, New Age International Publishers.

Medicinal Chemistry: An Introduction, G. Thomas, John Wiley & Sons

Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems, D. C. Young, John Wiley & Sons, Inc.

Computational Materials Science: An Introduction, J. G. Lee, CRC press, Taylor & Francis Group.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	H	
CO 3		H
CO 4		H

**DEPARTMENT OF MATHEMATICS
MASTER OF MATHEMATICS**

VISION:

To elucidate the philosophy of Mathematical principles coupled with the exhibition of Mathematical laws in fundamental and frontier areas of science whereupon fostering an intuitive mathematical mind.

MISSION:

To provide adequate understanding of Mathematical laws by means of both conventional techniques and skilful approaches.

To familiarize students as well as faculty members with the state-of-the-art by means of talks, workshops, symposia.

To invoke interest tinged with anxiety to facilitate further pursuit in terms of research pertaining to advanced knowledge.

PROGRAM OUTCOMES – MSC PROGRAMME

- PO 1: **Critical Thinking:** Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
- PO 2: **Knowledge Skill:** Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge.
- PO 3: **Scientific Communication Skills:** Imbibe effective scientific and / or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.
- PO 4: **Ethics:** Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behaviour such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects.
- PO 5: **Enlightened Citizenship:** Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges
- PO 6: **Analytical Reasoning:** Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
- PO 7: **Multicultural Competence:** Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".
- PO 8: **Lifelong Learning:** Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self-paced and self-directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling.
- PO 9: **Leadership Qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.
- PO 10: **Research Skills:** Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/ Matlab to various scientific investigations, problem solving and interpretation.

PROGRAMME SPECIFIC OUTCOMES FOR MSC MATHEMATICS

PSO 1: **Strong Foundation in Knowledge:** Have strong foundation in core areas of Mathematics, and able to communicate Mathematics effectively.

PSO 2: **Abstract Skills:** Evaluate hypotheses, theories, methods and evidence within their proper contexts
 PSO 3: **Problem Solving:** Solve complex problems by critical understanding, analysis and synthesis

PSO 4: **Proficiency in Interdisciplinary Skills:** Select, interpret and critically evaluate information from a range of sources that include books, scientific reports, journals, case studies and internet.

PSO 5: **Application and Research Efficiency:** Provide a systematic understanding of the concepts and theories of mathematics and their application in the real world- to an advanced level, and enhance career prospects in a huge array of fields, viz. in industry, commerce, education, finance and research.

PSO 6: **Lifelong Practical Knowledge:** Recognise the need to engage in lifelong learning through continuous education, and research leading to higher degrees like PhD, DSc etc.

COURSES OFFERED IN MSC MATHEMATICS

Sl. No.	Course Name
1.1	Real Analysis
1.2	Linear Algebra
1.3	Abstract Algebra
1.4	Differential equations
1.5	Mathematical Methods I
1.6	Community engagement and Service Learning
1.7	Fractal geometry and Applications
2.1	Topology and Functional Analysis
2.2	Complex Analysis
2.3	Measure Theory and Probability Theory
2.4	Mathematical methods II
2.5	Classical Mechanics
2.6	Essential Mathematics for Machine Learning
3.1	Discrete Mathematics
3.2	Computer Programming In C
3.3	Computer Programming In C Lab
3.4	Research Methodology for Mathematical Sciences
3.5	Research Seminar
3.6.1	Field theory & commutative Algebra
3.6.2	Number Theory
3.6.3	Mathematical Logic
3.6.4	Fuzzy sets and Applications
3.7.1	Fluid Dynamics I
3.7.2	Riemannian Geometry & Tensor Calculus
3.7.3	Dynamical Systems and Chaos
3.7.4	Convex Optimization
3.7.5	Numerical solution of PDE
3.8.1	Computational Number Theory
3.8.2	Scientific Computing
3.8.3	Special Functions
3.8.4	Introduction to Game Theory

4.1.1	Advance Analysis
4.1.2	Graph Theory
4.1.3	Multivariable calculus
4.1.4	Algebraic Number Theory
4.1.5	Algebraic Geometry
4.2.1	Fluid Dynamics II
4.2.2	Continuum Mechanics
4.2.3	Theory of Relativity
4.2.4	Numerical Optimization
4.3.1	Design and Algorithms Analysis
4.3.2	Machine Learning
4.3.3	Finite Elements Methods
4.3.4	Introduction to Cryptography
4.4	Research Project
4.5	Statistical Methods & Software in Research

MSC MATHEMATICS- MAPPING OF COURSES TO PO/PSO

Mapping	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PS0 1	PS0 2	PS0 3	PSO 4	PSO 5	PSO 6
1.1	M	H	M			M		M		M	H	M	M		L	M
1.2	M	M	M	L		M			L	M	M		M	L	L	M
1.3		H	M			M	M	M	L	H	M		M		M	H
1.4	M	M	M		L	M				H	M	H	H	M	M	M
1.5	M	M	M	L	L	M			M		M	H	M		L	
1.6			L	M	M				H							L
1.7		M	M	H			L							M		
2.1	H	H			L	M	L		L	M	M	H	H	M		M
2.2	M	H	M	M		M	M	M	L		H		M	M		M
2.3	H	H	M			M	M			M	H	M	H		M	M
2.4		H	M			M		M		M		M	M	M	M	M
2.5		H	M			M			L		H		M	M		
2.6		M	M	H			L							M		
3.1	M	M				M	M						L		H	M
3.2		H	H			M		M		L			M		M	
3.3			H	M	M		M	M	M	L		H		M	L	L
3.4			M	M	M		L		M	L		M		M		L
3.5	M	H		M		M	M	M		M	H	H	M			M
3.6.1		M	M	L	L	M		M		H	M	M	M		M	H
3.6.2		M	M	L	L	M		M		H	M	M	M		M	H
3.6.3		M	M	L	L	M		M		H	M	M	M		M	H
3.6.4		M	M	L	L	M		M		H	M	M	M		M	H
3.7.1		M	H	L		M	L	M		M		M	M	M	H	M
3.7.2		M	H	L		M	L	M		M		M	M	M	H	M
3.7.3		M	H	L		M	L	M		M		M	M	M	H	M
3.7.4		M	H	L		M	L	M		M		M	M	M	H	M
3.7.5		M	H	L		M	L	M		M		M	M	M	H	M
3.8.1	M	M	H			M	L	M		M		M	M	M	H	M
3.8.2	M	M	H			M	L	M		M		M	M	M	H	M
3.8.3	M	M	H			M	L	M		M		M	M	M	H	M
3.8.4	M	M	H			M	L	M		M		M	M	M	H	M

3.9				H	H		M	M	M			M		M	M	
4.1.1	M	H		M		M	M	M		M	H	H	M			M
4.1.2	M	H		M		M	M	M		M	H	H	M			M
4.1.3	M	H		M		M	M	M		M	H	H	M			M
4.1.4	M	H		M		M	M	M		M	H	H	M			M
4.1.5	M	H		M		M	M	M		M	H	H	M			M
4.2.1		M	M	L	L	M		M		H	M	M	M		M	H
4.2.2		M	M	L	L	M		M		H	M	M	M		M	H
4.2.3		M	M	L	L	M		M		H	M	M	M		M	H
4.2.4		M	M	L	L	M		M		H	M	M	M		M	H
4.3.1		M	H	L		M	L	M		M		M	M	M	H	M
4.3.2		M	H	L		M	L	M		M		M	M	M	H	M
4.3.3		M	H	L		M	L	M		M		M	M	M	H	M
4.3.4		M	H	L		M	L	M		M		M	M	M	H	M
4.4			H	M	L		M		L	M		M		M		M
4.5	M	M	H			L							M		M	M

DETAILED SYLLABUS THEORY COURSES

MARA0014: REAL ANALYSIS

(4-0-0)

COURSE OUTCOMES

CO 1: Classify the convergence of sequences and series of real numbers, and study various tests. (Understanding)

CO 2: Recall the fundamental properties of continuity and uniform continuity. (Remembering)

CO 3: Test for uniform convergence of sequence and series of real valued functions. (Analysing)

CO 4: Solve problems of the Riemann integrals and improper integrals. (Evaluating)

CO 5: Develop the concepts of compact sets, connected sets and their properties. (Creating)

Module I: (14 lectures)

Review of set theory, relations and functions, finite and infinite sets, countable and uncountable sets, Real number system as a complete ordered field, Archimedean property, supremum, infimum. Sequence of real numbers, bounded sequence, limsup, liminf, Cauchy sequences, Series, convergence of series, root and ratio tests, absolute convergence.

Module II: (8 lectures)

Limit, Continuity, types of discontinuity, Intermediate value theorem, Fixed point theorem, uniform continuity, Monotonic functions.

Module III: (14 lectures)

Sequence and series of real valued functions, Point wise and uniform convergence, uniform convergence and continuity, uniform convergence and differentiation, uniform convergence and integration. Cauchy criterion for uniform convergence. Series of functions and convergence, Weierstrass M-test.

Module IV: (12 lectures)

Riemann sums and Riemann integral, Riemann-Stieltjes Integrals, Improper Integrals Functions of several variables, directional derivative, partial derivative, derivative as a linear transformation, inverse and implicit function theorems.

Module V: (16 lectures)

Open and closed sets, limit points, interior points, Euclidean space, compact spaces, Bolzano Weierstrass theorem, Heine Borel theorem in $\mathbb{R}$ only.

Suggested Readings

Principles of Mathematical Analysis, W. Rudin, McGraw Hill Kogakusha Ltd.

Mathematical Analysis, T. Apostol, Addison-Wesley; Publishing Company.

Introduction to Real Analysis, R. G. Bartle and D. R. Sherbert, John Wiley & Sons, Inc., New York.

The Elements of Real Analysis, R. G. Bartle, Wiley International Edition.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3	M		H		
CO 4				H	
CO 5	M				H

MALA0015: LINEAR ALGEBRA

(4-0-0)

COURSE OUTCOMES

CO 1: Find the fundamental concepts and properties associated with vector spaces. (Remembering)

CO 2: Demonstrate the algebra of matrices, eigenvalues and eigenvectors. (Understanding)

CO 3: Develop the representation between linear transformations and Matrix theory. (Applying)

CO 4: Choose various examples in Inner product spaces and study the applications to various problems. (Evaluating)

CO 5: Elaborate quadratic forms and solve related problems. (Creating)

Module I: (10 lectures)

Vector spaces, subspaces, quotient spaces, linear dependence, basis, dimension of a vector space, Linear Transformations.

Module II: (20 lectures)

Algebra of Matrices, trace of matrices, rank and determinant of matrices, system of linear equations. Eigenvalues and eigenvectors, relation between characteristic and minimal polynomial, Cayley- Hamilton theorem, Diagonalizability.

Module III: (10 lectures)

Matrix representation of linear transformations. Change of basis, canonical forms, diagonal forms, triangular forms, Jordan forms.

Module IV: (15 lectures)

Inner product spaces, properties of inner products and norms, Cauchy-Schwarz inequality, Orthogonality and orthogonal complements, orthonormal basis, Gram-Schmidt process.

Module V: (5 lectures)

Quadratic forms, reduction and classification of quadratic forms.

Suggested Readings

Linear Algebra, K. Hoffman and R. Kunze, Prentice Hall.

Linear Algebra, G.E. Shilov, Prentice Hall.

Linear Algebra: A Geometric Approach, S. Kumaresan, Prentice-Hall of India Pvt. Ltd., New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		
CO 2		H	M		
CO 3			H		
CO 4				H	

CO 5					H

MAAB0016: ABSTRACT ALGEBRA**(4-0-0)****COURSE OUTCOMES**

CO 1: Find the concepts of Group theory and the application of Sylow theorems. (Understanding)

CO 2: Categorize among unique factorization domain, Euclidean domain, Principal ideal domain and irreducible criteria. (Analysing)

CO 3: Organize the characteristics of field extensions, Algebraic extension, Galois theory. (Applying)

CO 4: Develop the concepts related to representation theory and study their application. (Creating)

Module I: (15 lectures)

Review of Groups, Cayley's theorem, class equations, Sylow theorems and its applications, Direct products of groups, Solvable groups, Jordan-Holder theorem.

Module II: (20 lectures)

Rings, ideals, prime and maximal ideals, quotient rings, Euclidean domain. principal ideal domain, unique factorization domain, Polynomial ring over a field, reducible and irreducible polynomials, irreducibility criteria.

Module III: (20 lectures)

Fields, finite fields, field extensions, Algebraic extensions, Galois Theory.

Module IV: (5 lectures)

Fundamentals of representation theory.

Suggested Readings

Topics in Algebra, I. N. Herstein, Wiley Eastern Limited, New Delhi.

University Algebra, N. S. Gopalakrishnan, Wiley Eastern.

Contemporary Abstract Algebra, J. A. Gallian, Narosa Publishing.

Algebra, Dummit & Foote, John Wiley & Sons

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

MADE0017: DIFFERENTIAL EQUATIONS**(4-0-0)****COURSE OUTCOMES**

CO 1: Find the classification of differential equations with existence and uniqueness criteria. (Remembering)

CO 2: Develop appropriate methods to solve linear differential equations. (Applying)

CO 3: Examine the solvability of differential equation and partial differential equation. (Analysing)

CO 4: Determine various methods for the solution of Partial Differential Equation. (Evaluating)

Module I: (16 lectures)

Classification of Differential Equations, their origin and solution; Exact differential equation and integrating factors, special integrating factors, linear equation and Bernoulli equations. existence and uniqueness for initial Value problem: Peano and Picard theorem.

Module II: (18 lectures)

Second order Linear Differential equations, dimension of the solution space for homogeneous equations, general solution for non-homogeneous Equations.; method of undetermined coefficients, method of variation of parameters. Power series solution about an ordinary point, solution about singular points, Frobenius method BVP, Sturm-Liouville Problem, Orthogonality of Characteristic functions, Fourier series exp.

Module III: (26 lectures)

Origin of Partial Differential Equation, Linear and quasi-linear partial differential equation, method of characteristics, Lagrange's and Charpit's method to solve first order PDE, Cauchy problem for first order PDE, Classification of PDEs (second order), Method of separation of variables for Heat (one and two dimension), Wave and Laplace equation.

Suggested Readings

Differential Equations, S. L. Ross, Wiley-India.

Partial Differential Equations an introduction, W. Strauss, John Wiley and Sons Ltd.

Linear PDE for scientist and engineers, Tye Myint U and L. Debnath; Birkhauser, Boston.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	
CO 2	M	H	
CO 3		M	H
CO 4			H

MAMT0018: MATHEMATICAL METHODS I**(4-0-0)****COURSE OUTCOMES**

CO 1: Explain basic numerical methods to solve algebraic and transcendental equations. (Understanding)

CO 2: Classify interpolation formulae and solve different numerical problems. (Applying)

CO 3: Make use of Interpolation formulae to solve numerical differentiation and integration. (Evaluating)

CO 4: Compose various methods to obtain numerical solutions of ODE and PDE. (Creating)

CO 5: Determine the methods to solve linear programming problems. (Evaluating)

Module I: (10 lectures)

Numerical solution of algebraic and Transcendental equations: Bisection method, Regula-Falsi methods and Newton- Raphson method; Rate of convergence of these methods. Of systems of linear algebraic equations: Gauss elimination method, GaussJordan method, Gauss-Seidel methods, Error analysis.

Module II: (6 lectures)

Interpolation: Finite differences, Newton's forward and backward difference interpolations, Central difference interpolation, Lagrange's and Newton's divided difference interpolation, Hermite and spline interpolation.

Module III: (15 lectures)

Numerical differentiation and integration: Differentiation using interpolation formulae (Newton's forward and backward difference interpolation, Central difference interpolation, Lagrange's and Newton's divided difference interpolation), Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rule, Romberg method.

Module IV: (14 lectures)

Numerical solutions of ODE and PDE: Initial value problem for ODE of first and second order, Taylor series method, Picard's method, Euler and modified Euler methods, Runge-Kutta methods, Milne's and Adam's predictor and corrector methods, Finite difference solution of second order ODE and PDE.

Module V: (15 lectures)

Mathematical formulation of LPP, Solution of a LPP by graphical method, simplex method, Revised simplex method, Duality. Transportation and Assignment problem, Two person-zero sum games. Equivalence of Rectangular game and linear programming.

Suggested Readings

Numerical methods, Problems and solutions, M.K. Jain, S. R. K. Iyengar, R. K. Jain, New Age International(P) Ltd.

Elementary Numerical Analysis – An Algorithmic Approach, S D. Conte and Carlde Boor, McGrawHill.

Introduction to Numerical Analysis, K. E. Atkinson, John Wiley.

Operations Research: An Introduction, H. A. Taha, Macmillan.

Operations Research, Kant Swarup, P. K. Gupta and M. M. Singh, Sultan Chand and Sons.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M			
CO 2	M	M	H		
CO 3				H	
CO4	L	M	M	H	
CO5					H

MATF0019: TOPOLOGY AND FUNCTIONAL ANALYSIS

(4-0-0)

COURSE OUTCOMES

CO 1: Demonstrate the basic characteristics and properties of metric spaces. (Understanding)

CO 2: Categorize the various properties related to Topological Spaces. (Creating)

CO 3: Examine the Connectedness and Compactness of Topological Spaces. (Analysing)

CO 4: Deduct various results from separation axioms and Metrization theorem. (Evaluation)

CO 5: Explain basic results related to Normed linear spaces, Banach spaces and Hilbert spaces. (Understanding)

Module I: (10 lectures)

Metric spaces, open and closed sets, limit points, interior points, convergence, Cauchy sequence, completeness, completion in metric spaces, separable spaces.

Module II: (10 lectures)

Topological Spaces, Basis for a topology, The order topology, The product topology, The subspace topology, Closed sets and limit points, convergent sequence, Continuous function, homeomorphism, metric topology.

Module III: (10 lectures)

Connected spaces, connected subspaces of real line, Components, local connectedness, Compact spaces, compact spaces of real line, limit point compactness, local compactness.

Module IV: (15 lectures)

The countability axioms, the separation axioms, Urysohn Lemma, Urysohn metrization theorem. Tychonoff's theorem, Stone-Cech Compactification.

Local finiteness, the Nagata Smirnov Metrization theorem, paracompactness, the Smirnov Metrization theorem, space of continuous function.

Module V: (15 lectures)

Normed linear spaces, properties of normed linear spaces, Banach space, Hahn-Banach theorem, Open mapping theorem, Closed graph theorem, Principle of uniform boundedness, Hilbert spaces, Orthogonal complements, orthonormal sets, the Reisz representation theorem, Bessel's inequality, Parseval's identity, The dual space, self –adjoint, normal and unitary operators.

Suggested Readings

Introduction to topology and modern analysis, G. F. Simmons, Tata-McGraw-Hill.

Topology, J. R. Munkres, Prentice Hall.

Introductory functional analysis with application, E. Kreyszig, John Willey and Sons.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		
CO 2	M	H	M		
CO 3		M	H		
CO 4				H	
CO 5					H

MACA0020: COMPLEX ANALYSIS**(4-0-0)****COURSE OUTCOMES**

CO 1: Define the concept analytic functions and the significance of CR-equations. (Remembering)

CO 2: Explain the basic concepts and theorems associated with complex functions. (Understanding)

CO 3: Apply Cauchy Integrals formulae and Residue theorem to evaluate real and complex integrals. (Applying)

CO 4: Analyse various theorems associated with entire functions and Complex integrals. (Analysing)

Module I: (10 lectures)

Complex numbers and their properties, Complex Plane, Polar form of complex numbers, Powers and roots, set of points in the complex plane. Complex function, Special power functions, Reciprocal function.

Module II: (15 lectures)

Limits and Continuity, differentiability and analyticity, Cauchy-Reimann equations, Harmonic functions, Exponential and Logarithmic functions, complex powers, Trigonometric and Hyperbolic functions.

Module III: (20 lectures)

Complex integrals, Cauchy-Goursat Theorem, Cauchy's integral formula and their consequences, Taylor and Laurent series, Zeroes and poles, Residues and residue theorem and consequences, evaluation of real improper integrals.

Module IV: (15 lectures)

Entire function, Liouville's theorem, Maximum modulus principle, Schwarz Lemma, Schwarz-Pick Lemma, Open Mapping theorem. Conformal Mapping, Linear Fractional Transformations, Cross Ratio.

Suggested Readings

Foundation of Complex Analysis, S. Ponnusamy, Alpha science International.

Functions of one Complex variable I, J. B. Conway, Springer.

Complex variable, Murray Spiegel, Seymour Lipschutz, John Schiller, Dennis Spellman, Schum's outlines.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		
CO 3			H	
CO 4			M	H

MAMP0021: MEASURE THEORY AND PROBABILITY THEORY**(4-0-0)****COURSE OUTCOMES**

CO 1: Explain the concept of algebra of sets, measure and Lebesgue measure. (Understanding)

CO 2: Demonstrate understanding of the statement and proofs of monotone convergence theorems and their applications. (Understanding)

CO 3: Explain the axioms and properties of probability theory. (Understanding)

CO 4: Develop probabilistic concepts within the framework of measure theory. (Applying)

Module I: (12 lectures)

Algebra of sets, Borel set, extension of measures, Lebesgue measure on: outer measure, measurable sets and Lebesgue measure. Extension of measure, Lebesgue-Stieltjes measures and distribution functions.

Module II: (18 lectures)

Measurable functions and Integration: Lebesgue integral, Monotone convergence theorem, extended monotone convergence theorem, Fatou's Lemma, dominated convergence theorem, Comparison of Riemann and Lebesgue integral. Radon-Nikodym Theorem and related results.

Module III: (10 lectures)

Probability axioms, sample spaces, events, law of total probability, conditional probability, Bayes Theorem and independence.

Module IV: (20 lectures)

Random Variables, types of random variables, distribution functions, function of random variables, standard univariate discrete and continuous distributions and their properties; expectations, moments, moments generating functions; Chebyshev's inequality, joint, marginal and conditional distributions; covariance, correlation; Random vectors, functions of random vectors, strong and weak law of large numbers, central limit theorem.

Suggested Readings

Probability and Measure Theory, R.B. Ash and C. Doleans Dade, Academic press.

An Introduction to Probability Theory and its Applications, W. Feller, Wiley.

An Introduction to Probability and Statistics, V. K. Rohatgi and A. K. Md. E. Saleh, Wiley.

Real Analysis, Royden, H.L. and Fitzpatrick, P. M., Pearson.

Measure Theory, Halmos, P. R., Springer-Verlag.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3	M		H	
CO 4			M	H

MAMD0022: MATHEMATICAL METHODS II

(4-0-0)

COURSE OUTCOMES

CO 1: Gain the knowledge fundamentals concepts of calculus of variation and integral equations and their applications. (Understanding)

CO 2: Use concept of Laplace and Fourier transform in solving science and engineering problems. (Applying)

CO 3: Analyse and classify Differential Equations, Partial Differential Equations and Integral Equations and their solutions by various methods. (Analysing)

CO 4: Determine the solutions of various classes of differential equations and special functions with their properties.

(Evaluating)

Module I: (10 lectures)

Linear functional, minimal functional theorem, general variation of a functional, Euler- Lagrange equation, Necessary and sufficient conditions for extrema, strong extremum and weak extremum, broken extremum; Weirstrass Erdmann corner conditions.

Module II: (10 lectures)

Linear integral equation of the first and second kind of Fredholm and Volterra type Reduction of ordinary differential equations into integral equations, Solution of integral Equations with separable kernels, Characteristic numbers and eigenfunctions, resolvent kernel.

Module III: (10 lectures)

Fourier Transform. Properties of Fourier Transform, Fourier sine and cosine transform, Inverse Fourier Transform, Application of Fourier transform to ordinary and partial differential equations of initial and boundary value problems.

Module IV: (12 lectures)

Laplace Transform and its properties, Convolution theorem, Inverse Laplace Transform, Application of Laplace Transform to solution of ordinary and partial differential equations of initial boundary value problems.

Module V: (18 lectures)

General solution of Bessel equation, Recurrence relations, Orthogonal sets of Bessel functions, Modified Bessel functions, Applications. General solution of Legendre equation, Legendre polynomials, Associated Legendre polynomials, Rodrigues formula, Orthogonality of Legendre polynomial, Concept and calculation of Green's function, Approximate Green's function, Green's function method for differential equations.

Suggested Readings

Introduction to Theory and Application of Laplace Transforms, Doetsch G., Springer Verlag.

Theory and problems of Laplace transforms, Murray Spiegel, Schum's Outline Series Tata Mc Graw Hill.

Integral Transforms & their applications, Brian Davies, Springer.

Integral Transforms & their applications, L Debnath, D Bhatta, Chapman & Hall/CRC.

Fourier analysis and its applications, G.B. Folland sally series, American Mathematical Society.

Fourier and Laplace Transform, R.J. Becrends H.G., Morsche. J.C. Vande Berg and E.M. VandeVrie, Cambridge Press.

Introduction to Fourier analysis and wavelets, Graduate Studies in Mathematics, Mark A. Pinsky, American Mathematical Society.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO2		H	M	M	
CO3			H		
CO4			M	M	H

MACL0023: CLASSICAL MECHANICS

(4-0-0)

COURSE OUTCOMES

CO 1: Learn and understand the fundamental of motion and its governing equations. (Understanding)

CO 2: Extend the concept of rigid body in two dimensions. (Understanding)

CO 3: Apply concepts of Lagrangian and Hamiltonian methods to model various practical situations. (Applying)

CO 4: Analyse diverse physical motions by studying the properties of mathematical model. (Analysing)

CO 5: Evaluate different practical situations by discussing the properties of existing models. (Evaluating)

Module I: (18 lectures)

Introduction to the ideas of constrained motion, Different classifications of constraints of motion, Holonomic and nonholonomic constraints, rheonomic and scleronomic dynamical constraints, Concept of degree of freedom.

Introduction to generalized coordinates, generalized velocities, Total Kinetic energy of a system of particles in terms of generalized velocity. Introduction to generalized momenta and generalized force. D'Alembert's principle and Lagrangian form of equation of motion of a dynamical system of N particles. Calculus of variations, Euler-Lagrange equation, application of calculus of variations in dynamical problems.

Module II: (12 lectures)

Two-dimensional motion of rigid bodies, Euler's dynamical equations of motion for a rigid body, Motion of a rigid body about an axis, motion about revolving axis, Eulerian angles, Euler's theorem on the motion of a rigid body, infinitesimal rotations, rate of change of a vector, Coriolis force, Euler's equations of motion, force free motion of a rigid body.

Module III: (15 lectures)

Hamilton's principle, Lagrange's equations from Hamilton's principle, extension of Hamilton's principle to non-conservative and non-holonomic systems, conservation theorems and symmetry properties. Hamilton's equations of motion, conservation theorems and physical significance of Hamiltonian, Hamilton's equations from variational principle, principle of least action.

Module IV: (15 lectures)

Hamilton Jacobi Method: Hamilton - Jacobi equation, Time independent Hamilton - Jacobi equation, canonical transformation generated by Hamilton characteristic function, application of Hamilton-Jacobi equation in solving problems of mechanics.

Suggested Readings

Classical Mechanics, H. Goldstein, Addison Wesley Publications, Massachusetts.

Lagrangian and Hamiltonian Mechanics by M.G. Calkin, World Scientific, Singapore.

Classical Mechanics, Takwale, R. G. & Puranik, P. S., Tata-McGraw Hill.

Problems and Solutions on Mechanics, Yung-Kuo, World Scientific.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H	M	
CO 3	L	M	H	M
CO 4		M	H	M
CO 5		L	M	H

MADS0030: DISCRETE MATHEMATICS

(4-0-0)

COURSE OUTCOMES

CO 1: Explain how to work with some of the discrete structures which include sets, relations, functions, graphs and recurrence relation. (Understanding)

CO 2: Construct mathematical statements using logical connectives and quantifiers. (Creating)

CO 3: Apply basic counting techniques to solve combinatorial problems. (Applying)

CO 4: Develop the given problem as graph networks and solve with techniques of graph theory. (Understanding)

Module I: Set Theory (18 lectures)

Sets and classes, relations and functions, Equivalence Relation, Partial Ordering Relation, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, Cardinal and ordinal numbers, Lattice; The

Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.

Module II: Logic (15 lectures)

Propositional logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency. Predicate Calculus.

Module III: Combinatorics (12 lectures)

Combinatorics: Mathematical induction, recursive mathematical definitions, basics of counting, permutations, combinations, inclusion-exclusion, recurrence relations (nth order recurrence relation with constant coefficients, Homogeneous recurrence relations, Inhomogeneous recurrence relation), generating function (closed form expression, properties of generating functions., solution of recurrence relation using generating functions, solution of combinatorial problem using generating functions).

Module IV: Graphs and Trees (15 lectures)

Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges; trees.

Suggested Readings

Discrete Mathematics with Applications, Susanna S. Epp, Wadsworth. Publishing Co. Inc.

Elements of Discrete Mathematics A Computer Oriented Approach, C L Liu and D P Mohapatra, Tata McGraw – Hill.

Discrete Mathematical Structure and Its Application to Computer Science, J.P. Tremblay and R. Manohar, Tata McGraw-Hill.

Discrete Mathematics, N. Biggs, Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4	M			H

MACP0031: COMPUTER PROGRAMMING IN C (2-0-0)

COURSE OUTCOMES

CO 1: Interpret the concepts of C language's syntax. (Understanding)

CO 2: Choose the loops and the decision-making statements to solve various problems. (Applying)

CO 3: Implement standard algorithms and translate pseudo-codes into C programs. (Applying)

CO 4: Apply their analytical skills for choosing the right data structure, function, data types and develop logic to solve various instances of problems. (Analysing)

Module I: Introduction to Algorithms and Programming Languages (8 lectures)

Introduction to structured programming and problem-solving methods: Algorithms, key features of algorithms, flowcharts, pseudocode, generation of programming languages, structured programming languages. Overview of C: Introduction to C, basic structure of a C program, compiling and executing C programs, comments, characteristics of a good program, character set, identifiers, keywords, data types, constants and variables, I/O statements, operators and expressions, precedence and associativity of operators, type conversion and type casting.

Module II: Decision Control Statements, Loops and Functions (8 lectures)

Decision Control Statements and Loops: Introduction to decision control statements, conditional branching statements, goto statements, while loop, do-while loop, for loop, nested loops, break and continue statements. Functions: Need for functions, function declaration and definition, user defined and library functions, passing parameters to function, return statement, scope of variables, storage classes, recursive functions.

Module III: Arrays (7 lectures)

Arrays: One-dimensional arrays, passing array to function, multidimensional arrays and their applications, character arrays, dynamic memory allocation. Some algorithms and programs on theory of matrices and numbers like Sieve method for primality test, generation of twin primes, solution of congruence using complete residue system, addition, subtraction and multiplication of matrices, transpose, and determinant.

Module IV: Structures, Files (7 lectures)

Structures and Unions: Declaration of structures and simple implementation of structures, unions, enumerated data types. Files: Introduction to files, file managements-open, close, input/output operations, command line arguments.

Suggested Readings

Computer Fundamentals and Programming in C, Thareja R., Oxford University Press, New Delhi.

Computer Programming in C Rajaraman V., 2005, Prentice-Hall of India Pvt. Ltd.

Computer Fundamental and C Programming, Balagurusamy E., Tata McGraw Hill publishing company limited, New Delhi.

Programming with C (Schaum's outlines series), Gottfried Byron S., Tata McGraw Hill publishing company limited, New Delhi.

Primes and Programming – An Introduction to Number Theory with Programming, Goblin P., 1993, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			M
CO 2		H	M	
CO 3		M	H	M
CO 4				H

MARM0032: RESEARCH METHODOLOGY FOR MATHEMATICAL SCIENCES**(3-0-0)****COURSE OUTCOMES**

CO 1: Learn and understand some basic concepts of research and its methodologies. (Remembering)

CO 2: Compare different results and identify appropriate research topics with the help of literature review. (Understanding)

CO 3: Select and define appropriate research problem and parameters. (Applying)

CO 4: Organize and conduct research (advanced project) in a more appropriate manner. (Evaluating)

CO 5: Design and write a research proposal, research report and thesis. (Creating)

Module I: (12 lectures)

Meaning of Research, Objectives of Research, Motivation in Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, literature survey of a research topic, Importance of knowing how Research is done, Research Process, Criteria of good Research, Problems encountered by Researchers in India.

Defining the Research problem: Selecting the Problem, Necessity of Defining the Problem, Techniques involved in defining a problem.

Module II: (15 lectures)

Report writing: Significance of Report writing, Difference steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Precautions for Writing Research Reports, Publishing a paper, Research proposal writing, Copyright issues, Ethics and plagiarism.

Module III: (18 lectures)

Research tools: MathSciNet, Scopus, ISI Web of Science, Impact factor, h-index, Google Scholar, ORCID, JStor, Online and open access journals, Virtual library of various countries. Scientific writing and presentation: LaTeX, Beamer. Software for Mathematics: MATHEMATICA, MATLAB.

Suggested Readings

Research Methodology; C.R. Kothari, New Age Publishers.

LaTeX, a Document Preparation System, L. Lamport, Addison-Wesley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	M	M
CO 2	M		
CO 3	M		M
CO 4		H	
CO 5		M	H

MAFA0033: FIELD THEORY AND COMMUTATIVE ALGEBRA**(4-0-0)****COURSE OUTCOMES**

CO 1: Define the key notions of field theory and outline their interrelation. (Remembering)

CO 2: Demonstrate the key concepts by interpreting them under various hypotheses. (Understanding)

CO 3: Identify perfect fields using separable extensions, construct examples of automorphism group of a field. (Applying)

CO 4: Analyse the proof a theorem by imposing the rules of commutative algebra. (Analysing)

CO 5: Determination of validity of a problem such as insolubility of quantic by field theoretic techniques. (Evaluating)

Module I: (10 lectures)

Field extensions. Simple extensions, algebraic and transcendental case. Minimum polynomial. Construction of simple algebraic extension from an irreducible polynomial. Classification of simple extensions.

Module II: (15 lectures)

Degree of extension. Algebraic elements and algebraic extensions; finite extensions. Algebraic numbers. Geometric constructions with ruler and compasses. The Galois group of an extension. Examples. Splitting field for a polynomial. Existence, uniqueness up to isomorphism. Normal extensions. Relation to splitting fields. Normality of intermediate extension. Normal closure.

Module III: (15 lectures)

Separability. Example of inseparable polynomial. Separability of all polynomials in characteristic zero. Separable extensions. Separability of intermediate extensions. Degree of the extension corresponding to a group of field automorphisms.

Module IV: (12 lectures)

Integral extension, integral closure of a ring, finitely generated modules, localization of a ring, construction, localization of modules, Dedekind domain, factorization ideals, unique factorization of ideals.

Module V: (8 lectures)

Galois groups of normal separable extensions, Galois extensions, factorization of prime ideals in Galois extensions, discrete valuation.

Suggested Readings

A First Course in Abstract Algebra, J.B. Fraleigh, Addison-Wesley.

Galois Theory, I. Stewart, Chapman and Hall.

Abstract Algebra, Dummit D.S.; Foote R. M., John Wiley and sons.

Introduction to Commutative Algebra, Atiyah M.F.; Macdonald I.G., Addison-Wesley.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	M
CO 2		H			
CO 3		M	M	M	
CO 4				H	M
CO 5					H

MANT0034: NUMBER THEORY

(4-0-0)

COURSE OUTCOMES

CO 1: Identify and analyse different types of divisibility tests, Euler's theorem, Wilson theorem etc and solve various related

CO 2: problems. (Applying)

CO 3: Apply Quadratic Reciprocity law and other methods to classify numbers as primitive roots, quadratic residues, and quadratic nonresidues. (Applying)

CO 4: Evaluate primitive roots and Pell's equation with the use of continued fraction. (Evaluating)

CO 5: Perceive classical cipher and public cryptosystem and their cryptanalysis. (Evaluating)

Module I: (15 lectures)

Divisibility, Congruences, complete residue system, reduced residue system, Chinese remainder theorem, Arithmetic modulo p , Fermat's little theorem, Wilson's theorem.

Arithmetic functions-Mobius function, Euler function.

Module II: (15 lectures)

Quadratic residues and congruences of second degree in one unknown, Legendre symbol, Jacobi symbol, congruences of second degree with prime modulus and with composite modulus.

Module III: (18 lectures)

Primitive roots and indices, order, necessary and sufficient condition for the existence of primitive roots, construction of reduced residue system.

Continued fractions, simple continued fractions, approximation of irrational numbers by continued fractions, solution of Pell's equation.

Introduction to partitions, geometric representation, generating functions, Euler's Pentagonal number theorem.

Module IV: (12 lectures)

Basic of Cryptography: History of cryptography, terminologies used in cryptography; Substitution Techniques- The Caesar Cipher, One Time Pads, The Vernam Cipher, Book Cipher; Transposition Techniques- Encipherment/Decipherment Complexity, Public Key Cryptography: Characteristics of Public Key System; RSA Technique-Encryption –Method; Diffie- Hellman Scheme.

Suggested Readings

Elementary Number Theory, M. Burton, Universal Book Stall, New Delhi.

An Introduction to the Theory of Numbers, G. H. Hardy and E. M. Wright, Oxford, Clarendon Press.

Number Theory, G. E. Andrews, Hindustan Publishing Corporation, New Delhi.

Number Theory, S. G. Telang, Tata McGraw Hill Publishing Company Limited, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3	M		H	
CO 4	M			H

MAML0035: MATHEMATICAL LOGIC**(4-0-0)****COURSE OUTCOMES**

CO 1: Interpret any Mathematical statement into the language of logic. (Understanding)

CO 2: Analyse various methods of proofs and deduction theorems. (Analysing)

CO 3: Interpret the syntax of first-order logic and semantics of first-order languages. (Understanding)

CO 4: Analyse the validity a problem by means of completeness and consistency. (Analysing)

CO 5: Determine the valuation and validity of various logical statements. (Evaluating)

Module I: (15 lectures)

Propositions, truth table, negation, conjunction and disjunction. Adequate set of connectives, propositions and precedence of logical operators. Propositional equivalence: Logical equivalences. Arguments and validity.

Module II: (15 lectures)

Formal definition of proof, various methods of proof, theorem and deduction, theory of L of statement calculus. Valuation and tautology in L, extensions of L, adequacy theorem of L.

Module III: (15 lectures)

First order logic, truth values of well-formed formulas, first order systems with equality, first order arithmetic, formal set theory.

Module IV: (15 lectures)

Completeness and compactness, notion of consistency, Boolean algebra, incompleteness, first incompleteness theorem, undecidability.

Suggested Readings

Logic for Mathematicians - Hamilton A. G., Cambridge University press.

Introduction to Mathematical Logic - Mendelson E., CRC Press, Taylor and Francis Group.

Fundamentals of Mathematical Logic, Hinman P. G., A.K. Peters, 2005, Wellesley.

Mathematical Logic, 2nd edition, Ebbinghaus H.D., Flum J., Thomas W., Springer-Verlag**Mapping of Cos to Syllabus**

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	
CO2	M	H		
CO3	M	M	H	
CO4	M			H
CO5		M	M	M

MAFS0036: FUZZY SETS AND APPLICATIONS**(4-0-0)****COURSE OUTCOMES**

CO 1: Classify the crisp and fuzzy set theorems. (Understanding)

CO 2: Apply fuzzy set theory in modelling and analysing uncertainty in a decision problem. (Applying)

CO 3: Analyse and examine the difference between the crisp set and fuzzy set concepts. (Analysing)

CO 4: Determine fuzzy set theory and uncertainty concepts. (Evaluating)

Module I: (17 lectures)

Fuzzy sets - Fuzzy numbers, fuzzy numbers in the set of Integers, arithmetic with fuzzy numbers. Definition of fuzzy sets, α -level sets, convex fuzzy sets. Basic operations on fuzzy sets, types of fuzzy sets, Cartesian products, algebraic products, bounded sum and difference, t-norms and t-conorms. Fuzzy sets in contrast of probability theory.

Module II: (12 lectures)

The extension principle - the Zadeh's extension principle, image and inverse image of fuzzy sets. Fuzzy relations, basic properties of fuzzy relations, fuzzy relations and approximate reasoning.

Module III: (16 lectures)

Fuzzy relations and fuzzy graphs, composition of fuzzy relations, min-max composition and its properties, fuzzy equivalence relations, fuzzy relational equations, fuzzy graphs.

Module IV: (15 lectures)

Possibility Theory: Fuzzy measures, evidence theory, necessity measure, probability measure, possibility measure, possibility distribution, possibility theory and fuzzy sets, possibility theory and probability theory.

Suggested Readings

Fuzzy Sets and Fuzzy Logic: Theory and Applications, Klir, G. J. and Yuan, B., Prentice Hall of India, New Delhi.

2 Fuzzy set theory and its Applications, Zimmermann, H. J., Allied publishers Ltd., New Delhi.

Fuzzy sets, fuzzy logic applications, G. Bojadziev and M. Bojadziev, World Scientific.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		H
CO 2	M	H	M	M
CO 3		M	H	
CO 4			M	H

MAFD0037: FLUID DYNAMICS I**(4-0-0)****COURSE OUTCOMES**

CO 1: Develop an appreciation for the properties of Newtonian fluids. (Remembering)

CO 2: Understand the dynamics of fluid flows and the governing non-dimensional parameters. (Understanding)

CO 3: Apply concepts of mass, momentum and energy conservation to flows. (Applying)

CO 4: Formulate the problems on buoyancy and solve them. (Evaluating)

Module I: (20 lectures)

Classification of fluids, Lagrangian and Eulerian methods. Equation of continuity. Irrotational flow, vorticity vector, equipotential surfaces. Streamlines, pathlines, streak lines of the particles, stream tube and stream surface. Mass flux density, conservation of mass leading to equation of continuity. (Euler's form.) Conservation of momentum and its mathematical formulation: Euler's form. Integration of Euler's equation under different conditions. Bernoulli's equation, steady motion under conservative body forces.

Module II: (15 lectures)

Boundary surface, Theory of irrotational motion, Kelvin's minimum energy and circulation theorems, potential theorems. Some two-dimensional flows of irrotational, incompressible fluids. Complex potential. Sources, sinks, doublets and vortices. Milne-Thomson circle theorem, Images with respect to a plane and circles. Blasius theorem.

Module III: (10 lectures)

Vortex motion and its elementary properties. Wave motion in a gas. Speed of Sound. Equation of motion of a gas. Subsonic, sonic and supersonic flows of a gas. Isentropic gas flows. Flow through a nozzle. Normal and oblique shocks.

Module IV: (15 lectures)

Three-dimensional flows. Sources, sinks, doublets. Axi-symmetric flow and Stokes stream function. Butler sphere theorem, Kelvin's inversion theorem and Weiss's sphere theorem. Images with respect to a plane and sphere. Axi-symmetric flows and stream function. Motion of cylinders and spheres.

Suggested Readings

A Treatise on Hydrodynamics, W. H. Besant and A. S. Ramsey, CBS.

Text book of Fluid Dynamics, F. Charlton, CBS.

Fluid Mechanics, P.K. Kundu and I.M. Cohen, Academic Press.

Theoretical Hydrodynamics, L.M. Milne Thomson, The Macmillan company, USA.

Ideal and incompressible fluid dynamics, N.E. Neill and F. Chorlton, Ellis Horwood Ltd.

Fluid Dynamics, D.E. Rutherford, Oliver and Boyd Ltd, London.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	M	H		
CO 3	M		H	
CO 4			M	H

MARC0038: RIEMANNIAN GEOMETRY AND TENSOR CALCULUS

(4-0-0)

COURSE OUTCOMES

CO 1: Recall the concept of calculating length of a curve and area of a domain in manifold M . (Remembering)

CO 2: Explain the Riemannian metric on surfaces embedded in Euclidean space. (Understanding)

CO 3: Apply the properties of geodesics on a Riemannian manifold in Euclidean space and for Lobachevski plane. (Applying)

CO 4: Evaluate Riemann curvature tensor. (Evaluating)

Module I: (15 lectures)

Introduction to Tensor, space of n dimensions, subspaces; transformation of coordinates; scalar; contravariant (tangent) and covariant (cotangent) vectors; scalar product of two vectors; tensor space of rank more than one contravariant and covariant tensors; symmetric and skew-symmetric tensors; addition and multiplication of tensors; contraction; composition of tensors; quotient law; reciprocal symmetric tensors of the second order, relative tensor, group properties.

Module II: (15 lectures)

Riemannian space; fundamental tensor; length of a curve; magnitude of a vector; associated covariant and contravariant vectors; inclination of two vectors, orthogonal vectors; coordinate hypersurfaces; coordinate curves; field of normals to a hypersurface; principal directions for a symmetric covariant tensor of the second order; Euclidean space of n dimensions.

Module III: (15 lectures)

Levi-Civita tensors; Christoffel symbols and second derivatives; need for covariant derivative; parallel transformations; covariant derivative of a contravariant and covariant vector; curl of a vector and its derivative; covariant differentiation of a tensor; divergence of a vector.

Module IV: (15 lectures)

Gaussian curvature; Riemann curvature tensor; geodesics; differential equations of geodesics; geodesic coordinates; geodesic deviation; Riemannian coordinates; geodesic in Euclidean space; straight lines.

Suggested Readings

An Introduction to Riemannian Geometry and Tensor Calculus, Cambridge university Press, C. E. Weatherburn.

Aspects of Gravitational Interactions, Nova Science publications Inc., Commack, NY, S. K. Srivastava & K. P. Sinha.

Tensor Analysis John Wiley & Sons, Inc., I. S. Sokolnikoff.

Tensor Calculus and Riemannian Geometry, Krishna Prakasahan Media (P) Ltd, D C Agarwal.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3		M	H	
CO 4				H

MANS0039: NUMERICAL SOLUTION OF PDE

(4-0-0)

COURSE OUTCOMES

CO 1: Define matrix norm, normed linear space and related results. (Remembering)

CO 2: Classify initial value problems (IVPs) and Boundary Value Problems (BVPs). (Understanding)

CO 3: Apply different numerical methods to PDEs. (Applying)

CO 4: Analyse accuracy of common numerical methods. (Analysing)

CO 5: Assess different numerical methods in order to find the approximate numerical solution of the PDEs. (Evaluating)

Module I: (10 lectures)

Review normed linear spaces, matrix norm and related results, eigenvalues for tridiagonal matrices. Matrix stability.

Module II: (20 lectures)

Classification of PDEs, Finite difference approximations to partial derivatives. Solution of one-dimensional heat conduction equation by Explicit and Implicit schemes (Schmidt and Crank Nicolson methods), CFL condition, stability and convergence criteria.

Module III: (15 lectures)

Hyperbolic equation, explicit/implicit schemes, method of characteristics. Solution of wave equation. Solution of 1st order Hyperbolic equation. Von Neumann stability.

Module IV: (15 lectures)

Finite difference method for stationary heat conduction, stability and convergence analyse.

Suggested Readings

Numerical methods for Ordinary differential equations, J.C. Butcher, John Wiley & Sons, New York.

Numerical methods for Ordinary differential systems: The initial value problem, J.D. Lambert, John Wiley & Sons, New York.

Numerical solution of ordinary differential equations, John Wiley, New York, K. Atkinson, W. Han and D.E. Stewart.

Finite Difference Methods (Oxford Applied Mathematics & Computing Science Series), G. D. Smith.

Numerical Solution of Ordinary Differential Equations (Wiley), E. Kendall, Atkinson, Han Weimin, David E. Stewart.

Numerical Methods for Scientific and Engineering Computation, M K Jain, S R K Iyengar, R K Jain, New Age International.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		

CO 2	M	H		
CO 3			H	M
CO 4			H	M
CO 5	M			H

MACN0040: COMPUTATIONAL NUMBER THEORY**(4-0-0)****COURSE OUTCOMES**

CO 1: Explain basic of fundamental number theoretic algorithms. (Understanding)

CO 2: Apply finite field theory in cryptography. (Applying)

CO 3: Analyse primality testing algorithms and their uses in Cryptography. (Analysing)

CO 4: Explain the number theoretic foundations of cryptography and the principles behind their security. (Understanding)

Module I: (10 lectures)

Representation of integers and polynomials, Divisibility and the Euclidean algorithm, extended Euclidean algorithm, Congruences, Chinese Remainder theorem, Hensel's lifting lemma, Modular exponentiation - Some applications to factoring.

Module II: (15 lectures)

Finite Fields, Multiplicative generators, Uniqueness of fields with prime power elements, Quadratic residues and reciprocity.

Module III: (20 lectures)

Primality Testing: Probabilities Primality testing, primality testing for numbers of a special form, AKS primality test including detecting perfect powers; Computing the Order of an element and generating primitive roots (and elements of a certain order), Computing Discrete Logarithms, Factoring Integers, factoring polynomials and tests constricting irreducible polynomials; Solving equations over Finite Fields including computing square roots.

Elliptic curves: The Geometry of elliptic curves, the Algebra of elliptic curves, elliptic curves over finite fields, The elliptic curve Discrete Logarithm Problem.

Module IV: (15 lectures)

Cryptosystems and basic cryptographic tools: Secret –key cryptosystems, Public-key cryptosystems, block and stream ciphers, message integrity; message authentication codes, Signature schemes, nonrepudiation, certificates, Hash functions; Some simple cryptosystems, Shift cipher, Substitution cipher, Affine cipher, Vigenère cipher, Hill cipher, Permutation cipher, Stream ciphers, Cryptanalysis of affine, substitution, Vigenère, Hill and LFSR stream ciphers. RSA cryptosystem and Rabin encryption.

Suggested Readings

Computational Number Theory, Abhijit Das, CRC Press.

Prime Numbers and Computer Method for Factorization, Hans Riesel, Birkhauser.

Modern Computer Arithmetic, R.P. Brent and Zimmermann, Cambridge University Press.

A Course in Number Theory and Cryptography, Neal Koblitz, Springer- Verlag.

Hand book of Applied Cryptography, Van Oorschot and Vanstone S.A, CRC Press.

Cryptography Theory and Practice. Douglas R. Stinson & Maura B. Paterson, Chapman & Hall/CRC Press, Taylor & Francis.

Cryptography. Simon Rubinstein-Salzedo, Springer.

An Introduction to Mathematical Cryptography, Jeffrey Hoffstein, Jill Pipher & Joseph H. Silverman, Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		
CO 3	M		H	

CO 4				H

MASC0041: SCIENTIFIC COMPUTING**(4-0-0)****COURSE OUTCOMES**

CO 1: Classify Initial conditions and boundary conditions specific to the problem. (Understanding)

CO 2: Apply different numerical methods to ODEs. (Applying)

CO 3: Analyse accuracy of iterative numerical methods. (Analysing)

CO 4: Assess the approximate numerical solution of the linear and nonlinear problems. (Evaluating)

Module I: (13 lectures)

Initial value problems (IVPs) for the system of ordinary differential equations (ODEs); Difference equations; Numerical methods; Local truncation errors, Stability analysis; Interval of absolute stability; Convergence and consistency.

Module II: (13 lectures)

Single-step methods: Taylor series method; Explicit and implicit Runge-Kutta methods and their stability and convergence analysis; Extrapolation method; Runge-Kutta method for the second order ODEs; Stiff system of differential equations.

Module III: (16 lectures)

Multi-step methods: Explicit and implicit multi-step methods; General linear multi-step methods and their stability and convergence analysis; Adams-Moulton method; Adams-Bashforth method; Nystrom method; multi-step methods for the second order IVPs.

Module IV: (18 lectures)

Boundary value problems (BVPs): Two-point non-linear BVPs for second order ordinary differential equations; Finite difference methods; Convergence analysis; Difference scheme based on quadrature formula; Difference schemes for linear eigenvalue problems; Mixed boundary conditions; Finite element methods; Assemble of element equations; Variational formulation of BVPs and their solutions; Galerkin method; Ritz method; Finite element solution of BVPs.

Suggested Readings

Numerical methods for Ordinary differential equations, J.C. Butcher, John Wiley Sons, New York.

Numerical methods for Ordinary differential systems: The initial value problem, J.D. Lambert, John Wiley & Sons, New York.

Numerical solution of ordinary differential equations, K. Atkinson, W. Han and D.E. Stewart, John Wiley, New York.

Numerical Methods for Scientific and Engineering Computation (New Age International), M K Jain, S R K Iyengar, R K Jain.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H	M	
CO 3			H	
CO 4				H

MASF0042: SPECIAL FUNCTIONS**(4-0-0)****COURSE OUTCOMES**

CO 1: Define the different types of special functions and their properties. (Remembering)

CO 2: Apply the properties of special functions in the mathematical analysis, functional analysis etc. (Applying)

CO 3: Analyse properties of special functions by their integral representations and symmetries. (Analysing)

CO 4: Illustrate purpose and functions of the gamma and beta functions, Fourier series and Transformation. (Understanding)

Module I: (12 lectures)

The Gamma and Beta Functions: Euler's integral for $\Gamma(z)$, the beta function, factorial function, Legendre's duplication formula, Gauss's multiplication theorem, summation formula due to Euler, behaviour of $\log \Gamma(z)$ for large $|z|$.

Module II: (18 lectures)

The Hypergeometric function: An integral representation. Its differential equation and solutions, $F(a,b,c;1)$ as a function of the parameters, evaluation of $F(a,b,c;1)$, contiguous function relations, the hypergeometric differential equation, logarithmic solutions of the hypergeometric equation, $F(a,b,c;z)$ as a function of its parameters, Elementary series manipulations, simple transformations, relation between functions of $\Gamma(z)$ and $\Gamma(1-z)$ quadratic transformations, theorem due to Kummer, additional properties.

Module III: (18 lectures)

The Confluent Hypergeometric function: Basic properties of ${}_1F_1$, Kummer's first formula. Kummer's second formula,

Generalized Hypergeometric Series: The function ${}_pF_q$, the exponential and binomial functions, differential equation, contiguous function relations, integral representation ${}_pF_q$, with unit argument, Saalschütz' theorem, Whipple's theorem, Dixon's theorem, Contour integrals of Barnes' type.

Module IV: (12 lectures)

Bessel Functions: Definition, Differential equation, differential recurrence relations, pure recurrence relation, generating function, Bessel's Integral, index half an odd integer, modified Bessel functions, Introduction to Legendre function, Meijer Gfunction and some basic properties.

Suggested Readings

Special Functions, Macmillan, Earl. D. Rainville.

Special Functions of Mathematics for Engineers, L.C. Andrews, SPIE Press.

Orthogonal Polynomials, Gabor Szego, American mathematical society.

Generalized Hypergeometric Functions, Reissue edition, L.J. Slater, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3	M		H	
CO 4	M			H

MAAS0046: ADVANCED ANALYSIS

(4-0-0)

COURSE OUTCOMES

CO 1: Apply Holder and Minkowski inequalities in L_p spaces and understand completeness of L_p -spaces. (Applying)

CO 2: Explain the concepts of Banach algebras, culminating in the Gelfand-Naimark theorem. (Understanding)

CO 3: Define the concept of signed measure and significance of Hahn decomposition theorem. (Remembering)

CO 4: Assess the product measure by integrals and discuss the applications of Fubini's theorem. (Evaluating)

Module I: (15 lectures)

L_p -space, Holder inequality, Minkowski's inequality, convergence, completeness, bounded linear functional.

Module II: (17 lectures)

Banach Algebra, Gelfand theory, algebra, Gelfand-Naimark-Segal (GNS) construction, normal operators, spectral theorem, Fredholm operator, space, calculus for normal operators.

Module III: (16 lectures)

Signed measure, Hahn decomposition theorem, mutually singular measure, Radon-Nikodym theorem, Lebesgue decomposition, Reisz representation theorem.

Module IV: (12 lectures)

Outer measure, Caratheory theorem, product measure, Fubini's theorem.

Suggested Readings

A first course in functional analysis, Conway J.B., Springer.

Banach algebra techniques in operator theory, Douglas R.G., Academic press.

Measure Theory, Halmos P.R., Springer-Verlag.

Measure theory and integration, Barra G.de, Wiley-Eastern.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3		M	H	
CO 4				H

MAGY0047: GRAPH THEORY

(4-0-0)

COURSE OUTCOMES

CO 1: Relate various basic terminologies, properties and results of graph theory. (Remembering)

CO 2: Classify different types of trees according to their properties. (Understanding)

CO 3: Analyse different properties of factorization, covering and colorability of graphs. (Analysing)

CO 4: Determine different results and properties of Eulerian, Hamiltonian and planner graphs. (Evaluating)

Module I: (13 lectures)

Graph, Types of Graphs, Subgraphs, walk, paths, cycles and components, intersection of graphs, Degrees, Degree sequences. operations on graphs, subdivision (of cycles), incentification (of vertices) homomorphism and contraction (of edges).

Module II: (18 lectures)

Trees, Spanning trees, Kruskal's and Prim's algorithm for minimal spanning tree, cycles, cocycles, cycle space, cocycle spaces, Connectivity, cut vertices, cut edges and blocks, connectivity parameters, Menger's theorem. Matching and covers.

Module III: (14 lectures)

Eulerian and Traversable graphs: Characterization theorems, characterization attempts for Hamiltonian graphs: Two necessary and sufficient conditions for a graph to be Hamiltonian, Factorization; Basic concepts, 1- factorization, 2- factorization, coverings, critical points and lines.

Module IV: (15 lectures)

Planarity and colorability: Plane and planar graphs, outer planar graphs, Euler's Polyhedron formula, Kuratowski's theorems. Chromatic number. Five colour theorem, Four Colour conjecture, chromatic polynomial. Adjacency matrix, Spectrum of a graph.

Suggested Readings

Graph Theory, F. Harary, Addison Wesley Publishing Co.

Introduction to graph theory, D. B. West, Prentice Hall, India (Pearson).

Algebraic Graph Theory, N. Biggs, Cambridge university press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	

CO 2		H		
CO 3			H	
CO 4				H

MACA0048: MULTIVARIABLE CALCULUS**(4-0-0)****COURSE OUTCOMES**

CO 1: Demonstrate an understanding of the concepts of multivariate and vector-valued functions and their applications. (Understanding)

CO 2: Examine differentiability of vector valued functions on R^n and understand the relation between directional derivative and differentiability. (Analysing)

CO 3: Learn about generalisation of concept of integration and ability to solve higher dimension integrals. (Understanding)

CO 4: Demonstrate an understanding of Green's, Stokes' and Gauss' theorem and of some physical applications of these theorems. (Applying)

Module I: (15 lectures)

Vectors, dot product of vectors, projection, triangle and Cauchy-Schwarz inequality, cross product of vectors and determinants. Non-linear function, parametric equation of curves, level surfaces, vector fields.

Module II: (20 lectures)

Open sets in R^n , sequences and closed sets, function of several variables, limit of a function of several variables, continuity, sequential continuity, partial and directional derivative, differentiability, chain rule, gradient, curl, divergence, Taylor's theorem, inverse function theorem, implicit function theorem, maximum value theorem, critical points, second derivative test.

Module III: (15 lectures)

Introduction to integration of a function of several variables, multiple integrals, iterated integral, Fubini's theorem, physical applications, determinant in n-dimensions, Jacobian and change of variables.

Module IV: (10 lectures)

Green's theorem, Stokes' theorem, Divergence theorem. Manifolds in R^n , Differential forms.

Suggested Readings

Calculus and Analytic Geometry, Thomas G. B., Finney R.L., Pearson.

Advanced Calculus, P. M. Fitzpatrick, AMS, Indian Edition.

Analysis on Manifolds, Munkres J.R., Wiley.

Principles of Mathematical analysis, Rudin W. McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	M
CO 4				H

MAAY0049: ALGEBRAIC NUMBER THEORY**(4-0-0)****COURSE OUTCOMES**

CO 1: Demonstrate Field extensions and characterization of finite normal extensions as splitting fields and study prime fields. (Understanding)

CO 2: Illustrate cyclotomic polynomials, cyclic extensions, Radical field extensions and Ruler & Compass constructions. (Understanding)

CO 3: Analyse the role of Minkowski's theorem towards the proof of Four-square theorem. (Analysing)

CO 4: Know the important applications of Galois Theory. (Applying)

CO 5: Discuss Artin-Whaples approximation theorem and Hensel's lemma. (Creating)

Module I: (15 lectures)

Integral extension, integral closure of a ring, finitely generated modules, localization of a ring, construction, localization of modules, norm, trace, transitivity of trace and norm, quadratic extension of rationales, discriminant, Dedekind domain, factorization ideals, unique factorization of ideals, the ideal class group.

Module II: (12 lectures)

Factorization of prime ideals in ring extensions, ramification, Ram-Rel identity, lifting of ideals, norms of ideals, norm of a prime ideal, lattices, Minkowski's theorem, the canonical embedding.

Module III: (12 lectures)

The Logarithmic embedding, The Dirichlet's unit theorem, real and imaginary quadratic fields, units in quadratic fields, cyclotomic extensions, an integral basis of a cyclotomic extension.

Module IV: (12 lectures)

Galois extensions, factorization of prime ideals in Galois extensions, decomposition of inertia groups, local fields, absolute values, discrete valuation.

Module V: (9 lectures)

Artin-Whaples approximation theorem, completions, Hensel's lemma.

Suggested Readings

Algebraic Theory of Numbers, Samuel P., Herman.

Algebraic Number Theory, Richard A. Mollin, CRC Press, Taylor and Francis group 3.

Algebraic Number Theory, Stewart I., Tall D., Chapman and Hall.

Problems in Algebraic Number Theory, Esmonde J., Murthy M. R., Springer.

Algebraic Number Fields, Janusz G.J., AMS.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			M	
CO 2	H	H			
CO 3			H		
CO 4			M	H	
CO 5					H

MAFL0050: FLUID DYNAMICS II

(4-0-0)

COURSE OUTCOMES

CO 1: Explain the concept of Newtonian and non-Newtonian fluid. (Understanding)

CO 2: Relate entropy principle to various thermal engineering applications. (Understanding)

CO 3: Apply the concept of second law efficiency and exergy principle to various thermal engineering applications. (Applying)

CO 4: Analyse steady state and transient heat conduction problems of real-life Thermal systems. (Analysing)

Module I: (15 lectures)

Stress components in a real fluid. Relations between rectangular components of stress. Connection between stresses and gradients of velocity. Navier-stokes equations of motion. Plane Poiseuille and Couette flows between two parallel plates, steady flow between concentric rotating cylinders, steady flow through cylindrical pipes; Reynolds' number. Theory of Lubrication. Flow through tubes of uniform cross section in the form of circle, annulus, ellipse and equilateral triangle under constant pressure gradient. Unsteady flow over a flat plate.

Module II: (12 lectures)

Boundary layer concept, Boundary layer equations in two-dimensional flow, Boundary layer flow along the flat plates: Blasius solution. Shearing stress, momentum loss thickness, Boundary layer thickness and skin

friction. Exact solution of the steady state boundary layer equations in two-dimensional motion. Flow past a wedge. Flow in a convergent channel.

Module III: (13 lectures)

Boundary layer on a surface with pressure gradient, Momentum integral theorems for Boundary layer, The Von Karman integral relation, Application of Momentum integral equation to Boundary layers: Von Karman-Pohlhausen method, Separation of boundary layer flow, Boundary layer control, Methods of Boundary layer control, Introduction to turbulent flow: Origin of turbulence, Reynold's modification of Navier-Stokes equations for turbulent flow, Semi-empirical theory of turbulence.

Module IV: (20 lectures)

Basic concepts of Magnetohydrodynamics, Maxwell's equations, Frame of reference, Lorentz force, Electromagnetic body force, Fundamental equations of MHD, Ohm's law for a moving conductor, Hall current, Conduction current, Kinematic aspect of MHD, Magnetic Reynolds number, MHD waves: Alfvén's waves, MHD waves in compressible fluid, MHD approximations, Electromagnetic boundary conditions, One dimensional MHD flow, Hartmann flow, MHD Couette flow, MHD Stoke's flow, MHD Rayleigh's flow, Hartmann-Stoke's boundary layer, Alfvén's boundary layer, Two dimensional MHD flow (a) Aligned flow (b) Stagnation point flow, MHD flows in a rotating medium, Effects of Hall current on MHD flows in a rotating channel, MHD heat transfer.

Suggested Readings

Boundary Layer Theory, H. Schlichting, McGraw Hill Comp.

Laminar Boundary Layer, L. Rosenhead, Dover Pub.

Fluid Mechanics [SI Units], Cengel, Tata McGraw-Hill Education.

Magnetohydrodynamics, T. G. Cowling, Interscience Publishers New York.

A Text Book of Magnetohydrodynamics, J.A. Shercliff, Pergamo.

Magnetohydrodynamics and Plasma Dynamics, S. I. Pai, Springer Verlag, New York.

Magnetofluid Dynamics for Engineers and Applied Physicists, K. R. Cramer and S. I. Pai, McGraw-Hill, New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	M
CO 4			M	H

MACM0051: CONTINUUM MECHANICS

(4-0-0)

COURSE OUTCOMES

CO 1: Define principles, axioms and hypothesis of governing equations of continuum mechanics. (Remembering)

CO 2: Extend the same principles to solve deformed and un-deformed configuration of particles. (Understanding)

CO 3: Develop the general theory to formulate and solve problems in hydrodynamics. (Applying)

CO 4: Examine the concept of macroscopic behaviour of particles. (Analysing)

CO 5: Estimate the elasticity behaviour of particles in continuum media. (Evaluating)

Module I: (15 lectures)

Principles of continuum mechanics, axioms. Forces in a continuum. The idea of internal stress. Stress tensor, Cauchy's stress principle. Equations of equilibrium. Symmetry of stress tensor. Stress transformation laws. Principal stresses and principal axes of stresses. Stress invariants. Stress quadric of Cauchy. Shearing stresses. Mohr's stress circles.

Module II: (20 lectures)

Deformation. Strain tensor. Finite strain components in rectangular Cartesian coordinates. Lagrangian and Eulerian descriptions, Infinitesimal strain components. Geometrical interpretation of infinitesimal strain

components. Principal strain and principal axes of strain. Strain invariants, strain quadratic of Cauchy's. The compatibility conditions. Compatibility of strain components in three dimensions. Constitutive equations.

Module III: (10 lectures)

Inviscid fluid. Circulation. Kelvins energy theorem. Constitutive equation for elastic material and viscous fluid. Navier and Stokes equations of motion. Motion of deformable bodies.

Module IV: (15 lectures)

Lagrangian and Eulerian approaches to the study of motion of continua. Material derivative of a volume integral. Equation of continuity. Equations of motion. Equation of angular momentum. Equation of Energy. Strain energy density function.

Suggested Readings

Schaum's Outline of Continuum Mechanics, G. E. Mase, Mc-Graw Hill.

A first course in continuum mechanics, Y.C. Fung, Cambridge University Press.

A course in continuum mechanics. Vol – I, L. I. Sedov, Groningen: Wolters-Noordhoff Publishing.

The elements of continuum Mechanics, C. Truesdell, Springer-Verlag.

Mathematical Theory of Continuum Mechanics, Rabindranath Chatterjee, Narosa.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		M
CO 3		M	H	M
CO 4			H	
CO 5				H

MATR0052: THEORY OF RELATIVITY

(4-0-0)

COURSE OUTCOMES

CO 1: Recall the fundamental principles of inertial frames and uniform motion in relativistic mechanics. (Remembering)

CO 2: Illustrate the concept of vacuum and various physical quantities in flat space as well as curved space time. (Understanding)

CO 3: Apply the concept of relativistic mechanics to define physical quantities in various coordinate system. (Applying)

CO 4: Analyse the path of motion of particles in presence of curved space-time. (Analysing)

CO 5: Assess the relativistic frequency shifts for sources moving in a gravitational field. (Evaluating)

Module I: (20 lectures)

The special theory of relativity: inertial frames of reference; postulates of the special theory of relativity; Lorentz transformations; length contraction; time dilation; variation of mass; composition of velocities; relativistic mechanics; world events, world regions and light cone; Minkowski space- time; equivalence of mass and energy.

Module II: (10 lectures)

Energy-momentum tensors: the action principle; the electromagnetic theory; energy-momentum tensors (general); energymomentum tensors (special cases); conservation laws.

Module III: (15 lectures)

General Theory of Relativity: introduction; principle of covariance; principle of equivalence; derivation of Einstein's equation; Newtonian approximation of Einstein's equations.

Module IV: (15 lectures)

Solution of Einstein's equation and tests of general relativity: Schwarzschild solution; particle and photon orbits in Schwarzschild space-time; gravitational red shift; planetary motion; bending of light; radar echo delay.

Suggested Readings

The Theory of Relativity, 2nd edition, R.K. Pathria, Hindustan Publishing co. Delhi.

General Relativity & Cosmology, J.V. Narlikar, Macmillan co. of India Limited.

Aspects of Gravitational Interactions, S. K. Srivastava and K. P. Sinha, Nova Science Publishers Inc. Commack, New York.

Essential Relativity – W. Rindler, Springer-Verlag.

General Relativity – R.M. Wald, University of Chicago Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	M	H		M
CO 3			H	
CO 4			M	M
CO 5				H

MAFE0053: FINITE ELEMENT METHODS

(4-0-0)

COURSE OUTCOMES

Learn and relate some basic concept of variational methods and finite element method. (Remembering)

CO 1: Relate simple problems into finite elements. (Understanding)

CO 2: Develop finite element models. (Applying)

CO 3: Analyse finite element method in two dimensional problems. (Analysing)

Module I: (15 lectures)

Integral formulations and variational methods: Weighted integral and weak formulations of boundary value problems, RayleighRitz method, Method of weighted residuals.

Module II: (15 lectures)

Finite element analysis of one - dimensional problems: Discretization of the domain, Derivation of element equations, Connectivity of elements, Imposition of boundary conditions, Solution of equations, Applications.

Module III: (15 lectures)

Time dependent problems in one dimension: Formulation of eigenvalue problem, Finite element models, Applications of semi discrete finite element models for time-dependent problems, Applications to parabolic and hyperbolic equations.

Module IV: (15 lectures)

Finite element analysis of two- dimensional problems: Interpolation functions – Evaluation of element matrices, Assembly of element equations, Imposition of boundary conditions, Solution of equations, Applications to parabolic and hyperbolic equations.

Suggested Readings

An Introduction to the Finite Element Method, Reddy J.N., Tata McGraw Hill, New Delhi.

Finite Element Analysis, Schaum's Outline Series, Buchanen G.R. and Rudhramoorthy R, Tata McGraw Hill, New Delhi.

Fundamentals of Finite Element Analysis, Huttan D.V., Tata McGraw Hill, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	L		
CO 2		H	M	
CO 3			H	
CO 4			M	H

MADN0054: DESIGN AND ANALYSIS OF ALGORITHMS**(4-0-0)****COURSE OUTCOMES**

CO 1: Learn the formal definition and importance of analysis of an algorithm and their asymptotic bounds. (Remembering)

CO 2: Outline different design strategies for the design of algorithms. (Understanding)

CO 3: Develop and analyse algorithms for given problems. (Applying)

CO 4: Compare and analysis different design strategies. (Analysing)

CO 5: Assess various algorithms in terms of correctness, computation cost and memory space used. (Evaluating)

Module I: (16 lectures)

Model of computations: Algorithms and their complexity, Random access machines, Computational complexity of RAM programs, A stored program model, abstraction of RAM, A primitive model of computation: Turing machine, relationship between Turing machine and RAM model.

Algorithms Analysis Techniques: Efficiency of algorithms, analysis of recursive programs, solving recurrence equations, a general solution for large class of recurrences.

Algorithms Design Techniques: Data structures: List, queues and stacks; Set representations, Graphs, Trees, Divide and Conquer algorithms, dynamic programming, Greedy algorithms, Backtracking, Local search algorithms, Balancing.

Module II: (10 lectures)

Sorting and Order Statistics: The sorting problem, Radix sorting, Sorting by comparison, Heapsort-an $O(n \log n)$ comparison sort, quicksort-an $O(n \log n)$ expected time sort, Order Statistics, Expected time of order statistics.

Data structures for set Manipulation problems: Fundamental operations on set, Hashing, Binary search, Binary search trees, Optimal binary search trees, A simple-disjoint set union algorithm, tree structures for UNION –FIND problem, Application and extensions of the UNION-FIND algorithm, Balanced tree schemes, Dictionaries and priority queues, Mergeable heaps, Concatenable queues, Partitioning.

Module III: (14 lectures)

Algorithms on Graphs: Minimum-cost spanning trees, Depth-first search, Bi-connectivity, Depth-first search of a directed graph, strong connectivity, Path- finding problems, A transitive closure algorithm, A shortest path algorithm, Path problems and matrix multiplication, Single- source problems, Dominators in a directed acyclic graph.

Matrix multiplications and related Operations: Basics, Strassen's matrix multiplication algorithm, Inversion of matrices, LUP decomposition of matrices, Application of LUP decomposition, Boolean matrix multiplication.

Module IV: (12 lectures)

NP-Complete Problems: Nondeterministic Turing machine, The class P and NP, Languages and problems, NP- completeness of the satisfiability problem, Additional NP-Complete problem, Polynomial space – bound problems.

Some Provably Intractable Problems: Complexity hierarchies, The space hierarchy for deterministic Turing machine. A problem requiring exponential time and space, A non- elementary problem.

Module V: (8 lectures)

Data structures and Algorithms for External Storage: A model for External computation, External sorting, Storing information in files, External search trees. Memory Management: The issues in memory management, Managing equal-sized blocks, Garbage collection algorithms for equal-sized blocks, storage allocation for objects with mixed sizes, Buddy systems, Storage compaction.

Suggested Readings

The Design and Analysis of Computer Algorithms, Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, Addition Wesley.

Data Structures and Algorithms, Alfred V Aho, John E Hopcroft and Jeffrey D Ullman, Addition Wesley.

Introduction to algorithms- A Creative approach, V Manbar, Addition Wesley.

Fundamentals of Computer Algorithms, Ellis Harwitz, Sartaz Sahani, Computer Science Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M	H			
CO 3		M	H		
CO 4			M	H	M
CO 5				M	H

MAIC0055: INTRODUCTION TO CRYPTOGRAPHY**(4-0-0)****COURSE OUTCOMES**

CO 1: Define the terms and concepts of symmetric key ciphers. (Remembering)

CO 2: Identify the importance of modular arithmetic, modulo operator and algebraic structures in symmetric key cipher. (Applying)

CO 3: Discuss some asymmetric-key cryptography, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem. (Analysing)

CO 4: Discuss some primality test algorithms and their efficiencies. (Analysing)

CO 5: Explain the concept of elliptic curve cryptosystems. (Understanding)

Module I: (14 lectures)

Introduction to Cryptography, classical cryptosystem, cryptanalysis on Substitution Cipher, Play Fair Cipher, Block Cipher. Data Encryption Standard (AES), Triple DES, Modes of Operation, Stream Cipher, Pseudorandom Sequence.

Module II: (16 lectures)

LFSR based stream cipher; Modular inverse, Extended Euclid Algorithm, Fermat's Little Theorem, Euler Phi-Function, Euler's theorem, Quadratic Residue, Polynomial Arithmetic. Advanced Encryption Standard (AES), Introduction to Public Key Cryptosystem, Diffie-Hellman Key Exchange, Knapsack Cryptosystem, RSA Cryptosystem.

Module III: (18 lectures)

Primality Testing: Probabilities Primality testing, primality testing for numbers of a special form, AKS primality test including detecting perfect powers; Computing the Order of an element and generating primitive roots (and elements of a certain order), Computing Discrete Logarithms, Factoring Integers, factoring polynomials and tests constricting irreducible polynomials; Solving equations over Finite Fields including computing square roots. ElGamal Cryptosystem.

Module IV: (12 lectures)

Cubic curves, singular points, Discriminant, Elliptic curves, Elliptic Curve over the Reals, Elliptic Curve Modulo a Prime. Generalized ElGamal Public Key Cryptosystem, Chinese Remainder Theorem, Rabin Cryptosystem, Legendre and Jacobi symbol.

Suggested Readings

A Course in Number Theory and Cryptography, A Neal Koblitz, Springer.

An Introduction to Mathematical Cryptography, Jill Pipher, Jeffrey Hoffstein, Joseph H. Silverman, Springer.

An Introduction to theory of numbers, Niven, Zuckerman and Montgomery, Wiley.

Elliptic curves: number theory and cryptography, Lawrence C. Washington, Chapman & Hall/CRC.

An Introduction to Cryptography, R.A. Mollin, Chapman & Hall.

Rational Points on Elliptic Curves, Silverman and Tate, Springer.

Guide to elliptic curve cryptography Hankerson, Menezes, Vanstone, Springer.

Elementary Number Theory, Jones and Jones, Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3		M	H	
CO 4		M	M	
CO 5				H

MADS0059: DYNAMICAL SYSTEMS AND CHAOS

(4-0-0)

COURSE OUTCOMES

CO 1: Define the concepts of nonlinearity, iterated functions, fixed points, differential equations, metric space and topology. (Remembering)

CO 2: Interpret the link between regular systems and unpredictable systems with chaotic nature. (Understanding)

CO 3: Classify and interpret the dynamical properties for a given problem in a dynamical system. (Analysing)

CO 4: Derive the model on of given physical situations to prove the basic dynamic behaviour with the existence of chaos. (Applying)

CO 5: Determine bifurcation points, Topological entropy, Topological transitivity, Devaney chaos, Li-Yorke chaos. (Evaluating)

Module I: Dynamical Systems and Vector Fields (12 lectures)

The notion of Dynamical systems and Vector Fields, The fundamental theorem on existence and uniqueness, Orbits, Topological conjugacy and orbits, Phase Portraits, Graphical analysis of orbits, Periodic orbits and stability theory, Nonlinear analysis on Logistic map and Tent Map.

Module II: Discrete systems and Bifurcations (12 lectures)

Period doubling bifurcations, Saddle-node bifurcation, Transcritical bifurcation, Pitchfork bifurcation, various universal routes to chaos, Feigenbaum universality, Chaos, Strange attractor, Fractals, Sharkovskii Order, Period 3 implies chaos.

Module III: Continuous systems and Dynamics (12 lectures)

First order continuous autonomous systems, Classification of fixed points of autonomous systems, Attractors and repellers, Second order continuous autonomous systems, Phase curves and fixed points, Classification of fixed points of linear systems.

Module IV: Topological Dynamics (12 lectures)

Topological Dynamical systems, Examples and Basic Properties, Topological transitivity, Mixing, Weak mixing, Devaney chaos, Li-Yorke chaos, Topological entropy and Application.

Module V: Symbolic Dynamics (12 lectures)

Shifts- one-sided and two-sided, Sub shifts and codes, Shift spaces, Languages, The Perron Frobenius theorem, Higher block shifts and Higher Power shifts, Entropy and application , Finite type constraints , Graph representations of shifts of finite type and their properties.

Suggested Readings

Nonlinear Dynamics and Chaos with application to Physics, Biology, Chemistry, and Engineering, Steven H Strogatz, West view Press.

A First Course in Chaotic Dynamical Systems: Theory and Experiments, Robert L Davaney, CRC Press, Taylor and Francis.

An Introduction to Symbolic Dynamics and Coding, Douglas Lind and Brian Marcus, Cambridge University Press.

Introduction to Dynamical Systems, Michael Brin and Garrett Stuck, Cambridge university Press.

Introduction to Nonlinear Dynamical Systems and Chaos, S Waggins, Springer.

Chaos and Fractals, H O Peitgen, H Jurgens and D Saupe, New Frontiers of Science, Springer.

Nonlinear Oscillations, Dynamical Systems and Bifurcation of Vector Fields, J Guckenheimer and P Holmes, Springer.

Introduction to Dynamical Systems, D K Arrowsmith, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M		
CO 2	M	H			
CO 3	M		H		
CO 4	M	H	M	H	M
CO 5				M	H

MACO0060: CONVEX OPTIMIZATION**(4-0-0)****COURSE OUTCOMES**

CO 1: Define some basic concept of functions and operations research. (Remembering)

CO 2: Analyse and solve a given a mathematical problem, classifying its algebraic structure. (Analysing)

CO 3: Derive the solution of a problem using mathematical methods and computing approach. (Applying)

CO 4: Determine the mathematical and social system solution procedure and analysing the results. (Evaluating)

Module I: Introduction (5 lectures)

Mathematical Optimization, least square and linear programming, convex optimization, nonlinear optimization.

Module II: Convex sets and functions (15 lectures)

Convex sets: Affine and convex sets, examples, operations that preserve convexity, generalised inequalities, separating and supporting hyperplanes, dual cones and generalised inequalities. Convex functions: Basic properties and examples, conjugate function, quasi-convex functions, log- concave and log convex functions, convexity with respect to generalised inequalities.

Module III: Convex optimization problems (20 lectures)

Optimization problems- convex, linear, quadratic, geometric, generalised inequality constraints, vector optimization. Duality: The Lagrange dual functions, geometric interpretation, saddle point, optimality conditions, perturbation and sensitivity analysis, theorem of alternatives.

Module IV: Applications (20 lectures)

Geometric problems- Projection on a set, distance between sets, Euclidean distance and angle, external volume ellipsoid, centering, classifications, placement and location, floor planning. Approximation and fittings- Norm, least- norm, regularised, robust, function fitting and interpolation, some problems involving two quadratic functions.

Suggested Readings

Convex optimization, Boyd and Vandenberghe, Cambridge University press.

Introductory lectures on convex optimization, Yuri Nesterov, Kluwer Academic Publisher.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H	L	
CO 2	L			H
CO 3	M	M	H	M
CO 4				H

MAGT0061: INTRODUCTION TO GAME THEORY**(4-0-0)****COURSE OUTCOMES**

CO 1: Define some basics of game theory, concepts of players, strategies, payoff etc. (Remembering)

CO 2: Illustrate different types of game strategies. (Understanding)

CO 3: Apply different methods to solve games and recommend which strategy to implement. (Applying)

CO 4: Analyse real life competitive situations using game theoretic techniques. (Analysing)

CO 5: Determine the methods of solution using simple real-life problem. (Evaluating)

Module I: Introduction (8 lectures)

Basics of game theory, Types of games, zero-sum games, non-zero-sum game, Simultaneous games, Sequential games, Prisoners Dilemma, Other Interesting two person games, Ultimate Game, Public Good Game, Theory of rational choice, Interacting decision makers, Solution of Game by Simplex method.

Module II: Games with Perfect Information (10 lectures)

Strategic games, the Prisoner's Dilemma, Nash equilibrium, Best response functions, Dominated actions, Equilibrium in a single population: symmetric games and symmetric equilibria, Cournot's model of oligopoly, Bertrand's model of oligopoly, Electoral competition, The War of Attrition, Auctions, Accident law.

Module III: Mixed strategy Nash Equilibrium (12 lectures)

Strategic games with randomization, Mixed strategy Nash equilibrium: concept and examples, Correlated equilibrium, Expected Payoffs, Mixed Strategy Equilibrium, Dominated Actions, Formation of Players' beliefs, Information and Bayesian Games:

examples, Bayesian game applications, Juries and Information Aggregation, Auctions with Private Information.

Module IV: Extensive Games (12 lectures)

Definitions, Subgame perfect equilibrium, the ultimatum game and the holdup game, Stackelberg's model of duopoly, buying vote, Extensive Games with Perfect Information: Extensions and Discussion, Coalitional Games and the Core, examples, Bayesian Games, Spence Signalling Game, Crawford and Sobel Cheap Talk Game.

Module V: Variants and Extensions (18 lectures)

Strictly Competitive Games and Maximization, Definition and Examples, Rationalizability, Iterated elimination of strictly and weakly dominated actions, Evolutionary Equilibrium, Monomorphic pure strategy equilibrium, Mixed strategies and polymorphic equilibrium, Asymmetric equilibria, Repeated games: The Prisoner's Dilemma, Infinitely repeated games, Strategies, Nash equilibria of general infinitely repeated games, Subgame perfect equilibria of general infinitely repeated games, Finitely repeated games, Bargaining, Repeated ultimatum game, Holdup game.

Suggested Readings

Game Theory, D. Fudenberg and J. Tirole, MIT press.

An Introduction to Game Theory, Osborne, M.J., Oxford University Press.

Microeconomic Theory, Mas-Colell, A., M.D. Whinston and J.R., Green Oxford University Press.

Primer in Game Theory, Gibbons, R.A, Pearson Education.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			M	

CO 2		H			
CO 3			H	M	
CO 4				H	M
CO 5				M	H

MAAN0062: ALGEBRAIC GEOMETRY**(4-0-0)****COURSE OUTCOMES:**

CO 1: Show the correspondence between algebraic objects and their geometric counterparts. (Remembering)

CO 2: Explain the interplay between algebraic geometry and commutative algebra. (Understanding)

CO 3: Analyse the connection between algebraic objects and geometric properties. (Analysing)

CO 4: Evaluate the properties of local rings with their validity in more generalized setting. (Evaluating)

Module I: (17 lectures)

Review of properties of polynomial rings on several variables, properties of algebraic sets, Nullstellensatz (weak form), Zariski topology on algebraic sets, correspondence between ideals of zero set and radical ideals, Nullstellensatz (strong form), irreducibility in Zariski topology, affine line and Zariski topology, Noetherian decomposition.

Module II: (15 lectures)

Topological dimension, Krull dimension, height of a prime ideal, ring of polynomial functions on affine variety, open sets and basic open sets in Zariski topology, quasi compactness, characterizing affine varieties, correspondence between k algebras and morphisms, the coordinate ring of an affine variety, automorphism of affine spaces and polynomial rings.

Module III: (16 lectures)

Projective spaces, projective spaces as copies of affine spaces, graded rings and homogeneous ideals, homogeneous localization and related properties, local rings, local rings at a point of a projective space, function fields, global regular functions on projective varieties, category of varieties, properties of homogeneous coordinate rings.

Module IV: (12 lectures)

Isomorphism of local rings, geometric interpretation of isomorphism of local rings, birationality, idea of non-singularity, smooth manifolds, correspondence between hypersurfaces and varieties.

Suggested Readings

Abstract Algebra, Dummit D.S., Foote R. M., John Wiley and sons Inc.

Undergraduate Commutative Algebra, Reid Miles, Cambridge university press.

Elementary Algebraic Geometry, Hulek Klaus, AMS Student mathematical library.

Basic Algebraic Geometry I, Shafarevich I.R., Springer-Verlag.

Algebraic Geometry, Hartshorne R., Springer-Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	M
CO 2		H		
CO 3		M	H	
CO 4			M	H

MANO0063: NUMERICAL OPTIMIZATION**(4-0-0)****COURSE OUTCOMES**

CO 1: Learn some basic concept of numerical methods and operations. (Remembering)

CO 2: Illustrate the different optimization problem and their solving methods. (Understanding)

CO 3: Classify the algebraic structure and the solution procedure for a given a mathematical problem. (Analysing)

CO 4: Derive the solution of a problem using computing approach. (Applying)

CO 5: Evaluating the mathematical and social system solution procedure and analysing the results. (Evaluating)

Module I: Mathematical Formulation (5 lectures)

Transportation problem, continuous and discrete, constrained and unconstrained, global and local, stochastic and deterministic convexity, and optimization algorithms.

Module II: Fundamental of unconstrained optimization (10 lectures)

Solution of unconstrained problems, local minimum, non-smooth problems. Two strategies- Line search and Trust Region, search direction for linear search methods, models for Trust Region method, steepest Descent method, first order methods- Gauss- Seidel, method of successive approximation or Gradient method.

Module III: Line Search (15 lectures)

General scheme, computing new t, optimal step size, Wolfe's rule. Newton methods- Forcing global convergence, alleviating the method, Quasi- Newton methods, global convergence, local convergence. Conjugate gradient- developing the method, computing the direction, orthogonalization process.

Module IV: Trust Region (18 lectures)

Elementary problems, curvilinear search incidence on the sequence x_k , least square, Gauss- Newton, algorithm based on Cauchy point, improving on the Cauchy point. Quadratic programming-basic mechanism, solution algorithm and convergence.

Module V: Newton's methods in constrained optimization (12 lectures)

Differential calculus, existence and uniqueness of solutions, first order optimality condition, second order optimality condition, speed of convergence, projection onto a closed convex set.

Suggested Readings

Numerical Optimization, Jorge Nocedal, Stephen J Wright, Springer publication.

Numerical Optimization Theoretical and Practical Aspect, J Frederic Bonnans, J Charles Gibert Claude Lemarechal, Claudia A Sagastizabal, Springer publication.

Numerical methods and optimization an introduction, Sergiy Butenko, Panos M Pardalos, CRC press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				M
CO 2	M	H			
CO 3			H		
CO 4				H	
CO 5				M	H

MAML0064: MACHINE LEARNING

(4-0-0)

COURSE OUTCOMES

CO 1: Explain the basic concepts of Machine learning, Data Mining and AI and their importance in real life. (Understanding)

CO 2: Illustrate the various characteristics machine learning. (Understanding)

CO 3: Utilize the ML algorithms for finding solutions of real-life problem. (Applying)

CO 4: Analyse ML methods for identifying problems. (Analysing)

CO 5: Determine the performances of ML by implementing Python. (Evaluating)

Module I: Introduction to Statistics and Machine learning (8 lectures)

Statistical Inference, Types of Variables, Probability Distribution, Normality, Measures of Central Tendencies, Normal Distribution, Fundamentals of Machine Learning, Data Science vs Machine Learning, Introduction to AI, Machine Learning Concepts and types, KNN methods, Productive Models.

Module II: Supervised Learning (12 lectures)

Classification, Regression, Random Forest, Decision tree, Linear Regression, Gradient Descent, Polynomial Regression, Learning Curves, Regularized Linear Models, Logistic Regression, Ridge Regression.

Module III: Unsupervised Learning (12 lectures)

Clustering, Partitioning Clustering, Hierarchical Clustering, Grid based clustering, Clustering algorithms, K-means algorithm, Applications of Clustering in different fields.

Module IV: Advanced Machine Learning concepts and techniques (10 lectures)

Ensemble methods, Boosting, Support Vector Machines, Linear SVM Classification, Nonlinear SVM Classification, SVM Regression, ANN, Deep Learning, Semi-supervised learning, Tensor flow, Evaluation in ML.

Module V: Dimensionality Reduction (8 lectures)

The Curse of Dimensionality, Main Approaches for Dimensionality Reduction, PCA, Kernel PCA, LLE, Other Dimensionality Reduction Techniques.

Module VI: Introduction Python in Machine Learning (10 lectures)

Introduction to Python, Python Basics, Variables and Data Types, Decision Making and Loops, Functions, Modules and Packages, Exception handling, File and Directories, Classes and objects, Regular expressions, Socket programming.

Suggested Readings

The Elements of Statistical Learning, T. Hastie, R. Tibshirani, J. Friedman; Springer Series in Statistics.

Machine Learning, Tom Mitchell, McGraw Hill.

Introduction to Machine Learning with Python, Andreas C. Muller and Sarah Guido, Sebastopol.

Pattern Recognition and Machine Learning, Chris Bishop, Springer.

Lecture notes in Machine Learning, Zdravko Markov, Tioga Publishing Co.

Data Mining Techniques, Arun Kumar Pujari, University Press.

Pattern classification, Richard O. Duda, Peter E. Hart, David G. Stork, Wiley, New York.

Mapping of Cos to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M			
CO 3			H	H		
CO 4					H	M
CO 5					M	H

MAPD0065: PLASMA DYNAMICS

(4-0-0)

COURSE OUTCOMES

CO 1: Understand and use the basic mathematical formalism needed for describing the dynamics of continuous media (Understanding)

CO 2: Have a very good knowledge of mathematical models for plasma and will be able to distinguish the dynamics of plasmas and neutral fluid media. (Remembering)

CO 3: Use the general theory to formulate and modify the basic dynamic fluid equations to account for the dynamics of plasma media at different levels: from MHD to kinetic scales (Applying)

CO 4: Able to describe the propagation of waves in plasmas, plasma turbulence, instabilities and derive the dispersion relation for these waves (Analyzing)

CO 5: Solve complex model for the various astrophysical regions, and obtain analytical expressions for some characteristic quantities (Evaluating)

Module I (10 lectures) Introduction

Basic properties of plasmas: Definition, occurrence and importance of plasmas, Debye shielding, Quasi-neutrality, plasma parameter, plasma frequency, Larmor orbits (basics), Non-ideal plasmas

Module II (10 lectures) Elements of plasma dynamics

Single particle motion: Cyclotron motion, Electrodynamics equations for a conducting fluid (Maxwell's equations, Conservation of electric charge, Generalized Ohm's law etc.) , Guiding center drifts: $E \times B$, curvature and gradient., Magnetic moment, adiabatic invariants, magnetic mirrors

Module III (18 lectures) Plasma as fluids

Introduction: The fluid equation of motion (Continuity equation, Momentum balance equation, Equations of state, Two-fluid equations, Plasma resistivity.

Waves in plasmas : Plasma oscillations, Langmuir waves, ion-acoustic waves ;Electromagnetic waves (parallel and perpendicular to B_0)

Module IV (12 lectures) Kinetic plasma theory

Vlasov and Boltzmann equations, Obtaining fluid equations from Boltzmann equation, From the two-fluid to MHD description of plasmas;Longitudinal and transverse waves in an unmagnetized plasma. Solution of initial value problem by Landau's method. Landau damping.

Module V: (10 lectures) Nonlinear effects in plasmas

Introduction, The Sagdeev potential, Derivation of KdV equation for ion-acoustic waves, Soliton solution in one dimension, Elementary ideas about the ponderomotive force and parametric instability.

Suggested Readings:

Introduction to Plasma Physics and Controlled Fusion, F. F. Chen, Plenum Press, New York, Second Edition, Vol. 1, 1984.

Fundamentals of Plasma Physics, J. A. Bittencourt, Springer-Verlag New York, 2008.

Elements of Plasma Physics, S. N. Goswami, New Central Book Agency (P) Ltd, 2011.

Methods in Nonlinear Plasma Theory, R. C. Davidson, Academic Press, New York and London, 1972.

Waves in Plasmas, Thomas H. Stix, American Institute of Physics, USA, 1992.

Introduction to Plasma Physics, R. J. Goldston and P. H. Rutherford, IOP Publishing, Bristol & Philadelphia, 1995.

Mapping COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M			M	
CO 2	H	H			M
CO 3	M	M	H	M	
CO 4		M			
CO 5			M	H	H

MAFG0154: FRACTAL GEOMETRY AND APPLICATIONS**(2-0-0)****COUSE OUTCOMES**

CO 1: Explain the basic concepts of fractals and their mathematical constructions. (understanding)

CO 2: Develop fractal dimensions and study their applications. (Applying)

CO 3: Categorize Mandelbrot set and Julia sets, and classify their graphical representation and geometric properties. (Analysing)

CO 4: Interpret random fractals, and study their applications to Health science and Stock markets. (Evaluating and Applying)

CO 5: Demonstrate various chaos, renormalization, universality of chaos, and their significance. (Understanding and Creating)

CO 6: Elaborate various applications in different fields of science and technology. (Creating)

Module I: Regular Fractals and Self-similarity (5 lectures)

Self-similarity, Examples of self-similarity, Fractals, Cantor Set, Koch Curve, Sierpinski gasket, Menger Sponge, Iterators and Generators, Geometry of Plane Transformations, Iterated Function Systems(IFS), Inverse problems, Random IFS, Driven IFS, Architecture.

Module II: Natural Fractals and Dimensions (5 lectures)

Ineffective way to measure, Fractal Dimensions and calculation, Hausdorff measure and dimension, Box counting dimension, Similarity dimension, The Moran formula, other dimensions, Area-Perim, Dim Algebra, Natural Fractals, Manufactured Fractals.

Module III: The Mandelbrot Set and Julia Sets (5 lectures)

Complex iteration, Julia sets, Julia sets of quadratic functions, The Mandelbrot set, Combinatorics of the Mandelbrot set, The boundary of the Mandelbrot set, Scaling in the Mandelbrot set, Complex Newton's method, Universality of the Mandelbrot set, Fractal in arts.

Module IV: Random Fractals and the Stock Market (5 lectures)

Self-similar distributions, Random Cantor set, Brownian motion, Fractional Brownian motion, Diffusion Limited aggregation, Levy Stable processes, Percolation, Bacterial Growth, Galaxy distributions, Internet traffic, Random fractal Cartoons, Stock market surrogates.

Module V: Chaos and Fractals (5 lectures)

Doubling, Introduction to Chaos, Test functions, Graphical iterations, Time series, Histograms, Bifurcation diagrams, Return map, Driven IFS, Kelly plot, Fixed points, Cycles, Period doubling bifurcations, Dust in the Tent map, Tent and Logistic bifurcation diagrams, Tangent bifurcations, Intermittency, Discontinuous bifurcations, Scaling, Universality, Renormalization, Control of chaos, Synchronization of chaotic processes.

Module VI: Fractal Applications (5 lectures)

Fractal growth, Singularities of Electrostatic and gravitational potentials, Fractal Antennas, Fractal in Finance, Self-Affine set and dimension, Application to encoding images, Panorama of Fractals and their uses, Animations, application of fractal geometry to Computer science, Telecommunications, and Medicine.

Suggested Readings

A Text by Michael Frame and Amelia Urry, Fractal Worlds, Yale University Press.

Fractal Geometry; mathematical foundations and Applications, Kenneth Falconer, John Wiley & Sons Ltd, England.

Fractal Geometry and Applications, Michel L Lapidus, A Jubilee of Benoit Mandelbrot,

The Fractal Geometry of Nature, Benoit Mandelbrot, W.H. Freeman and Co.

Fractal Geometry, Mathematical methods, Algorithms, Applications, A K Evans, Woodhead Publishing.

Fractals Everywhere, Michael Barnsley, Dover Books on Mathematics.

Chaos and Fractals: New Frontiers of Science, Heinz, Otto Peitgen, Springer and Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	M				
CO 2		H		M	L	
CO 3			H	H	M	
CO 4			M	H		L
CO 5				M	H	H
CO 6		H				H

MAMR0153: STATISTICAL METHODS AND SOFTWARE IN RESEARCH

(3-0-0)

COURSE OUTCOMES

CO 1: Explain the basis necessity and application of Statistics in different fields of Science and Social Sciences. (Remembering and understanding)

CO 2: Develop the significance of data analysis and interpretation. (Applying)

CO 3: Categorize Correlation and Regression, and interpret graphical representation. (Analysing and creating)

CO 4: Elaborate various software to study different problems in Statistics. (Creating)

Module I: Importance, Functions, Limitations (5 Lectures)

Importance, Statistics in States, Statistics in Economics, Statistics in Business, statistics in Astronomy, Statistics in Education, Statistics in Mathematics, Functions of Statistics, Limitations of Statistics.

Module II: Collection of Data, Classification and Tabulation (10 lectures)

Primary and Secondary data, Choice of methods, Direct personal observations, Information through Agencies, Sources of Secondary data, Meaning of Classification, rules of Classification, Statistical series, Frequency distribution, Continuous or Grouped Frequency Distribution Class Group Frequency, Structure and rules of Tabulation, and applications.

Module III: Correlation and Regression (10 lectures)

Significance of the study of Correlation, Correlation and Causation, Karl Pearson's coefficient of correlation, Rank Coefficient of correlation, Correlation of time series, Significance of Regression study, Correlation and Regression, Regression equations, Standard error of estimate.

Module IV: Statistical Analysis Software (20 lectures)

Importance of Software in Statistical problems, SPSS (IBM) ,(Statistical Package for Social Sciences), R Foundation for Statistical Computing, MATLAB (MathWorks), Microsoft Excel ,their algebraic results and Applications.

Suggested Readings

Statistics (Theory and Practice), RSN Pillai, and Bagavathi, S Chand & Company Ltd, New Delhi.

All of Statistics: A Concise Course in Statistical Inference, Larry A Wasserman, Springer Publishing Co.

A Second Course in Probability, Sheldon M Ross and Erol A. Pekoz, Pekozbooks.

Statistical Software (Free Websites).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H	M	
CO 3		L	H	M
CO 4				H

MAML0152: ESSENTIAL MATHEMATICS FOR MACHINE LEARNING

(2-0-0)

COURSE OUTCOMES

CO 1: Comprehend the basic and core concepts of vector space, matrices, matrix decompositions. (Understanding)

CO 2: Apply the concepts statistics and linear algebra in Dimension reductions. (Applying)

CO 3: Gain extensive knowledge of probability and statistics for analysis of data. (Analysing)

CO 4: Apply the fundamentals of calculus to evaluate partial derivatives, gradient and other concepts of vector calculus. (Applying)

Module I: (8 lectures)

Vector Spaces: Definitions and examples, Vector Subspaces: Examples and Properties, Basis and Dimensions, Linear Transformations, MATRIX THEORY- Norms and spaces, eigenvalues and eigenvectors, Special Matrices and their properties, least squared and minimum normed solutions.

Module II: (8 lectures)

Matrix Decomposition Algorithms- SVD: Properties and applications, low rank approximations, Gram Schmidt process, polar decomposition, DIMENSIONS REDUCTION ALGORITHMS and JCF- Principal component analysis, linear discriminant analysis, minimal polynomial and Jordan canonical form

Module III: (8 lectures)

Probability – Basic concepts of probability: conditional probability, Bayes' theorem, independence, theorem of total probability, expectation and variance, few discrete and continuous distributions, joint distributions and covariance.

Module IV: (6 lectures)

Calculus – Basic concepts of calculus: partial derivatives, gradient, directional derivatives, Jacobean, hessian, convex sets, convex functions and its properties.

Suggested Readings

Mathematics for Machine Learning, Marc Peter Deisenroth, A. Aldo Faisal, and Cheng Soon Ong, Cambridge University Press.

Analysis for Applied Mathematics. W. Cheney, New York: Springer Science Business Media.

Linear Algebra Done Right, Third Edition, S. Axler, Springer International Publishing.

Numerical Optimization. J. Nocedal and S. J. Wright, New York: Springer Science Business Media.

A First Look at Rigorous Probability Theory, Second Edition, J. S. Rosenthal, Singapore: World Scientific Publishing.

Mapping COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2	L	H		
CO 3		L	H	
CO 4				H

MASL0200: COMMUNITY ENGAGEMENT AND SERVICE LEARNING

(2-0-0)

COURSE OUTCOMES

CO 1: Develop understanding on Community University Engagement. (Remembering)

CO 2: Acquire knowledge of the measures taken by HEIs towards community engagement. (Understanding)

CO 3: Analyse a problem pertaining to the community by applying methods of participatory research. (Analysing)

CO 4: Apply various tools of CPBR to address real life issues of the communities. (Applying)

CO 5: Decide a suitable tool to connect with a certain community by identifying the major barriers. (Evaluating)

Module I: (Service Learning and Community University Engagement) (10 lectures)

Definition of Service Learning (SL), goals and objectives of SL. Meaning of community university engagement (CUE), Historical overview of Higher Educational Institutes (HEIs) in India, role played by various commissions in CUE, various policies adopted by University Grants Commission (UGC), objectives and structure of schemes adopted by UGC, measures taken by HEIs towards community engagement.

Module II: (Role of HEI fostering social responsibility) (10 lectures)

Understanding social responsibility of higher education institutes, forms of community engagement, notion of engaged teaching, engaged research, engaged service, meaning of an active citizen. Meaning of Community Based Participatory Research (CBPR), methods and tools associated with CBPR. Skills to utilize CPBR fostering social responsibility especially post emergency like pandemic etc.

Module III: Assignments (10 lectures)

Visiting nearby villages to collect data on the percentage of students enrolling into schools per year and represent the same using various Mathematical models.

To conduct fact finding visits in local areas to address a particular problem by helping the community understanding the situation employing tools like maps and meetings.

Suggested Readings

Where's the learning in service learning, J. Eyler, D.E. Giles Jr.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	M		
CO 3		M	

CO 4		H	M
CO 5			H

LABORATORY COURSES

MARS6001: RESEARCH SEMINAR

(2-0-0)

Objective

Objective of the Research seminar is to conduct a research literature survey which may lead to the development of a proposed project model to be executed in the 4th semester. This will help the students to familiarize themselves with the current literature on recent trends in the chosen area. Tasks to be performed by the students will include. o Literature survey on the chosen topic.

Presentation on the chosen topic, comprising the following components:

Presentation.

Report.

Viva Voce examination.

COURSE OUTCOMES

CO 1: Find the steps required to do research and projects (Remembering)

CO 2: Illustrate the methodology of research and journaling. (Understanding)

CO 3: Apply the research presentation skills in seminars and conferences. (Applying)

CO 4: List topics to pursue research in the field of pure and applied mathematics. (Analysing)

CO 5: Defend their research dissertations and reports. (Evaluating)

CO 6: Develop research topics and present the research ideas. (Creating)

MACP6002: COMPUTER PROGRAMMING IN C LAB

(0-0-1)

COURSE OUTCOMES

CO 1: Understand the fundamentals of OS, file handling, creating and editing simple C programs. (Understanding)

CO 2: Develop programming skills using the fundamentals and basics of C Language. (Applying)

CO 3: Develop programs using the basic elements like control statements, Arrays and Strings. (Applying)

CO 4: Effective usage of arrays, structures, functions and pointers. (Applying)

List of programs

Introduction to OS; file handling, directory structures, creating and editing simple C programs.

C programming using variables, assignment and simple arithmetic expressions.

Determination of roots of quadratic equations, $ax^2+bx+c=0$, $a \neq 0$.

Arranging given set of numbers in increasing/decreasing order, calculation of Mean.

Calculation of GCD/LCM of two integers.

Evaluation of factorial of a positive integer and evaluation of binomial coefficients.

Evaluation of factorial of binomial coefficients mod 2.

Sieve method for primality test.

Generation of twin primes.

Solution of congruence using complete residue system.

Addition, subtraction and multiplication of matrices.

Transpose, determinant .

Suggested Readings

Programming in ANSI C, E. Balaguruswamy, McGraw-Hill.

A first book of ANSI C, J. Brosin, Cengage Learning India P.Ltd. 4.

C Programming Language, Brain W. Kernighan & Dennis Ritchie, PHI.

5. Let us C, Kanetkar Y, BPB Publications, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO 1	H	M										
CO 2		H	H	M								
CO 3			H	H	H	H	H	H	H	H	M	M
CO 4				H				H		H	H	H

MARP6003: RESEARCH PROJECT**(8 credits)****Objective**

The objective of the research project is to train students to carry out research/investigation in a field that is of relevance to Mathematical science. During the project period, students will start a research project/investigation applying the knowledge acquired in the first three semesters and also incorporating the recent trends in the chosen area. In the project course, the student should be able to undertake detailed literature review as a way of information search, carry out detailed investigations as a way of solving project problems, write and put together a detailed report of the investigations carried out at the end of the fourth semester.

The mode and components of evaluation, supervisors and the weightages attached to them shall be published by the Department at the beginning of the semester.

COURSE OUTCOMES

CO 1: Identify different areas of research in the field of Mathematical sciences or in computing. (Remembering)

CO 2: Explain the importance of research in the chosen topic of interest. (Understanding)

CO 3: Apply theoretical knowledge to find out an appropriate topic of importance for research in the graduate level. (Applying)

CO 4: Analyse when a chosen approach does not yield the expected result. (Analysing)

CO 5: Evaluate the project and present in an appropriate form. (Evaluating)

CO 6: Learn to choose a methodology or technique or approach to fulfil a set of objectives or prove or disprove a hypothesis. (Creating)

MACM6004: COMPUTATIONAL SKILL DEVELOPMENT: MATHEMATICA**(2 Credits- 30 Lectures)****COURSE OUTCOMES**

CO 1: Learn how to use Mathematica, a powerful coding language in science and engineering computing (Remembering).

CO 2: Apply the application-oriented principle to various real-life problems (Applying)

CO 3: Evaluate simple math computations, modeling and simulation problems, data analysis and processing, as well as visualization techniques. (Evaluating)

Module I (10 Lectures)

Introduction to Mathematica and to the Wolfram Language (knowledge-based language, built-in support for real-world entities, Wolfram Alpha and the Wolfram Demonstrations Project), Notebook Interfaces, Text-Based Interfaces, Numerical Calculations: Arithmetic, Exact and Approximate Results, Some Mathematical Functions, Arbitrary-Precision Calculations, Complex Numbers, Getting Used to Mathematica, Mathematical Notation in Notebooks, Defining Variables, Making Lists of Objects, Manipulating Elements of Lists, The Four Kinds of Bracketing in Mathematica, Sequences of Operations.

Module II (10 Lectures)

Lists, strings, rules, patterns and pattern matching, different programming paradigms (procedural, functional and rule-based), Graphics and image manipulation (the 30+ members of the plot family, pixels and voxels, the built-in image editor).

Module III (10 Lectures)

Linear and polynomial algebra. Exact and numerical optimization. Calculus and differential equations (analytic and numerical solutions of ODEs and PDEs). Plane and solid geometry. Probability and statistics (descriptive statistics, built-in support for 100+ distributions).

Suggested Readings

The Mathematica Book, S. Wolfram, 5th edition, Wolfram Media, 2003

Mathematica Basic Training Course Li Han Long, Sui Ying Deng, National Defense Industry Press, 2016

Introduction to Mathematica with Applications, M. Muresan, Springer, 2017

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M		
CO 2		M	M
CO 3			H

MACS6005: COMPUTATIONAL MATHEMATICS WITH SAGE MATH**(2 Credits- 30 Lectures)****COURSE OUTCOMES**

CO 1: Learn and understand the basic Python programming language. (Understanding)

CO 2: Understand how to use Sagemath software and its applications. (Understanding)

CO 3: Solve problems in Calculus, Applied Linear Algebra, Numerical Method and differential equations using Sagemath. (Evaluating)

Module I (10 lectures)

Installation of Python; Getting Started with Python Python as an advanced calculator; For loop in Python; While loop in Python; Use of SciPy and SymPy in Python; Classes in Python - Part 01; Classes in Python - Part 02;

Module II (12 lectures)

Solving Equations in SageMath; 2d Plotting with SageMath; 3d Plotting with Sage Math; Calculus of one variable with Sagemath, Integration with Sage Math; Improper Integral using SageMath; Application of integration using SageMath; Partial derivative with sage math, limit and continuity of real valued functions; working with vectors in sagemath; Solving systems of linear equation in sage math, vector space in sage math, Matrix Spaces with SageMath; Linear Transformations with SageMath, eigenvalues and eigenvectors with sage math;

Module III (8 lectures)

Finding Roots of algebraic and transcendental equations in Sage Math; Numerical solutions of linear equations and numerical integration with sagemath; Solving 1st and 2nd order ODE with Sage Math; Euler's Method to solve 1st order ODE with SageMath.

Suggested Readings

Computational Mathematics with SageMath, Paul Zimmermann, Siam

Mathematical Computational with Sagemath, Paul Zimmermann Alexandre Casamayou Nathann Cohen Guillaume Connan Thierry Dumont

An introduction to Sage Programming: With applications to SAGE Interacts for Numerical methods, Razvan A Mezei, Springer

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2		H	M
CO 3			H

**DEPARTMENT OF PHYSICS
MSC PHYSICS**

VISION:

To endow the students with profound understanding of physics, the foundation for all natural sciences, and drive them towards critical thought for further study and research, to pave the way for suitable career opportunities and enable them to be of service to the society as responsible human beings.

MISSION:

To strengthen the fundamental concepts of physics and provide advanced understanding of physical phenomena by emphasizing on the correlation between theory and observation.

To spark creative interest towards the pursuit of innovative research in fundamental and applied physics.

PROGRAM OUTCOMES – MSC PROGRAMME

- PO 1: **Critical Thinking:** Inculcate critical thinking to carry out scientific investigation objectively . Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
- PO 2: **Knowledge Skill:** Equip the student with skills to analyse problems, formulate an hypothesis, evaluate and validate results, and draw reasonable conclusions thereof .Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems , rather than replicate curriculum content knowledge .
- PO 3: **Scientific Communication Skills:** Imbibe effective scientific and / or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.
- PO 4: **Ethics:** Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned .Ability to identify unethical behaviour such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects.
- PO 5: **Enlightened Citizenship:** Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges
- PO 6: **Analytical Reasoning:** Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
- PO 7: **Multicultural Competence:** Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is , "welcoming for all students" .
- PO 8: **Lifelong Learning:** Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling .
- PO 9: **Leadership Qualities:** Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.
- PO 10: **Research Skills:** Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/ Matlab to various scientific investigations , problem solving and interpretation

PROGRAMME SPECIFIC OUTCOMES FOR MSC PHYSICS

PSO 1: **Understand the advanced theoretical concept of physics:** Understand the advanced theoretical principles of physics.

PSO 2: **Acquire analytical and logical skill for research:** Acquire the ability to analyse critical research oriented problems logically.

PSO 3: **Expertise in experimental physics and learn to use sophisticated instruments safely:** Learn to handle sophisticated experiments perfectly and safely.

COURSES OFFERED IN MSC PHYSICS

Sl. No.	Course Name
1.1	Classical Mechanics
1.2	Quantum Mechanics I
1.3	Mathematical Physics
1.4	Electronics I
1.5	Physics Laboratory I
1.6	Value Added Course
2.1	Quantum Mechanics II
2.2	Condensed Matter Physics
2.3	Electrodynamics
2.4	Nanophysics I
2.5	Physics Laboratory II
3.1	Atomic and Molecular Physics
3.2	Nuclear Physics
3.3	Research Methodology
3.4	Computer Oriented Numerical Methods
3.5	Computer Oriented Numerical Methods Laboratory
3.6	Project Phase I
3.7	Particle Physics
3.8	Plasma Physics I
3.9	Electronics II
3.10	Nanophysics II
3.11	Physics and Service Learning
3.12	Value Added Course
4.1	Statistical Mechanics
4.2	Project Phase II
4.3	Study Tour
4.4	Gauge Theories
4.5	General Theory of Relativity and Cosmology
4.6	Astrophysics
4.7	Plasma Physics II
4.8	Plasma Physics Laboratory
4.9	Electronics III
4.10	Electronics Laboratory
4.11	Nanophysics III
4.12	Nanophysics Laboratory

MSC Physics- Mapping of Courses to PO/PSO

Map- ping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
1.1	H	H	M			M		H		M	H	M	
1.2	H	H	M			M		H		M	H	M	
1.3	H	H	M			M		H		M	H	M	
1.4	H	H	M			M		H		M	H	M	
1.5	M	M	L	M		M	M	M	M	L		L	H
1.6			H							H		H	
2.1	H	H	M			M		H		M	H	M	
2.2	H	H	M			M		H		M	H	M	
2.3	H	H	M			M		H		M	H	M	
2.4	H	H	M			M		H		M	H	M	
2.5	M	M	L	M		M	M	M	M	L		L	H
3.1	H	H	M			M		H		M	H	M	
3.2	H	H	M			M		H		M	H	M	
3.3	M	M	M	H	H	M		H	M	H	L	H	M
3.4	H	H	M			M		H		M	H	M	
3.5	H	H	L			H		H		M	H	H	
3.6	H	H	H	H		M	H	H	H	H	M	H	H
3.7	H	H	M			M		H		M	H	M	
3.8	H	H	M			H		H		M	H	M	
3.9	H	H	M			M		H		M	H	M	
3.10	H	H	M			M		H		M	H	M	
3.11			H	H	H		H	H	H				M
3.12			H							H		H	
4.1	H	H	M			M		H		M	H	M	
4.2	H	H	H	H		M	H	H	H	H	M	H	H
4.3		H	H		H		H	H	H	M	M	M	H
4.4	H	H	M			M		H		M	H	M	
4.5	H	H	M			M		H		M	H	M	
4.6	H	H	M			M		H		M	H	M	
4.7	H	H	M			H		H		M	H	H	
4.8	M	M	L	M		M	M	M	M	L		L	H
4.9	H	H	M			M		H		M	H	M	
4.10	M	M	L	M		M	M	M	M	L		L	H
4.11	H	H	M			M		H		M	H	M	
4.12	M	M	L	M		M	M	M	M	L		L	H

THEORY COURSES**PSCM0020: CLASSICAL MECHANICS**

(4-0-0)

COURSE OUTCOMES

CO 1: Explain Hamilton's and Lagrange's equations and use them for solving problems in physics. (Understanding)

CO 2: Build the concepts of Canonical transformation. (Creating)

CO 3: Explain the motion of rigid body and visualise the Euler rotations. (Understanding)

CO 4: Solve rigid body problems. (Applying)

CO 5: Develop the theory of special relativity in terms of four vector notation. (Creating)

Module I: (12 lectures)

Hamilton's variational principle; derivation of Lagrange's equations; velocity dependent forces; dissipation. Charged particles in an electromagnetic field. Space time symmetries and conservation Laws. Variational theorem. Space transformation.

Module II: (12 lectures)

Two-body problem; central forces; classification of orbits; differential equation for orbits. Kepler problem; scattering in laboratory and centre of mass frames, transformation of cross sections, energies. Rutherford scattering. Kinematics of decay of particles (into two particles).

Module III: (12 lectures)

Rigid body motion: fixed and moving coordinate systems; orthogonal transformations. Euler angles; angular momentum; rotational kinetic energy. Principal axes transformation; Euler equations; force free motion of a rigid body symmetric top.

Module IV: (12 lectures)

Legendre transformation; Hamiltonian equations; Significance of the Hamilton function. Cyclic coordinates and conservation theorems. Poisson Brackets – Poisson Bracket of Angular momentum with coordinates. Canonical Transformation Theory. Contact transformation; integral invariants.

Module V: (12 lectures)

Special theory of relativity: Lorentz transformations. Four dimensional formulation. Force momentum and energy in relativistic mechanics. Properties of space-time in relativity. Two body decay of a particle.

Suggested Readings

Classical Mechanics, H. Goldstein, C. Poole and J. Safko, Pearson Education Asia.

Classical Mechanics, N. C. Rana and P. S. Joag, Tata McGraw Hills.

Classical Mechanics of Particles and Rigid bodies, K. C. Gupta, Wiley Eastern.

Principles of Dynamics, D. T. Greenwood, Prentice Hall.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			H	
CO 2			H		
CO 3		H			
CO 4			H		
CO 5					H

PSQM0021: QUANTUM MECHANICS I

(4-0-0)

COURSE OUTCOMES

CO 1: Conceptualise different interpretations of quantum mechanics. (Understanding)

CO 2: Apply the concepts of quantum mechanics to different problems in physics. (Applying)

CO 3: Make use of variational method and WKB approximation. (Applying)

CO 4: Inspect how to encounter spin. (Analysing)

CO 5: Comprehend the idea of symmetry in quantum mechanics. (Analysing)

Module I: (10 lectures)

Introduction and revision: inadequacy of classical mechanics; basic postulates of quantum mechanics; ensemble and Copenhagen interpretation. Schrödinger equation; continuity equation; Ehrenfest theorem; admissible wave functions; stationary states. One dimensional problems; potential well and barriers; harmonic oscillator.

Module II: (10 lectures)

Equation of motion: Schrodinger, Heisenberg and Dirac representations; equation of motion in the respective representations. Application to linear harmonic oscillator.

Module III: (10 lectures)

Three dimensional problems: Separation of variables; orbital angular momentum; spherical harmonics. Harmonic oscillator in Cartesian and polar coordinates. A free particle and a particle in 3-D box in Cartesian and polar coordinates, Coulomb problem in spherical and parabolic coordinates - regular and irregular solutions.

Module IV: (11 lectures)

Spinors and their transformation properties. Pauli spin matrices. Identical particles and statistics. Addition of angular momenta. Clebsch-Gordan coefficients. Wigner-Eckart Theorem.

Module V: (8 lectures)

Symmetry in quantum mechanics. Reflections, time reversal, space inversion, particle exchange. Displacement in space and time, space translation and rotational symmetry. Selection rule and conservation laws.

Module VI: (11 lectures)

Variational methods for bound states; lower and upper limits in simple cases. WKB approximation; connection with classical limits, validity of WKB approximation. Connection formulae; application to bound states, tunneling in one dimension. Application to radial Schrodinger equation.

Suggested Readings

Quantum Mechanics, E. Merzbacher, John Wiley.

Quantum Mechanics, G. Ahrulhas, Prentice Hall.

Quantum Mechanics, L. I. Schiff, McGraw Hill.

Quantum Mechanics, V. K. Thankappan, New Age Int. Pub.

Quantum Mechanics, P. T. Mathews and Venkatesan, Tata McGraw Hill.

Principles of Non-Relativistics and Relativistic Quantum Mechanics, K. D. Krori, PHI.

Quantum Mechanics (3 volumes), L. D. Landau and E. M. Lifshitz, Pergamon Press.

Quantum Mechanics, Albert Messiah, Dover Publications.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H	H				
CO 2			H	M	M	M
CO 3						H
CO 4				H		
CO 5					H	

PSQM0024: QUANTUM MECHANICS II

(4-0-0)

COURSE OUTCOMES

CO 1: Explain relativistic quantum mechanics. (Understanding)

CO 2: Interpret path integral approach to quantum mechanics. (Understanding)

CO 3: Apply the concept of quantum mechanics to the problems of scattering. (Applying)

CO 4: Build concept about perturbation theory. (Applying)

CO 5: Develop concepts on advanced topics like Hartree- Fock equation. (Applying)

Module I: (11 lectures)

Stationary perturbation theory: Non Degenerate case; first and second order of energy and wave functions, perturbation of one dimensional harmonic oscillator by potentials of the bx^2 and cx^3 . Degenerate case; first order Stark effect in hydrogen; Zeeman effect without electron spin.

Module II: (9lectures)

Time dependent perturbation theory; first order transition probabilities; constant perturbation. Transition to continuum; Harmonic perturbation; Fermi's golden rule; Sudden and adiabatic approximations.

Module III: (10 lectures)

Many Electron Atoms: Indistinguishable particles; Pauli's Principle; inclusion of spin; spin functions for two and three electrons; the Helium atom; central field approximation, Thomas-Fermi model of the atom; Hartree equation, Hartree- Fock equation.

Module IV: (13 lectures)

Scattering theory: asymptotic behaviour of scattering wave function; relation to cross sections, Green's function for scattering problem; Green's function with different boundary conditions; scattering integral equations; Born approximation and its validity criteria; scattering by screened Coulomb potential; Born series. Partial waves and phase shifts. Scattering amplitude; optical theorem; low energy scattering. Effective range; scattering length; resonance.

Module V: (12lectures)

Relative wave equations: Klein-Gordon equation. Difficulty with probability interpretation. Dirac equation; four component solutions for free particle; negative energy solutions – particles and antiparticles. Covariant form of Dirac equation; 4-current density. Properties of γ -matrices. Dirac equation in the presence of electromagnetic field; non- relativistic reduction; spin and magnetic moment.

Module VI: (5 lectures)

Path integral approach to quantum mechanics: Feynman's Path Integral method, equivalence of Feynman and Schrödinger equations, Dirac-Feynman Action Principle.

Suggested Readings

Quantum Mechanics, E. Merzbacher, John Wiley.

Quantum Mechanics, G. Aruldhas, Prentice Hall.

Quantum Mechanics, L. I. Schiff, McGraw Hill.

Quantum Mechanics, V. K. Thankappan, New Age Int. Pub.

Quantum Mechanics, P. T. Mathews and Venkatesan, Tata McGraw Hill.

Quantum Mechanics Theory and Applications, Ghatak and Lokanathan, Laxmi Publications.

Principles of Non-Relativistics and Relativistic Quantum Mechanics, K. D. Krori, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1					H	
CO 2						H
CO 3				H		
CO 4	H	H				
CO 5			H			

PSCP0025: CONDENSED MATTER PHYSICS

(4-0-0)

COURSE OUTCOMES

CO 1: Explain about crystal structure in details. (Understanding)

CO 2: Illustrate physics of phonons. (Understanding)

CO 3: Identify free electron and nearly free electron models. (Applying)

CO 4: Discuss about advanced topics like plasmons, polaritons, polarons, etc. (Creating)

Module I: (11lectures)

Crystal structure. Diffraction of waves by crystal. Scattered wave amplitudes, Brillouin zones. Fourier analysis of the basis. Crystal binding and elastic constants.

Module II: (9 lectures)

Phonons: quantisation of lattice vibrations, dispersion relation for acoustic and optical phonon, energy gap, density of states, heat capacity, thermal conductivity and thermal expansion.

Module III: (8 lectures)

Free electron Fermi gas: Fermi energy, density of states, heat capacity, thermal conductivity and electrical conductivity. Wiedemann-Franz law.

Module IV: (10 lectures)

Nearly free electron gas: Schrodinger equation of an electron in a periodic potential, Bloch theorem, energy gaps at the zone boundary, approximation solution near a zone boundary, energy bands and their role in properties of metals, insulators and semiconductors. Holes on energy bands. Hall effect.

Module V: (12 lectures)

Shape of fermi surfaces in the free electron and nearly free electron models. Tight binding approximations. Electron orbits, hole orbits and open orbits. Quantization of orbits in a magnetic field. De Hass-van Alphen effect and its role in experimental determination of Fermi surfaces.

Module VI: (10 lectures)

Plasmons, polaritons and polarons: dielectric functions of the electron gas, plasmons, electrostatic screening, Mott metal- insulator transition, polaritons, polarons. Peierls instability of linear metals.

Suggested Readings

Introduction to Solid State Physics, C. Kittel, John Wiley and Sons, Inc.

Quantum Theory of Solids, C. Kittel, John Wiley and Sons, Inc.

Quantum Theory of the Solid State, J. Callaway, Academic Press, New York.

Solid State Physics, H. Ibach and H. Luth, Narosa Pub. House.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H	H	H	
CO 4						H

PSED0026: ELECTRODYNAMICS

(4-0-0)

COURSE OUTCOMES

CO 1: Explain various phenomena from the standpoint of electrodynamics. (Remembering)

CO 2: Outline the origin and propagation of electromagnetic waves. (Understanding)

CO 3: Explain the nature of electromagnetic radiation. (Understanding)

CO 4: Infer the extension of classical electrodynamics to the generalized 4-dimensional case. (Analysing)

CO 5: Apply the laws of electrodynamics to solve various physical problems. (Applying)

Module I: (7 lectures)

Maxwell's equations: review of Maxwell's equations; boundary conditions at interface between different media; Poisson's and Laplace's equations

Module II: (8 lectures)

Electromagnetic waves: linear and circular polarisation; Stoke's parameters; Poynting theorem of complex field vectors; frequency dispersion (normal and anomalous); characteristics of dielectrics, conductors and plasma and their interaction with electromagnetic waves.

Module III: (10 lectures)

Simple radiating systems: Gauge invariance; Green's function for the wave equation; concept of retarded potential, radiation from an oscillating dipole and its polarisation. Electric dipole fields, magnetic dipole and electric quadrupole fields; centre fed linear antenna, scattering at long wavelengths – viz. by dipoles induced in a small scatterer, scattering by a small dielectric sphere.

Diffraction: Scalar diffraction theory; vectorial diffraction theory, Scattering in a short wavelength limit.
Guided waves: waveguides, TE waves in a rectangular waveguide, coaxial transmission lines.

Module IV: (15 lectures)

Radiation from accelerated charge: Lienard-Wiechart potentials; radiated power from accelerated charge at low velocities. Larmor's power formula. The fields of a point charge in arbitrary and uniform motion. Radiation from an ultra-relativistic particle. Angular and frequency distribution of radiation from moving charges.

Module V: (12 lectures)

Special theory of relativity: matrix representation of Lorentz transformation; infinitesimal generators; Thomas precession; invariance of electric charge; covariance of electrodynamics; transformation of electromagnetic fields

Suggested Readings

Classical Electrodynamics, J. D. Jackson, John Wiley and Sons.

Classical Electrodynamics, S. P. Puri, Tata McGraw Hill Publishing Company Ltd.

Electrodynamics, S. L. Gupta, V. Kumar and S. P. Singh, Pragati Prakashan.

Introduction to Electrodynamics, D. J. Griffiths, Prentice Hall of India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		M	M	M	
CO 3		M	M	M	
CO 4					H
CO5	M	M	M	M	M

PSAM0028: ATOMIC AND MOLECULAR PHYSICS

(4-0-0)

COURSE OUTCOMES

CO 1: Explain atomic and molecular spectroscopy in details. (Understanding)

CO 2: Understand interaction of radiation with atoms. (Understanding)

CO 3: Analyse bond formation. (Analysing)

CO 4: Apply the concept of symmetry to molecules. (Applying)

Module I: (15 lectures)

Introduction of atomic spectrum; fine structure and hyperfine structure of energy levels. Angular momentum and magnetic moment. Doublet structure energy levels and single electron atom. Term symbols and fine structure of energy levels of two electron atoms using L-S coupling and j-j coupling schemes; identification of ground state. Interaction of nuclear and electronic magnetic moments and hyperfine structure with examples.

Module II: (10 lectures)

Interaction of radiation with atoms; spontaneous and stimulated emission; absorption; transition. Einstein's A and B coefficients. Working principles of He-Ne laser.

Module III: (12 lectures)

Theories of molecular bond formation; van der Waals bonding, ionic bonding, valence bond and molecular orbital models of covalent bonding. Homonuclear diatomic molecules and the term symbols and their ground states.

Module IV: (8 lectures)

Vibronic states of molecules and nature of vibronic spectra; harmonic and anharmonic vibrations and potential constants; rotational spectrum and moment of inertia of molecules.

Module V: (15 lectures)

Symmetry of molecules; symmetry elements and points group; proper and improper rotations and their matrix representation. Introduction to character table of point group; reducible and irreducible representation for simple molecules such as H_2O , NH_3 , etc. Normal coordinates and normal modes of vibrations. Infrared absorption and Raman scattering from molecular vibrations and rotations, and selection rules.

Suggested Readings

Introduction to Atomic Spectra, H. E. White, Mc-Graw Hill.

Atoms and Molecules, Martin Karplus and Richard N. Porter, W. A. Benjamin.

Spectra of Diatomic Molecules, G. Herzberg, Van Nostrand.

Principles of Lasers, O. Svelto, Plenum Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			H	
CO 2		H			
CO 3			H		
CO 4					H

PSCN0030: COMPUTER ORIENTED NUMERICAL METHODS

(2-0-0)

COURSE OUTCOMES

CO 1: Explain the concept of numerical methods. (Understanding)

CO 2: Apply numerical techniques to solve different problems in Physics. (Applying)

CO 3: Understand high level language through Fortran. (Understanding)

Module I: Numerical Analysis (10 lectures)

Introduction to numerical methods: approximate and significant figures, absolute and relative errors, general formula for errors, application of the error formula to the fundamental operations of arithmetic and to logarithms. The error of a sum, the error of a difference, the error of a product and number of correct digits, the error of quotients and number of correct digits, the relative error of a power, the relative error of a root, successive approximation, Taylor's series, principle of least square, law of error of residuals.

Matrices and linear equations: addition, subtraction and multiplication of matrices, inversion of matrices, Jacobi transformation of a symmetric matrix, determinant of a matrix, transpose of a matrix, solution of equations by matrix method, Gauss-Jordan elimination Method, eigenvalues and eigenvectors.

The solution of numerical, algebraic and transcendental equations: Equations in one unknown: Finding approximate values of the roots, finding roots by repeated application of location theorem, bisection method, the Newton-Raphson method; their convergence and geometric significance.

Module II: Solutions of Ordinary Differential Equations (9 lectures)

Equations of the first order: Euler's method and its modification, the Runge-Kutta method, checks, errors and accuracy.

Equations of the second order and systems of simultaneous equations: Milne's-predictor and corrector methods, boundary value problems, conditions for convergence.

Minimization or maximization of functions: golden section search in 1-D, parabolic interpolation and Brent's method in 1-D, 1-D search with 1 derivatives, Downhill simplex method in multidimensions, Direction set (Powell's method in Multidimensions).

Module III: (5 lectures)

a. Numerical Integration: Classical formulae for equispaced abscissae: Simpson's rule, trapezoidal rule, Gaussian

b. quadrature formula.

c. Computation of factorials, computation of square roots, recurrence relations.

Module IV: Review of FORTRAN Language I

(6 lectures) a. Introduction to computing

Constants, variables, expressions, operations, statements, functions and built in functions.

Conditional and looping structures, arrays, subprograms and subroutines.
File operations.

Suggested Readings

Theory and problems of Programming with FORTRAN, Seymour Lipschutz and Arthur Poe, McGraw-Hill.
FORTRAN 77 and numerical methods, C. Xavier and R. Rajaraman, New Age International Publishers
FORTRAN 77 Programming, V. Rajaraman, Prentice Hall of India.

Numerical Analysis, V. Rajaraman, Wiley Eastern.

Numerical Recipes in FORTRAN, W. H. Press, S. S. Tenkulsky, W. T. Wattering and B. P. Flannery, Cambridge University Press.

Introductory Methods of Numerical Analysis, S. Sastry, Prentice Hall of India.

Numerical Methods for Scientific and Engineering Computation, M. K. Jain et al., New Age International Publications.

Introduction to Numerical Analysis, F. B. Hildebrand, McGraw-Hill Book Company Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	
CO 2	H	H	H	
CO 3				H

PSSM0034: STATISTICAL MECHANICS (4-0-0)

COURSE OUTCOMES

CO 1: Appreciate the connection between statistical mechanics and thermodynamics. (Analysing)

CO 2: Conceptualise quantum statistical mechanics. (Understanding)

CO 3: Understand the physics of phase transition. (Understanding)

CO 4: Understand non-equilibrium physics. (Understanding)

Module I: Essentials (17 lectures)

Probability theory: the random walk problem, binomial, Poisson and Gaussian distributions, central limit theorem.

Classical equilibrium statistical mechanics: concept of equilibrium; Ergodic hypothesis; microcanonical, canonical and grand canonical Ensembles; partition functions and their relation to thermodynamics.

Classical nonequilibrium statistical mechanics: approach to equilibrium, Liouville's theorem, Boltzmann's H theorem

Module II: Quantum Statistics (15 lectures)

Quantum statistical mechanics: Schrödinger and Heisenberg Picture; pure and mixed states, the density matrix, quantum mechanical Liouville's theorem; the fundamental postulates.

Quantum statistics: quantum gases of independent particles; partition functions; Bose Einstein's and Fermi Dirac's distributions; electrons in metals; black body radiation; Bose Einstein's Condensation

Module III: Phase Transitions (15 lectures)

Phenomenology: first and second order phase transitions; elementary ideas of critical phenomena; universality of critical exponents; scaling of thermodynamic functions.

Theory: the Landau theory of phase transition with examples. c) Exact solutions: Ising model in one dimension.

Module IV: Non Equilibrium Phenomena and Irreversible Processes (13 lectures)

Non equilibrium phenomena: transport theory; Boltzmann equation; Maxwell-Boltzmann distribution.

Irreversible processes: fluctuations; Brownian motion; Langevin's equation; Wiener Khintchine relations, Nyquist theorem, Fluctuation-Dissipation theorem; Fokker Planck equation.

Suggested Readings

Fundamental of Statistical and Thermal Physics, Frederick Reif, McGraw Hill, Singapore.

World Scientific, Shang-Keng Ma, Statistical Mechanics, Singapore.

Wiley-Interscience, John Wiley and Sons Inc., Richard E. Wilde, and Surjit Singh, Statistical Mechanics: Fundamental and Modern Applications, New York.

Statistical Physics: Statics, Dynamics and Renormalisation, Leo P. Kadanoff, World Scientific, River Edge, New Jersey.

Statistical Mechanics, K. Huang, John Wiley and Sons Inc., New York.

Statistical Physics, D. J. Amit and J. Verbin, World Scientific, Singapore.

Statistical Physics, L. D. Landau, E. M. Lifshitz, Butterworth-Heinemann.

Statistical Mechanics, R. K. Pathria, Academic Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

PSPL0036: PLASMA PHYSICS I **(4-0-0)**

COURSE OUTCOMES

CO 1: Understand and explain the basic theoretical concepts of plasma physics. (Remembering)

CO 2: Understand the behaviour of a single charged particle in electric and magnetic fields. (Understanding)

CO 3: Understand the purpose, principles and techniques of various plasma diagnostic. (Application)

CO 4: Understand the underlying principles of some laboratory and naturally occurring plasma. (Analysing)

CO 5: Know various applications of plasma. (Analysing)

Module I: Introduction to Plasma Physics (12 lectures)

Role of temperature in occurrence of plasma; definition of plasma: quasineutrality and collective behaviour of plasma; concept of temperature; Debye shielding; criteria for plasma; classification of plasma; occurrence of plasma in nature.

Module II: Single Particle Motion (12 lectures)

Uniform electric and magnetic fields; non-uniform magnetic field: grad-B drift, curvature drift, magnetic mirrors, the loss cone; non-uniform electric field; time-varying electric field; time-varying magnetic field; adiabatic invariants.

Module III: Plasma Diagnostics (14 lectures)

Langmuir probe: I-V characteristics, measurement of plasma potential, floating potential, electron temperature and electron density; double probe; optical emission spectroscopy: radiation from plasma, plasma models, temperature measurement by Boltzmann plot and line intensity ratio method, line broadening in plasma, Doppler broadening and Stark broadening, applications; absorption spectroscopy; calorimetric methods; laser and microwave interferometer.

Module IV: Laboratory and Space Plasma (10 lectures)

Glow discharge plasma; production and stabilization of thermal plasma, principle of DC, AC and high frequency discharges, RF and ECR plasmas, dielectric barrier discharge plasma, laser produced plasmas; sun and solar winds, Van Allen belts, the ionosphere, formation of, accretion disks, dusty plasmas.

Module V: Applications of Plasma (12 lectures)

Thermal plasma: nanoparticle synthesis, plasma spraying, waste management; plasma sputtering; plasma nitriding; plasma processing; plasma enhanced vapour deposition; plasma assisted surface engineering; biomedical applications; the magnetohydrodynamic generator; plasma propulsion.

Suggested Readings

Introduction to Plasma Physics and Controlled Fusion, F. F. Chen, Plenum.

Fundamentals of plasma physics, J. A. Bittencourt, Springer.

Principles of plasma diagnostics, I. H. Hutchinson, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	
CO 5					H

PSEC0037: ELECTRONICS II

(4-0-0)

COURSE OUTCOMES

CO 1: Know about different types of transistors. (Understanding)

CO 2: Understand the application of transistors for circuit design. (Application)

CO 3: Utilize Describe devices like thyristors, operational amplifiers, oscillators, etc. (Analysing)

CO 4: Understand the digital electronics design using analog devices. (Understanding)

CO 5: Understanding the application of analog devices for electronic instruments and sensors (Application)

Module I: (20 lectures)

Bipolar junction transistor: BJT biasing: fixed bias, emitter bias, voltage divider bias, D.C. collector feedback bias; DC and AC load line, Q- point, stability considerations. BJT modeling: two port representation of BJT with z, y, h- parameters; re and hybrid models of C-E, C-B, C-C configuration.

Hybrid-pi model of C-E amplifier in voltage divider bias configuration, frequency response in low, mid and high frequency conditions, respective voltage gain, current gain, input and output impedances.

Field effect transistors: FET biasing: self bias, fixed bias, voltage divider bias, stabilization of Q-point. Small signal AC equivalent circuit of FET as amplifier, hybrid parameters. JFET amplifiers: CS, CD amplifiers; enhancement mode MOSFET amplifier, depletion mode MOSFET amplifiers; Introduction to CMOS, characteristics, structure of MOSFET, CMOS.

Module II: (25 lectures)

Thyristors: four layer diode, SCR, Photo SCR, gate controlled switch, silicon controlled switch, Diac, Triac, UJT;

Op-Amp - ideal operational amplifiers: Input impedance. DC offset parameters, frequency parameters, gain- bandwidth, CMRR, SVRR, SR. Op-Amp applications in constant gain multiplier, voltage summing, log - antilog amplifier, subtractor, comparator – zero crossing detector, Schmitt trigger, integrator, differentiator and controlled sources. instrumentation amplifier. Active filters: low, high and bandpass filters; ADC and DAC.

555 timer: block diagram, monostable operation, astable operation, bistable operation, voltage controlled oscillator, ramp generator.

Module III: (15 lectures)

Feedback configurations: voltage series, voltage shunt, current series, current shunt.

Oscillators: introduction and classification, general form of LC oscillator, e.g. Hartley oscillator, Colpitts oscillator, RC phase shift oscillator, Wein Bridge oscillator, crystal oscillator.

Regulated power supply: voltage feedback regulation, current limiting characteristics, power supply characteristics, 3 terminal IC regulators, current boosters, switching regulators.

Characteristics of instruments: static characteristics, span, accuracy and precision, linearity, tolerance, error, repeatability, sensitivity, calibration, hysteresis, input impedance, resolution, bias and drift.

Suggested Readings

Electronic Devices and Circuit Theory, Robert L. Boylestad and Louis Nashelsky, Pearson Education.

Millman's Electronic Devices and Circuits, Jacob Millman, Christos C. Halkias and Satyabrata Jit, Tata McGraw Hill.

Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Tata McGraw- Hill.

Solid State Electronic Devices, Streetman and Banerjee, Prentice Hall.
 Electronic Devices and Circuits, David A. Bell, Prentice Hall of India.
 Integrated Electronics, Jacob Millman, Christos C. Halkias, McGraw Hill Int.
 Op-amps and Linear Integrated Circuits, Ramakant A. Gayakwad, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	H	M	M
CO 3		H	M
CO 4	H	H	M
CO 5	M	M	H

PSNS0041: NANOPHYSICS II (4-0-0)

COURSE OUTCOMES

CO 1: Explain different properties of nanomaterials. (Understanding)
 CO 2: Know about different methods for the synthesis of nanomaterials. (Applying)
 CO 3: Appreciate the technology associated with characterization of nanomaterials. (Applying)

Module I: (15 lectures)

Surfaces and interfaces in nanostructures; ceramic interfaces, superhydrophobic surfaces, grain boundaries in nanocrystalline materials, defects associated with interfaces; thermodynamics of nanomaterials, natural nanomaterials; toxicology of nanomaterials.

Module II: (25 lectures)

Chemical routes for synthesis of nanomaterials: electrochemical synthesis, photochemical synthesis; synthesis in supercritical fluids. hydrothermal growth of nanoparticles and different nanostructures. Ostwald ripening; zeta potential; fabrication of nanomaterials by physical methods: -inert gas condensation, arc discharge, plasma arc technique, RF plasma, MW plasma, ion sputtering, laser ablation, laser pyrolysis, ball milling, molecular beam epitaxy, physical and chemical vapour deposition method; electrodeposition. Core-shell quantum dots.

Module III: (20 lectures)

Nanostructures: zero-, one-, two- and three- dimensional structure, size control of metal nanoparticles; properties: optical, electronic, magnetic properties; surface plasmon resonance, structural characterization X-ray diffraction, small angle x-ray scattering, optical microscope and their description, scanning electron microscopy (SEM), scanning probe microscopy (SPM), TEM and EDAX, SAED analysis, scanning tunneling microscopy (STM), atomic force microscopy (AFM). Spectroscopic characterizations: basic concepts of spectroscopy, operational principle and application for analysis of nanomaterials, UVVIS-IR spectrophotometers, principle of operation and application for band gap measurement (Tauc plot).

Suggested Readings

A. Rao Introduction to nanoscience, G. L. Hornyak, J. Dutta and H. F. Tibbals, CRC Press.
 Nano: The Essentials, T. Pradeep, McGraw Hill.
 Nanotechnology and Global Sustainability, D. Maclurcan and N. Radywyl (Eds.), CRC Press.
 Fundamentals of Nanoelectronics, G. W. Hanson, Pearson.
 Springer Handbook of Nanomaterials, R. Vajtai (Ed.), Springer.
 Springer Handbook of Nanotechnology, B. Bhushan (Ed.), Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		H
CO 2		H	

CO 3			H

PSGR0044: GENERAL THEORY OF RELATIVITY AND COSMOLOGY**(4-0-0)****COURSE OUTCOMES**

CO 1: Relate the concepts from special theory of relativity with generalized tensor calculus. (Remembering)

CO 2: Explain Einstein's field equation from basic principles. (Understanding)

CO 3: Illustrate the implications of the general theory of relativity. (Understanding)

CO 4: Extend Einstein's gravity to the cosmological scale. (Understanding)

CO 5: Identify Newtonian gravity as a special case of general relativity. (Applying)

Module I: Theoretical Background of Relativity (15 lectures)

Foundations of relativity: postulates of relativity, GR units, space-time intervals, proper time; special Lorentz transformations in Minkowski space-time; four-vectors.

Review of tensor calculus in Euclidean space; tensor calculus in Riemannian space: generalized N-dimensional spaces, covariant and contravariant tensors; Riemann-Christoffel curvature tensor, Christoffel symbols, Einstein's tensor, geodesics; metric tensor, covariant differentiation, Bianchi Identities, Ricci tensor.

Module II: General Theory of Relativity (30 lectures)

Motion of a free particle in a gravitational field, equations of electrodynamics in the presence of a gravitational field; gravitational field equations – action for gravitational field, energy-momentum tensor, extremum principle, Einstein field equations, energy-momentum pseudotensor.

Field of gravitating bodies – Schwarzschild solution, Birkhoff's theorem, motion in a centrally symmetric gravitational field, precession of perihelion of Mercury, deflection of light, gravitational lensing; black holes – Schwarzschild black holes, Kruskal space, black hole thermodynamics; gravitational waves – plane waves, weak field approximation, gravitational radiation, transverse-traceless gauge.

Module III: Fundamentals of Cosmology (15 lectures)

Cosmological principle, cosmological time; spaces of constant curvature, Hubble's constant, Hubble's Law, red-shift of galaxies, big bang, age and density of universe; cosmological constant

Einstein space, de Sitter space, anti-de Sitter space; Robertson-Walker metric, introduction to Friedmann-Robertson-Walker (FRW) universe.

The observed universe and its dynamics, Friedmann-Lemaître-Robertson-Walker (FLRW) metric, Friedmann equation and its solutions; composition of the universe – origin of matter, big bang nucleosynthesis, abundance of light elements, dark matter and dark energy, cosmological constant as dark energy, origin of matter-antimatter asymmetry, baryogenesis.

Suggested Readings

Introduction to Tensor Calculus, Relativity and Cosmology, D. F. Lawden, Dover Publications.

A First Course in General Relativity, B. Schutz, Cambridge University Press.

Introduction to Cosmology, B. Ryden, Cambridge University Press.

Gravitation, C. W. Misner, K. S. Thorne and J. A. Wheeler, Princeton University Press.

The Classical Theory of Fields, L. D. Landau and E. M. Lifshitz, Butterworth-Heinemann.

The Meaning of Relativity, A. Einstein, Oxford & IBH.

General Theory of Relativity, P. A. M. Dirac, Prentice-Hall of India.

Feynman Lectures on Gravitation, R. P. Feynman, F. B. Moronigo and W. G. Wagner, Addison-Wesley.

Gravitation and Cosmology, S. Weinberg, Wiley.

Introduction to Cosmology, J. V. Narlikar, Cambridge University Press.

Modern Cosmology, S. Dodelson, Academic Press.

Physical Foundations of Cosmology, V. Mukhanov, Cambridge University Press.

Fundamentals of Special and General Relativity, K. D. Krori, PHI.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	
CO 3		H	H
CO 4		H	H
CO 5		H	

PSAR0045: ASTROPHYSICS**(4-0-0)****COURSE OUTCOMES**

CO 1: Define and spell out fundamental concepts of Astronomy. (Remembering)

CO 2: Outline the various parameters describing the behaviour of stars and their evolution. (Understanding)

CO 3: Classify the various types of interstellar media. (Analysing)

CO 4: Explain the physical processes underlying the energy generation in stars. (Understanding)

CO 5: Apply astrophysical models to various observational scenarios. (Applying)

Module I: Fundamentals of Astronomy (12 lectures)

Astronomy fundamentals: celestial coordinate systems, telescope and its operational principles and mounting, atmospheric extinctions, magnitude systems. Radiation mechanism, flux density and luminosity, specific intensity, (emission/absorption coefficients, source functions), basics of radiative transfer and radiative processes.

Module II: Stellar Parameters (18 lectures)

Magnitudes, motions and distances of stars: absolute stellar magnitude and distance modulus, bolometric and radiometric magnitudes, colour-index and luminosities of stars, stellar positions and motions, velocity dispersion, statistical and moving cluster parallax, extinction, stellar temperature, effective temperature, brightness temperature, color temperature, kinetic temperature, excitation temperature, ionization temperature, spectral classification of stars, utility of stellar spectrum, stellar atmospheres. Binaries, variable stars, clusters, open and globular clusters, compact objects, shape, size and contents of our galaxy, normal and active galaxies.

Module III: Interstellar Medium (10 lectures)

Neutral and ionized gas, gaseous nebulae, HII regions, supernova remnants, photo-dissociation regions, different phases of the interstellar medium: cold neutral medium, warm neutral and ionized medium, hot medium, diffuse clouds, dense clouds.

Module IV: Stellar Physics (20 lectures)

Introduction to stars: HR diagram, a discussion on the variety of stellar phenomena, stellar structure, stellar opacities, stellar polytropes, energy generation in stars: calculation of thermonuclear reaction rates for non-resonant and beta-decay reactions, various reaction chains: pp-I, II, III, CNO, He-burning, C-burning, Si-burning, stellar degeneracy and equations of state: stellar degeneracy, Chandrasekhar mass, EoS of matter at near-nuclear and nuclear densities, final stages of stellar evolution: supernovae and neutron stars.

Suggested Readings

An Introduction to Astronomy and Astrophysics, P. Jain, CRC Press.

An Introduction to Astrophysics, B. Basu, PHI Learning Pvt. Ltd.

Astrophysics: Stars and Galaxies, K. D. Abhayankar, Universities Press.

Introduction to Stellar Astrophysics, Erika Böhm-Vitense, Cambridge University Press.

Gravity: Introduction to Einstein's General Relativity, J. B. Hartle, Pearson Education.

Physical Cosmology, P. J. E. Peebles, Princeton University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	L	L	
CO 2		H		
CO 3			H	
CO 4				H
CO 5				H

PSPM0046: PLASMA PHYSICS II

(4-0-0)

COURSE OUTCOMES

CO 1: Understand fluid and kinetic model of plasma and their uses in the study of plasma. (Understanding)

CO 2: Explain the theory of various kinds of waves existing in plasma. (Understanding)

CO 3: Explain the phenomenon of diffusion in plasma and its consequences. (Analysis)

CO 4: Explain some basic instabilities and non linear phenomena in plasma. (Remembering)

CO 5: Understand the principles and challenges involved in energy production by fusion. (Analysis)

Module I: Plasma as fluids and Plasma Kinetic Theory (20 lectures)

Introduction to fluid model; equation of motion; continuity equation; fluids drifts perpendicular to B; fluids drifts parallel to B; the plasma approximation; Introduction to kinetic theory; equations of kinetic theory; derivation of the fluid equation; plasma oscillation; Landau damping: meaning and physical derivation.

Module II: Waves in Plasma (10 lectures)

Representation of waves; group velocity; plasma oscillation; electron plasma waves; sound waves; ion waves; validity of plasma approximation; ion acoustic waves; Alfvén waves.

Module III: Diffusion and Resistivity (10 lectures)

Diffusion and mobility; plasma decay by diffusion; steady state solution; recombination; diffusion across a magnetic field; the single MHD diffusion equation; solutions of the diffusion equation.

Module IV: Instability and Non-linear Effects (10 lectures)

Hydro-magnetic equilibrium; diffusion of magnetic field into a plasma; classifications of instability; two stream instability; plasma sheaths; ion acoustic shock waves; the ponderomotive force; parametric instabilities; plasma echoes; nonlinear Landau Damping.

Module V: Controlled Fusion (10 lectures)

Controlled fusion and problems; magnetic confinement: toruses, mirrors, pinches; laser fusion; plasma heating; fusion technology; tokamaks; ITER.

Suggested Readings

Introduction to Plasma Physics and Controlled Fusion, F. F. Chen, Plenum.

Fundamentals of plasma physics, J. A. Bittencourt, Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L	L		
CO 2		H			
CO 3			H		
CO 4				H	
CO 5					H

PSE0047: ELECTRONICS III

(4-0-0)

COURSE OUTCOMES

CO 1: Illustrate advanced topics of digital electronics. (Understanding)

CO 2: Explain microprocessor, microcontroller and assembly language. (Understanding)

CO 3: Apply the knowledge in advanced digital structures. (Applying)

CO 4: Understand digital circuit design (Application)

CO 5: Analyse the working of processor for execution of computer program (Analysing)

Module I: (15 lectures)

Number system: representation of signed integers, binary arithmetic on signed and unsigned integers and detection of overflow and underflow, weighted binary Codes: BCD, 2421, non-weighted codes: excess-3 codes, gray codes, error detecting codes, error correcting codes, alphanumeric codes: ASCII code, EBCDIC codes.

Boolean algebra and logic gates: rules (postulates and basic theorems) of Boolean algebra, dual and complement of a Boolean expression, sum of products and product of sums forms. canonical forms. Conversion between different forms, conversion between Boolean expression and truth table; implementing logic expressions with logic gates (logic circuits).

Digital logic families: designing of basic logic gates with diode and transistor; elementary idea of DTL, TTL, RTL, ECL, I²L logic family and characteristics.

Module II: (15 lectures)

Combinational circuit: Simplification of Boolean expressions using algebraic method, Karnaugh map method and QuineMcCluskey method, Don't Care conditions. Multiplexer, demultiplexer, encoder, decoder, half-adder, full-adder, magnitude comparator, parity checkers: basic concepts, design of parity checkers, parity generation, code converters, binary –to- gray and gray-to-binary Code converter; concept of magnitude comparator.

Sequential circuit: simple R-S flip-flop or Latch, clocked R-S Flip-flop, D flip-flop. J-K flip-flop, T flip-flop, master-slave flipflop, J-K Master-Slave flip-flop. Asynchronous preset and clear, edge triggering and level triggering. Registers: shift registers, parallel/serial in, parallel/serial out. Buffer counter design: different types of counters like asynchronous and synchronous, up and down, ring, Johnson etc. counter design using state diagram, state table and state equation.

Semiconductor memory: classification of memories, main memory and secondary memory, sequential access memory, static and dynamic memory, volatile and nonvolatile memory, concept of ROM, PROM, EPROM, RAM, DRAM, SDRAM, PSRAM, memory decoding.

Module III: (30 lectures)

History and evolution of microprocessor; introduction to CPU: components of CPU, block diagram, buses-data, control and address; ALU, control unit; main memory and secondary memory; I/O devices; memory addressing- memory mapped I/O and I/O mapped I/O; address decoding; memory and I/O interfacing.

Introduction to 8085; block diagram, registers, use of register pairs, PSW, accumulator; addressing modes; Instruction set of 8085: data transfer, arithmetic, logic, branch and machine control instructions; instruction cycle: fetch, decode and execute. Delay and counter; stack and its application; interrupt and its application; assembly level language programming of 8085.

Interfacing: Memory interfacing; I/O interfacing; interfacing small devices like keyboard, 7-segment display, relay, event counter etc.; idea of PPIs like 8251, 8255, 8257 and 8279 (block diagram and function only); serial communication standard (RS-232C).

Example of 16-bit processors (introduction to 8086); microcontroller (block diagram and application of 8051).

Suggested Readings

Digital Logic and computer Design, M. Mano, PHI.

Modern Digital Electronics, R. P. Jain, TMGH.

Digital Fundamentals, Jain and Floyd, Pearson Education.

Digital Electronics, Malvino and Leach, Pearson Education.

Digital Computer Electronics, Malvino, TMGH.

Digital Design, Principles and Practices, Morris Mano, Pearson Education.

Digital Circuits and Design, S. Salivahanan and S. Arivazhagan, Vikash Publishing House Pvt. Ltd.

Digital Techniques, P. H. Talukdar, N. L. Publications.

Fundamentals of Digital Circuits, Anand Kumar, PHI.
 Introduction to Microprocessors, Gaonkar, New age Publication.
 Fundamentals of Microprocessor, B. Ram, Dhanpat Rai.
 8085 Microprocessor Programming and Interfacing, N. K. Srinath, PHI.
 Microprocessor Based Design, Slater, PHI.
 Microprocessors, Gilmore, McGraw Hill Publication.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	
CO 2		M	H
CO 3	M	H	M
CO 4	H	H	
CO 5			H

PSNY0048: NANOPHYSICS III

(4-0-0)

COURSE OUTCOMES

CO 1: Explain properties of nanomaterials in detail. (Understanding)
 CO 2: Explain quantum effects on nanostructures. (Understanding)
 CO 3: Give outline nanomechanics. (Understanding)
 CO 4: Take part in higher studies and research in nanophysics. (Analysing)

Module I: (15 lectures)

Absorption and scattering of EM waves from nanoparticles based on bulk properties. Electronic phenomena in nanostructures: electronic structures and effective mass theory for bulk Si, Ge, GaAs; excitons. Boltzmann electron transport in bulk. Electron energy states in quantum confined systems, semiconductor heterojunctions.

Module II: (20 lectures)

X-ray photoelectron spectroscopy (XPS): fundamentals: photoelectric effect, binding energy and chemical shift, ultraviolet photoelectron spectroscopy (UPS): information.

Extracted: band structure, occupied band states of clean solid surfaces as well as bonding orbital states of adsorbed molecules; fundamentals of Fourier transform infrared radiation (FTIR) and Raman spectroscopy.

2-DEG systems, quantum wires, quantum dots. Transmission in nanostructures: tunneling in planar barrier, resonant tunnel diodes. Ballistic transport, Landauer formula, electron transport in quantum waveguide structures.

Module III: (15 lectures)

Single electron phenomena: electronic states in quantum dots, without and with magnetic fields, single electron tunneling and Coulomb blockade, single electron tunneling, elastic, inelastic, spin polarized tunneling, surface density of states for different dimensions, role of tip geometry, lithography and atomic manipulation; single electron transistor. Spin-orbit interaction and spin effects.

Module IV: (10 lectures)

Nanomechanics: introduction to NEMS, CNT oscillation, nanoscale electrometer, bolometer nanophotonics; science of Graphene.

Suggested Readings

Transport in Nano-Structures, D. K. Ferry and S. M. Goodnick, Cambridge University Press.
 Electronic Transport in Mesoscopic Systems, S. Datta, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		L	L

CO 2		H		
CO 3				H
CO 4			H	

PSEL0049: ELECTRONICS I**(4-0-0)****COURSE OUTCOMES**

CO 1: Explain about passive components and DC networks, digital electronics (Understanding)

CO 2: Understanding physics of electronic devices and circuits (Understanding)

CO 3: Explain electronic communication. (Understanding)

CO 4: Experiment with electronic devices and circuits. (Applying)

Module I: Passive Components and DC Networks (15 lectures)

Passive components: resistors, capacitors and inductors-types, characteristics and applications;

DC networks: voltage and current sources, dependent sources, KCL, KVL, current division rule, voltage division rule, Y- Delta conversion, mesh analysis, node analysis, Thevenin's theorem, Norton's theorem, superposition theorem, maximum power transform theorem.

Module II: Electronic Devices and Circuits (20 lectures)

Semiconductor concepts: semiconductor material, intrinsic semiconductor, extrinsic semiconductor, energy levels, concept of hole and electron, mobility, conductivity, n-type and p-type, majority and minority carriers, mechanism of current flow.

Semiconductor diode: PN junction and various biasing conditions, V-I characteristics, diode equation, diode resistance, equivalent circuit, transition capacitance and diffusion capacitance; rectifier circuit with filter, clipper, clamper, voltage multiplier.

Special purpose diodes: Zener diodes, LED, 7 segment display, photo diode, photo transistor, opto coupler, Schottky diode, varactor diode, tunnel diode.

Transistor - BJT: construction, npn, pnp, operation and configuration, V-I characteristics, introduction to FET- JFET, MOSFET.

OP-AMP: block diagram, ideal op-amp equivalent circuit, ideal characteristics, transfer curve, open loop and closed loop configurations, op-amp as an inverting amplifier, non-inverting amplifier, adder, subtractor.

Module III: Digital Circuits (12 lectures)

Number systems, Boolean algebra, De-Morgan's law, AND, OR, NOT, Universal gates, combinational logic circuits.

Module IV: Communication (13 lectures)

Introduction: communication process, source of information, communication channels, modulation types and need, block diagram of communication systems, AM, FM, PAM, PWM, PPM.

Introduction to digital modulation: ASK, PSK, FSK.

Suggested Readings

Electronic Devices and Circuits, S. Salivahanan, McGraw Hill Publications.

Communication System, R. D. Singh and S. D. Sapre, TMGH.

Networks and Systems, D. Roy Choudhury, New Age International.

Electronic Devices and Circuits, David A. Bell, Oxford University Press.

Digital electronics, Moris Mano, EEE.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	L	H	
CO 2	M	H	H	
CO 3	M	M		H
CO 4	H	H	M	

PSNP0050: NANOPHYSICS I
(4-0-0)

COURSE OUTCOMES

CO 1: Explain basic concepts of nanophysics. (Remembering)

CO 2: Explain the working principle of various characterization techniques. (Understanding)

CO 3: Explain various fabrication techniques. (Understanding)

CO 4: Analyse the relation between nanoparticles size and their properties. (Analysing)

CO 5: Understand various natural nanomaterials and bio-molecular nanoscience. (Understanding)

Module I: Introduction (20 lectures)

Distinction between nanoscience and nanotechnology, requisite definitions; historical perspectives; nano-materials: overview, definitions, and examples; structurally confined materials: nanoparticles, islands, nanowires, thin films; metal nanoparticles: fundamentals and applications; self-assembled monolayers, semiconductor quantum dots: fundamentals and applications; ceramic nanomaterials: fundamentals and applications; carbon nanomaterials(Fullerenes and carbon nanotubes and nanofibers): fundamentals and applications; magnetic nanoparticles: fundamentals and applications; bionanomaterials, computational nanomaterials, composite nanomaterials and applications.

Module II: Characterization tools (10 lectures)

Electron microscopy, atomic force microscopes, X-ray spectroscopy, surface enhanced Raman spectroscopy, lithography, computer modelling and simulation.

Module III: General Fabrication Methods (12 lectures)

Background; top down fabrication: mechanical methods, thermal methods, high energy methods, chemical fabrication methods, lithographic methods; bottom up fabrication: gaseous phase methods, liquid phase methods, template synthesis

Module IV: Basic Properties of Nanomaterials (10 lectures)

Importance of surface: natural, inorganic and the nano perspectives; particle shape and surface; surface: geometric surface to volume ratio, specific surface area; atomic structure: crystal systems.

Module V: Natural and Bio-nanoscience (8 lectures)

Natural nanomaterials: inorganic natural nanomaterials, nanomaterials from the animal kingdom, nanomaterials derived from cell walls, nanomaterials in insects; Introduction to biomolecular nanoscience: history, biomolecular nanoscience, nano perspective

Suggested Readings

Introduction to nanoscience, G. L. Hornyak, J. Dutta and H. F. Tibbals, A. Rao, CRC Press.

Nano: The Essentials, T. Pradeep, McGraw Hill.

Nanotechnology and Global Sustainability, D. Maclurcan and N. Radywyl (Eds.), CRC Press.

Environmental Chemistry for a Sustainable World, Vol.2, E. Lichtfouse, J. Shwarzbauer and D. Robert, Springer Verlag.

Introduction to nanotechnology, G. L. Hornyak, J. Dutta, H. F. Tibbals and A. Rao, CRC Press.

Fundamentals of Nanoelectronics, G. W. Hanson, Pearson.

Mapping of COs to Syllabus

Course Out-comes	Module I	Module II	Module III	Module IV	Module V
CO 1	H			L	
CO 2		H			
CO 3			H		
CO 4				H	
CO 5					H

PSRM0051: RESEARCH METHODOLOGY

(3-0-0)

COURSE OUTCOMES

CO 1: Understand the meaning, significance and ethics of research. (Understanding)

CO 2: Conduct literature survey. (Understanding)

CO 3: Present and defend their project accurately, both orally and written. (Applying)

CO 4: Present and defend their research results accurately, both orally and written at specialized levels. (Creating)

CO 5: Appreciate statistics as a tool for designing research, analysing data and drawing valid conclusions therefrom.

(Analysing)

Module I: Introduction to Research (6 lectures)

Definition of research; objectives of research, importance of research, motivation in research, research methods and research methodology, importance of research methodology; types of research: Basic Research and Applied Research, theoretical; simulations and experimental research. Various stages of research; ethics in scientific research: ethical values of science, ethics of researcher, personal and internal code of conduct, conduct guidelines, ethical standards of publication, scientific fraud and malpractice; plagiarism.

Module II: Literature Survey (6 lectures)

Functions of the literature review in research, conducting a literature survey, sources of information, use of internet, technical and scientific documents, characteristics and quality indices of journals, developing theoretical and conceptual frameworks, writing literature review.

Module III: Research Documentation and Presentation (8 lectures)

Structure of scientific documents; types of scientific reports: research papers, patents, dissertation, posters, slide presentation; skills for academic writing, online communication technologies, preparation of research projects, monitoring and evaluation processes; writing dissertation using LaTeX documents and beamers; citing references and bibliography, thesis defense.

Module IV: Statistics in Research (10 lectures)

Discrete distributions – binomial, geometric, Poisson; continuous distributions – Gaussian, log-normal, gamma, chi-squared; central limit theorem; populations and samples, sample statistics – averages, variance, standard deviation, moments, covariance and correlation; standard errors and confidence limits; Bayesian inference; hypothesis testing – Neyman-Pearson test, Student's t-test, Fisher's F-test; goodness-of-fit.

Suggested Readings

Research Methodology: A Step-by-Step Guide for Beginners, Ranjit Kumar, Sage Publications Ltd.

Research Methodology: Methods and Techniques, C. R. Kothari, New Age International (P) Ltd.

Methodology of Educational Research, Lokesh Koul, Vikas Publishing.

The A-Z of PhD Trajectory, Eva O. L. Lantsoght, Springer.

Writing for Publication, Mary RenckJalongo and Olivia N. Saracho, Springer.

Mathematical Methods for Physicists: A Comprehensive Guide, George B. Arfken, Hans J. Weber and Frank E. Harris, Associated Press.

Bayesian Statistics for Beginners: A Step-by-Step Approach, Therese M. Donovan and Ruth M. Mickey, Oxford University Press.

Data Analysis: A Bayesian Tutorial, D. S. Sivia and J. Skilling, Oxford University Press.

Mathematical Methods for Physics and Engineering, K. F. Riley, M. P. Hobson and S. J. Bence, Cambridge University Press.

Writing for Publication, Mary RenckJalongo and Olivia N. Saracho, Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4			H	
CO 5				H

PSHP0052: HIGH ENERGY PHYSICS I

(4-0-0)

COURSE OUTCOMES

CO 1: Summarize the mathematical skills like group theory, tensors, kinematics, etc. (Understanding)

CO 2: Explain different groups like Lorentz group, Lie group and their algebra. (Understanding)

CO 3: Explain scalar field quantisation. (Analysing)

CO 4: Explain quantum field theory and hence identify quantum electrodynamics. (Applying)

Module I: Preliminaries (8 lectures)

Tensors, covariant and contravariant tensors, Lorentz covariance and four vector notation; Klein-Gordon equation; Dirac equation and its covariant form.

Module II: Group theory and Tensors (10 lectures)

Introduction to group theory, Lie group and Lie Algebra, representation theory, Representations of both Lorentz and Poincaré groups, Irreducible representations of the Lorentz group; Young tableau.

Module IV: Quantum field theory (22 lectures)

Concepts of fields and quantisation, Lagrangian field theory, Hamiltonian field theory, Noether's Theorem and Conserved Currents, canonical quantization of freefields (Scalar, complex, EM and Dirac fields), conservation of energy, momentum and charge of the field, The concept of vacuum and Fock space in field theory; C, P, T transformation of scalar and E. M. fields.

Module V: Quantum Electrodynamics (20 lectures)

Concepts of Causality, propagator and Feynman propagator, Green's function, Interaction picture and time evolution operator, S-matrix, path integral formalism, Covariant perturbation theory, Feynman rules in momentum space, Wick's theorem, reduction of time-ordered products, calculation of second order process, Compton scattering, Klein-Nishina formula, Mott scattering, Basics of renormalization.

Suggested Readings

Introduction of Elementary Particle, D. Griffiths, Wiley-vch Verlag GmbH.

Quarks and Leptons: An Introductory Course in Modern Particle Physics, F. Halzen and A. D. Martin, Wiley India.

Quantum Field Theory, L. H. Ryder, Cambridge University Press.

Introduction to High Energy Physics, D. H. Perkins, Addison-Wesley.

Particle Physics, Brian R. Martin and Graham Shaw, Wiley.

An introduction to Quantum Field Theory, Michael E. Peskin and Daniel V. Schroeder, Westview Press Inc.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4				H	H

PSEP0053: HIGH ENERGY PHYSICS II
(4-0-0)

COURSE OUTCOMES

CO 1: Explain gauge theories. (Understanding)

CO 2: Familiarise with physics of spontaneous symmetry breaking and Higgs mechanism. (Analysing)

CO 3: Explain standard model and physics beyond standard model. (Understanding)

CO 4: Build the theory of neutrino physics. (Analysing)

CO 5: Recall group theory and learn how to apply it to gauge theory. (Applying)

Module I: Introduction (10 lectures)

Introduction to Gauge symmetries – global and local gauge transformations, abelian group $U(1)$ (QED), Yang-Mills (Non- Abelian) groups – $SU(2)$ (isospin), $SU(3)_C$ (QCD).

Module II: Spontaneous Symmetry Breaking (SSB) (12 lectures)

Ground state with spontaneous symmetry breaking, some examples; global symmetry breaking and Goldstone bosons, proof of Goldstone theorem, local symmetry breaking and Higgs mechanism for giving masses to vector bosons, examples $U(1)$, $SU(2)$.

Module III: Standard Model (SM) (12 lectures)

Standard model of electroweak unification, gauge bosons W^+ , W^- , Z^0 , charged weak current and neutral current, Higgs particle, experimental status.

Module IV: Beyond Standard Model (12 lectures)

Introduction to Grand Unified Theories (GUTs) – $SU(5)$ and $SO(10)$, and proton decay predictions; Minimal Supersymmetric Standard Model (MSSM) and its extension, its predictions; Introduction to String Theories and Planck scale physics.

Module V: Neutrino Physics (14 lectures)

Solar and atmospheric neutrino puzzles, theory of neutrino oscillations in vacuum and medium (MSW mechanism), neutrino masses and leptonic mixings, survey of various neutrino oscillation experiments, seesaw mechanism for small neutrino masses.

Suggested Readings

Gauge Theory of elementary particle physics, Ta-Pei Cheng and Ling-Fong Li, Oxford University Press.

Quarks and leptons: An introductory Course in Modern Particle Physics, Francis Halzen and Alan D. Martin, John Wiley & Sons.

Introduction to Elementary Particles, David Griffiths, John Wiley & Sons.

A First Course in String theory, Barton Zwiebach, Cambridge Univ. Press.

Grand Unified theories, Graham G Ross, Oxford University Press.

Massive Neutrinos in Physics and Astrophysics, R. N. Mohapatra and P. B. Pal, World Scientific, Singapore.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H	H	
CO 4					H
CO 5	H				

PSNP0054: NUCLEAR AND PARTICLE PHYSICS
(4-0-0)

COURSE OUTCOMES

CO 1: Explain the properties of nucleus in details. (Understanding)

CO 2: Describe Shell model and learn to calculate the spin and parity of nuclear ground state. (Analysing)

CO 3: Knowledge of nuclear reaction and learn the selection rules for nuclear transitions. (Analysing)

CO 4: Classify the elementary particles and explain the quark model. (Understanding)

Module I: General Properties of Nuclei (6 lectures)

Nuclear size, shape and charge distribution, spin, parity and isospin of nucleon and nuclei. Determination of nuclear size and charge density, concept of magnetic dipole moment and electric quadrupole moment, Binding energy.

Module II: Nuclear Two Body Problem and Nuclear Force (12 lectures)

Properties of deuteron bound state and low energy n-p scattering in terms of scattering length and effective range, spin dependence, charge independence of nucleon force. Non-central part of nucleon force, exchange forces, Yukawa theory of nuclear force, magnetic moment and electric quadrupole moment of deuteron.

Module III: Nuclear Models (10 lectures)

Semiempirical mass formula, liquid drop model, Failure of Liquid drop model, Evidence of shell structure, magic numbers, effective single particle potentials (square well, harmonic oscillator, Wood-Saxon with spin orbit interaction), extreme single particle model and its successes and failures in predicting ground state spin, parity, Nordheim rule, rotational and vibrational model.

Module IV: Nuclear Reactions (12 lectures)

Kinematics governing nuclear reactions, Q-value, cross section of nuclear reactions, neutron reactions at low energies, Coulomb effects in nuclear reactions, neutron reactions, compound nucleus hypothesis, Breit Wigner one level formula for resonance reactions. Elements of direct reactions (qualitative), energies of fission and fusion, neutron induced fission, chain reaction.

Module V: Nuclear Decay (8 lectures)

Fermi theory of decay, selection rules, non-conservative of parity. Gamma decay, electric and magnetic multipole transitions, selection rules, examples of beta and gamma decay.

Module VI: Particle Physics (12 lectures)

Classification of fundamental forces, Elementary particles and their quantum numbers (charge, spin, parity, isospin, strangeness, etc.), Symmetries and conservation laws, SU(2) and SU(3), CPT theorem, CP violation in K decay, Gell-Mann Nishijima relation, quark model, baryons and mesons, coloured quarks and gluons, Relativistic kinematics.

Suggested Readings

Atomic and Nuclear Physics, Vol-II, S. N. Ghosal, S. Chand and company Ltd.

Introductory Nuclear Physics, S. M. Wong, Prentice Hall Inc.

Concepts of Nuclear Physics, B. L. Cohen, Tata McGraw Hill Publishing Company Ltd.

The Atomic Nucleus, R. D. Evans, Tata McGraw Hill Publishing Company Ltd.

Nuclear Radiation Detectors, S. S. Kapoor and V. S. Ramamurthy, Wiley Eastern Ltd.

An introduction to nuclear Physics, W. N. Cottingham and D. A. Greenwood, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H	H	H	
CO 4						H

PSMP0055: MATHEMATICAL PHYSICS-I

(3-1-0)

COURSE OUTCOMES

CO 1: Explain the concepts and applications of the function of complex variables. (Remembering)

CO 2: Apply the advanced concepts of vector spaces in solving physical problems. (Applying)

- CO 3: Utilize the concepts and applications of some special functions. (Applying)
 CO 4: Illustrate some of the basic concepts of residue theorem. (Understanding)
 CO 5: Analyse physical scenarios using the concepts of vector space. (Analysing)

Module I: (16 lectures)

Functions of complex variable: Analytic functions; derivatives of an analytic function. Series of analytic functions: Taylor series, Laurent series; zeros and isolated singular points of analytic functions; the calculus of residues: theorem of residues; evaluation of integrals; Jordan's lemma; Principal value of an integral; multi-valued functions; Riemann surfaces; evaluation of an integral involving a multi-valued function; analytic continuation; dispersion relations.

Module II: (16 lectures)

Review of vector analysis; definition of vector spaces; finite dimensional vector spaces: linear independence, basis and dimensionality, inner product of vectors and norm of vector, Schmidt's orthogonalization method, Schwarz's and Bessel's inequalities; matrices: orthogonal, Hermitian, unitary and normal matrices; linear operators: matrix representation of linear operators; linear transformation: similarity transformation, orthogonal and unitary transformations; eigenvectors and eigenvalues, diagonalization of matrices (or operators); infinite dimensional vector space: Hilbert space, Fock space.

Module III: (20 lectures)

Special functions: associated Legendre differential equation and functions; generating functions; spherical harmonics; orthonormality. Bessel's equation; Bessel function; Spherical Bessel function, Neumann and Hankel functions; expansion of a plane wave into partial waves. Laguerre and associated Laguerre differential equation and functions; generating functions; recurrence relations; orthonormality. Hypergeometric and confluent hypergeometric functions.

Module IV: (8 lectures)

Integral transforms: general properties of Laplace transforms; inverse Laplace transform; application of Laplace transforms; convolution theorem; solution of differential equations using Laplace transform.

Suggested Readings

Mathematical Methods for Physicists, G. Arfken, H. Weber and F. Harris, Elsevier.
 Mathematical Methods of Physics, J. Mathews and R. L. Walker, The Benjamin-Cumminngs Publishing Company.
 Mathematics for Physicists, P. Dennery and A. Krzywicki, Harper and Row.
 A.W.Joshi, Matrices and Tensors in Physics, 3rd Edition, New Age Int. (2005)
 S. Andrilli & D.Hecker, Elementary Linear Algebra, Academic Press (2006).
 J. Brown and R.V.Churchill, Complex Variables and Applications, McGraw-Hill, 8th Edition (2008)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module II
CO 1	H				
CO 2		H			
CO 3			H		
CO 4					H
CO 5				H	

PSMP0056: MATHEMATICAL PHYSICS-II (3-1-0)

COURSE OUTCOMES

- CO 1: Explain the concepts and applications of the special function (Applying)
 CO 2: Illustrate some of the basic concepts of tensor analysis and its application to different branches of physics. (Understanding, Applying)
 CO 3: Analyse Illustrate some of the basic concepts of group theory and its application to different branches of physics. (Understanding, Applying)

Module I: (20 lectures)**Special functions-II**

Power series solution, Frobenius method, Sturm-Liouville theory and boundary value problems, boundary value problems on Laplace equation, Poisson equation and diffusion equation, Green's functions and method involving Green's function and its applications; method of separation of variables for different wave equations in Cartesian and curvilinear coordinates involving special functions like Legendre, Hermite, Laguerre and Bessel functions

Module II: (20 lectures)**Tensor Calculus**

Manifolds and coordinate systems. Transformation of coordinates: Galilean and Lorentz transformations. Tangent vectors and gradients, inner and outer products, contraction, symmetric and antisymmetric tensors, metric tensor, covariant and contravariant derivatives. Metric tensor in different curved spaces. Four vectors and physical examples from special relativity and electrodynamics. Covariant derivatives and parallel transport. Geodesics. Idea of curvature. Calculation of Laplacian in curved spaces.

Module III: (20 lectures)**Group Theory**

Group axioms, permutation groups (S_2 and S_3) and symmetry operations of equilateral triangle, multiplication table, subgroup, classes and characters, finite groups (Z_n), cosets, factor group, normal subgroup, point symmetry group, direct and semi direct product of groups, homomorphism and isomorphism, direct and semi-direct products, block diagonalisation - reducible and irreducible representation, group representation by matrix [unitary representation and conservation laws], Lie groups and algebras [generators, $SO(2)$, $SO(3)$ and $SU(2)$]; unitary group, special unitary group, Lorentz group, rotation group, direct product, Young Tableau, Dynkin diagrams.

Suggested Readings

Mathematical Methods for Physicists, G. Arfken, H. Weber and F. Harris, Elsevier.

Mathematical Methods of Physics, J. Mathews and R. L. Walker, The Benjamin-Cumminngs Publishing Company.

Mathematics for Physicists, P. Dennery and A. Krzywicki, Harper and Row.

A.W.Joshi, Matrices and Tensors in Physics, 3rd Edition, New Age Int. (2005)

M. Hamermesh, Group Theory and Its Applications to Physical Problems, Dover (1989)

D.B. Lichtenberg, Unitary symmetry and elementary particles, second edition, Academic Press (1978).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 2		H	
CO 3			H
CO 4			

PSPS0200: PHYSICS AND SERVICE LEARNING**(2-0-0)****COURSE OUTCOMES**

CO 1: Explain the meaning of service learning and active learning. (Understanding)

CO 2: Illustrate engaged teaching and engaged research. (Understanding)

CO 3: Organise service learning. (Applying)

CO 4: Illustrate CBPR. (Understanding)

CO 5: Find the regulations of educational statutory bodies on social responsibility. (Remembering)

Module I: (6 lectures)

Understanding social responsibility of educational institutes; meaning of community university engagement (CUE), engaged teaching, engaged research. Community Based Participatory Research (CBPR). Statutory bodies of higher educational institutions and social responsibility.

Module II: (9 lectures)

Active learning. Service learning; principles of service learning; classification of service learning models; difference between service learning and other community experiences; historical context of university community partnership; physics students and service learning. Service Learning for a postgraduate physics student and its scope in research.

Module III: (15 lectures)

Conceptualisation of the idea of service learning through any two of the following practical implementations: (i) conducting awareness programmes on scientific temper for nearby communities, (ii) organising demonstrations of scientific experiments for school children to eradicate the fear of pursuing higher studies in science, (iii) surveying the need of the communities and find out various possibilities of providing the solutions from physics point of view, (iv) providing consultancy to school students for various inter school science competitions, (v) providing video lectures and/or demonstrations for school students. (vi) Radiation measurement activity and awareness campaign by students.

Suggested Readings

Service-Learning Essentials: Questions, Answers, and Lessons Learned, Barbara Jacoby, Jossey-bass.

Where's the Learning in Service-Learning?, Janet Eyler and Dwight E. Giles Jr., Jossey-bass.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1		H	
CO 2	H		
CO 3			H
CO 4	H		
CO 5	H		

LABORATORY COURSES**PSPL6003: PHYSICS LABORATORY II****(0-0-4)****COURSE OUTCOMES**

CO 1: Explain the characteristics of SCR. (Understanding)

CO 2: Find out resistivity of a semiconductor. (Application)

CO 3: Determine of difference in wavelengths of Na using Fabry-Perot interferometer. (Application)

CO 4: Verify the Beer-Lambert law using UV visible spectrometer. (Analysis)

CO 5: Use nuclear radiation detectors. (Application)

CO 6: Understand phonon dispersion using simulator. (Understanding)

CO 7: Have some fundamental understanding of plasma experiments. (Understanding)

At least 10 experiments should be performed from the following:

To study the characteristic of SCR using the breadboard.

To study resistivity of a semiconductor by probe method.

Determination of difference in wavelengths of Na using Fabry-Perot interferometer.

To verify the Beer-Lambert law using UV visible spectrometer.

Verification of inverse square law for gamma ray using GM counter.

To study attenuation of beta rays using GM counter.

To determine the activity of a gamma emitter.

To study gamma ray spectrum of Cs-137 source and determine the resolution of a gamma-ray spectrometer.

To calibrate the scintillation spectrometer and determine the energy of gamma rays from an unknown source.

To study attenuation of gamma-rays from Cs-137 source by using different absorbers.
 To study the decay curve for half-life components of irradiated ^{115}In by a neutron source.
 To study phonon dispersion of a monatomic chain of atoms using electronic analogue of the chain.
 Experimental verification of Paschen law in a glow discharge system.
 To find the floating potential of a plasma using the Langmuir probe.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14
CO 1	H													
CO 2		H												
CO 3			H											
CO 4				H										
CO 5					H	H	H	H	H	H	H			
CO 6												H		
CO 7													H	H

PSPL6009: PHYSICS LABORATORY I

(0-0-4)

COURSE OUTCOMES

CO 1: Demonstrate the validity of various network theorems. (Understanding)
 CO 2: Explain the working of various circuits containing semiconductor devices. (Understanding)
 CO 3: Construct various rectifier circuits. (Applying)
 CO 4: Build various filter circuits. (Applying)
 CO 5: Illustrate the working of various transistor circuits. (Understanding)
 CO 6: Explain the behaviour of Op-Amp circuits. (Understanding)
 CO 7: Demonstrate the working of logic circuits. (Understanding)
 CO 8: Explain the transmission of electromagnetic waves through optical fibers. (Understanding)

At least 10 experiments should be performed from the following:

Verification of KCL and KVL using discrete components.
 Verification of Thevenin's theorem.
 VI characteristics of PN junction diode.
 Series voltage regulation using zener diode and transistor.
 Design and study the clipper circuit.
 Design and study the clamper circuit.
 VI characteristics of Zener diode.
 Design of Half wave and Full wave rectifier with and without filter.
 RC low pass and high pass filter realization.
 Static Characteristics of a Bipolar Junction Transistor (CE Mode).
 Static Characteristics of a Bipolar Junction Transistor (CB Mode).
 Design of voltage multiplier: voltage doubler / quadrupler.
 Design BJT as a switch.
 Op-Amp as Inverting and Non Inverting amplifier.
 Realization of basic gates using discrete components.
 To measure attenuation and bending losses of an optical fibre.
 To study and verify the truth table of logic gates.
 To realize half/full adder and half/full subtractor.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9
CO 1	H	H							
CO 2			H	H	H	H	H		

CO 3								H	
CO 4									H

Course Outcomes	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15	Exp 16	Exp 17	Exp 18
CO 5	H	H	H	H					
CO 6					H				
CO 7						H		H	H
CO 8							H		

PSCN6010: COMPUTER ORIENTED NUMERICAL METHODS LAB**(0-0-8)****COURSE OUTCOMES**

CO 1: Find out inverse, eigenvalues and eigenvectors of a matrix. (Application)

CO 2: Perform numerical integration and differentiation and solution of differential equations. (Application)

CO 3: Understand special functions and orbitals. (Understanding)

CO 4: Numerical solutions of algebraic equations. (Application)

CO 5: Numerical solutions of simultaneous equations. (Application)

CO 6: Understand chaos. (Understanding)

CO 7: Apply Monte-Carlo simulations. (Application)

CO 8: Study LCR circuits. (Application)

CO 9: Model data. (Analysing)

CO 10: Compute Fourier transform. (Application)

At least 10 experiments should be performed from the following: (All experiments are to be done using the Fortran, C Language) Basic operations using a matrix A.

To find the transpose of A.

To find the inverse of A.

To verify the accuracy of $AA^{-1} = I$.

To diagonalise a given matrix.

To find the eigenvalues and eigenvectors.

Numerical differentiation.

To find the derivative of a given function $f(x)$ using the standard formula where h is the step size.To determine the second derivative of a given function $f(x)$ using the standard formula.Plot the case (a) as a function of x .Plot the case (b) as a function of x .

Compare the above cases (a) and (b) with the results obtained analytically in specific cases.

Numerical method of solving Schrödinger equation.

Obtain numerical solution for the time independent Schrodinger equation in one dimension for a given potential using Runge-Kutta Method or Fox Godwin method.

To plot the wave function obtained from above versus x .

Obtain numerical solution for the time independent Schrodinger equation in three dimension for a given potential using Runge-Kutta method or Fox Godwin Method.

To plot the wave function obtained from above versus r .

To evaluate the eigenvalues and eigenvectors for case (a).

To evaluate eigenvalues and eigenvectors for case (b).

To count the number of nodes of the function determined in (a) above and see if it is consistent with the theoretical expectation.

To determine the boundary value problems for cases (a) and (c).

Spherical harmonics.

To compute the Legendre polynomials.

To plot spherical harmonics as a function of polar angles.

To compute the spherical Bessel function (regular and irregular).

To plot the case (c).

Numerical integration.

To integrate a given function numerically by Simpson's Rule.

To compare the results obtained from (a) with those obtained analytically.

To integrate a given function numerically by Trapezoidal rule.

To compare the results obtained from (b) with those obtained analytically.

To integrate a given function numerically by Gauss-Legendre integration.

To compare the results obtained from (c) with those obtained analytically.

Solution of algebraic equations.

Solve a given equation numerically using Newton Raphson method.

Compare the result of (a) with those obtained numerically.

To solve a given equation using bisection method.

Comparative study of (a), (b) and (c).

Solution of simultaneous equations.

Using Gauss-elimination and Gauss Jordan elimination method.

Compare (a) with solutions obtained analytically or algebraically.

Logistic systems.

To explore the regions of (a) stable fixed points (b) periodic and (c) chaotic solution.

Radioactivity.

Use Monte-Carlo method to simulate radioactive decay.

Write a program for a radioactive series, when the daughter is also radioactive and so on.

Plot N (number of nuclei) Vs time t.

From the slope calculate the activity at different times.

LCR circuits.

To compute the charge and discharge of an RC circuit using DC source.

To compute the charge and discharge of RC circuits using AC source.

Analyse the energy in the RL circuit using the Runge-Kutta method.

Study the energy dissipated in a series LCR circuit. Plot it versus time t.

Modelling of data.

To compute for a given sample of data.

To fit a given sample of data by least square method by a straight line.

To fit by minimizing by straight line.

To make a polynomial fit by least square method.

To make a polynomial fit by minimizing.

Fourier transform special methods.

To compute Fourier transform of discretely sampled data.

To compute Fast Fourier transform of real functions and Sine and Cosine Transformations.

To compute Fourier transform of a given function in two or more dimensions.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	H											
CO 2		H	H		H							
CO 3				H								
CO 4						H						
CO 5							H					
CO 6								H				
CO 7									H			
CO 8										H		
CO 9											H	
CO 10												H

PSPM6013: PLASMA PHYSICS LABORATORY**(0-0-4)****COURSE OUTCOMES**

- CO 1: Explain the breakdown mechanism of gasses. (Remembering)
 CO 2: Understand the electrical properties of a gas discharge. (Understanding)
 CO 3: Operate and conduct experiments in plasma devices. (Application)
 CO 4: Collect and analyse data from plasma devices. (Analysing)
 CO 5: Use plasma diagnostic tools. (Application)

At least 10 experiments should be performed from the following:

- Experimental determination of minimum breakdown voltage in a glow discharge system.
 To study the effect of variation in chamber pressure on different regions of a glow discharge.
 To study the effect of variation in discharge voltage on different regions of a glow discharge.
 To plot the I-V characteristics of a glow discharge plasma.
 To find the variation in resistance of a glow discharge plasma with chamber pressure.
 To find the variation in resistance of a glow discharge plasma with discharge voltage.
 To find the variation in floating potential with discharge voltage of a plasma using Langmuir probe.
 To find the variation in floating potential with chamber pressure of a plasma using Langmuir probe.
 To find the plasma potential of a plasma using Langmuir.
 To find the electron temperature of a plasma using the Langmuir probe.
 To find the electron density of a plasma using the Langmuir probe.
 Identification of different ions/atoms/molecules in plasma by optical emission spectroscopy(OES).
 To find the plasma density by optical emission spectroscopy (OES) using Stark Broadening of hydrogen lines.
 To find the plasma temperature by optical emission spectroscopy (OES) using line intensity ratio method.
 To find the plasma temperature by optical emission spectroscopy (OES) using Boltzmann Plot method.

Mapping of COs to Syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Exp 13	Exp 14	Exp 15
CO 1	H	M	M												
CO 2				H	M	M									
CO 3	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
CO 4	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
CO 5							M	M	M	M	M	M	M	M	M

PSEL6014: ELECTRONICS LABORATORY**(0-0-4)****COURSE OUTCOMES**

- CO 1: Explain transistor operation. (Remembering)
 CO 2: Understand amplifier design using transistor. (Understanding)
 CO 3: Operational Amplifier and Timer applications. (Application)
 CO 4: Analyse Logic Gates. (Analysis)
 CO 5: Application of gates for Digital circuits. (Application)

At least 10 experiments should be performed from the following:

- Design of amplifiers: Transistor amplifiers with and without feedback.
 Design of Integrator and Differentiator using Op-amp.
 Op-amp linear applications: adders, subtractors, comparator.
 Op-amp based active filters.
 555 timer as monostable multivibrator.
 555 timer as astable multivibrator. 7. 555 timer as bistable multivibrator
 To verify the truth table of MUX and DEMUX.
 Realization of 2:4 decoder and 4:2 encoder design.
 To verify the truth table of one bit and four bit comparators using logic Gates.

Truth table verification of Flip-Flops: (i) RS-Type, (ii) D- Type, (iii) T- Type, (iv) J-K Master Slave
To study shift register in all its modes i.e. SIPO/SISO, PISO/PIPO.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12
CO 1	H	H										
CO 2	M	H			M	M						
CO 3			H	M	H	M	M	M				
CO 4	M				M	M	M	M	M	M	M	M
CO 5							M	M	M	H	M	M

PSNY6015: NANOPHYSICS LABORATORY

(0-0-4)

COURSE OUTCOMES

CO 1: Calculations of molarity. (Remembering)

CO 2: Understanding hydrothermal synthesis. (Understanding)

CO 3: Understanding characterization techniques. (Understanding)

CO 4: Application of characterization techniques on synthesized material.

(Application)

CO 5: Analysis of characterizing results. (Analysis)

At least 10 experiments should be performed from the following:

Calculate molarity for different solutions. Learn to use the scientific balance (adjustments, taring, etc.).

Prepare stock solution of the following (100 ml)

10mM $\text{Zn}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$

10mM 100ml $\text{C}_6\text{H}_{12}\text{N}_4$

25 mM $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$

Synthesize ZnO nanoparticles using hydrothermal process.

Perform seeding of pre-synthesized ZnO nanoparticles on glass substrate. Also perform direct seeding of ZnO particles on glass substrate by thermal oxidation.

Grow ZnO nanorods on glass substrate hydrothermally.

Synthesize ZnS nanoparticles using hydrothermal process.

Synthesize manganese doped ZnS nanoparticles using hydrothermal process.

Make film of ZnO nanoparticles on glass substrate using the LBL machine.

Use Super-hydrophobicity testing machine to find out the roll-off and contact angle of a nanoparticle coated surface.

Synthesize CdS nanoparticles using hydrothermal process. Observe colour variations with size when illuminated with UV light.

Synthesize gold nanoparticles using Turkevitch process.

Sample preparation for different characterization techniques.

UV-vis spectroscopy to study optical properties of nanomaterials.

Tauc's plot to determine band gap of semiconductors.

Electron Microscopy Imaging of metallic and semiconducting nanoparticles.

Analysing SAED patterns.

Measurement of lattice fringes in TEM images using ImageJ software.

Analysing EDS plots.

Extracting information from XRD plots.

Measurement of WCA and ROA for different nanomaterial coated substrates.

PL spectroscopy on luminescent nanoparticles.

Mapping of COs to the syllabus

Course Outcomes	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11
CO 1	H	H	M	M	M	M	M	M			

CO 2	M	H			M	M	M	M	M	M	M

Course Outcomes	Exp 12	Exp 13	Exp 14	Exp 15	Exp 16	Exp 17	Exp 18	Exp 19	Exp 20	Exp 21
CO 2	M	M								
CO 3		H	M	H	M	M	M	M	M	M
CO 4		M	M	M	M	M	M	M	M	
CO 5						M	M	M	H	M

PSST6016: STUDY TOUR

Study Tour is a mandatory non-credited course to be taken up in the final semester of M.Sc. (physics) with an objective to provide students an exposure to higher studies and research in physics in other reputed institutes of the county. The study tour will not be less than 2 days and will not exceed 14 days. During the tour, the focus will be on visiting different higher educational institutes and/ or research institutes. A report will be submitted and a presentation will be given at the end of the tour by each student based on which he/she will be declared "Pass"/"No Pass" in the course.

PSPP6017: PROJECT PHASE I

(2 credits)

During this phase the student will start a project applying the knowledge acquired during the first two semesters and also incorporating the recent trends in the chosen area. It should include phases of design, implementation and reporting. This project is to be executed individually within or outside the campus. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

E-resource for learning:

LaTeX

PSPR6018: PROJECT PHASE II

(3 credits)

During this phase the student will complete the project started in the previous semester. The final implementation of the project and report writing shall be done in this semester. The student shall be required to make a number of presentations to report on the progress of the project. There will be a viva voce examination which shall follow the final submission of the project report. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

PSCP6120: COMPUTATIONAL PHYSICS USING PYTHON

(2-0-0)

COURSE OUTCOMES

CO 1: Outline the fundamental elements of Python computing. (Understanding)

CO 2: Estimate the accuracy and speed of a Python code. (Applying)

CO 3: Develop Python code for solving definite integrals and finding derivatives. (Applying)

CO 4: Solve systems of equations using Python arrays. (Applying)

CO 5: Develop optimized numerical solutions of ordinary differential equations. (Applying)

CO 6: Make use of Monte Carlo methods in random processes for solving physical problems. (Applying)

CO 7: Propose computational solutions to physical problems using Python. (Creating)

Module I: Elements of Python programming (9 lectures)

Data types, basic mathematical operations, variables; lists: indexing, slicing, altering, appending and deleting elements, concatenation; tuples and dictionaries; conditional statements; loops: while and for loops, nested-for loops; Python libraries: installing packages, importing packages; NumPy arrays and matrices,

example: eigenvalues and eigenvectors; basics of data handling using Pandas; introduction to SciPy; data visualization using Matplotlib and Seaborn.

Module II: Accuracy and speed (2 lectures)

Variables and data ranges; numerical error; program speed.

Module III: Numerical integrals and derivatives (4 lectures)

Fundamental integral evaluation methods: trapezoidal rule, Simpson's rule; error estimation of integrals; Romberg integration; Gaussian quadrature; numerical differentiation: forward and backward differences, central differences, second derivatives, partial derivatives, differentiation error estimation.

Module IV: Solving linear and non-linear equations (6 lectures)

Linear equations: Gaussian elimination, back-substitution, pivoting, LU decomposition, matrix inverse, tridiagonal and banded matrices; nonlinear equations: binary search, Newton's method, secant method

Module V: Numerical solutions of ordinary differential equations (4 lectures)

First-order differential equations with one variable: Euler's method, Heun's method, 4th order Runge-Kutta method; differential equations with multiple variables; second-order differential equations; boundary value problems: shooting method, relaxation method; eigenvalue problems.

Module VI: Random processes (5 lectures)

Random numbers generators and seeds; non-uniform random numbers, Gaussian random numbers; Monte Carlo integration: mean value method, integrals in many dimensions, importance sampling; importance sampling; Markov chain methods.

Suggested Readings

Mark E.J. Newman, Computational Physics, Createspace Independent Pub.

Rubin H. Landau, Manuel J. Paez and Cristian C. Bordeianu, Computational Physics: Problem Solving with Python, Wiley.

Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, O'Reilly Media.

David Beazley and Brian K. Jones, Python Cookbook: Recipes for Mastering Python 3, O'Reilly Media.

Jake VanderPlas, Python Data Science Handbook: Essential Tools for Working with Data, O'Reilly Media.

Duncan M. Mcgreggor, Mastering Matplotlib, Packt Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H	M	M	M	M
CO 3			H			
CO 4				H		
CO 5					H	
CO 6						H
CO 7		M	M	M	H	H

**SCHOOL OF LIFE SCIENCES DEPARTMENT OF BIOSCIENCES PROGRAMME: MASTER
OF SCIENCE (MSc) BIOCHEMISTRY**

PROGRAMME OUTCOMES

- PO 1:** Critical Thinking: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
- PO 2:** Knowledge Skill: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge
- PO 3:** Scientific Communication Skills: Imbibe effective scientific and/or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization
- PO 4:** Ethics: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects
- PO 5:** Enlightened Citizenship: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.
- PO 6:** Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
- PO 7:** Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".
- PO 8:** Lifelong Learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self-paced and self-directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling.
- PO 9:** Leadership Qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.
- PO 10:** Research Skills: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations, problem solving and interpretation

PROGRAMME SPECIFIC OUTCOMES:

- PSO1: Confidence:** Demonstrate a comprehensive understanding of chemical and biological structure, principles, techniques, and applications
- PSO2: Knowledge based Skill:** To develop better understanding and improve skills that would enable them to begin a career in research laboratories, industries as well as to generate self-employability
- PSO3: Scientific Social Responsibility:** To develop linkages between scientific community and society to build trust, partnership and responsibility of science towards achieving social goals
- PSO4: Research and analysis:** Realize the impact of science in society and plan to pursue research, and learn to work as a team as well as independently to retrieve information, carry out research investigations and result interpretations
- PSO5: Diagnostic skills:** Attain a remarkable understanding of biochemical principles of bioenergetics, metabolism, physiology and disorders through diagnostic laboratory procedures.

PSO6: Technical and analytical skills: Acquire a thorough knowledge on omics biology, high-throughput omics approaches to analyse biological samples such as genomics, transcriptomics, proteomics, metabolomics and comprehensive analysis approach.

MAPPING OF COURSES WITH POS/PSOS

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
Thermodynamics and Enzymology	3	3	2	2	2	3	2	3	3	3	3	2	1	2		
Cell Biology and Genetics	3	3	2	2	2	3	2	3	3	3	3	2	1	2	1	1
Fundamentals of Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	1	3	2	1
Analytical Techniques	3	3	2	2	2	3	2	3	3	3	3	3	2	3	1	1
Lab I- Fundamentals of Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	1	3	2	1
Lab II- Thermodynamics and Enzymology	3	3	2	2	2	3	2	3	3	3	3	2		2		
Lab III- Cell Biology and Genetics	3	3	2	2	2	3	2	3	3	3	3	3	1	3	2	1
Lab IV- Analytical Techniques	3	3	2	2	2	3	2	3	3	3	3	3	2	3	1	1
Industrial/ Laboratory visit											2	3		3	2	3
Genetic Engineering	3	3	2	2	2	3	2	3	3	3	2	3	2			1
Computer Applications and Bioinformatics	3	3	2	2	2	3	2	3	3	3	2	3	1	2		3
Basic Microbiology	3	3	2	2	2	3	2	3	3	3		3		1		
Molecular Biology	3	3	2	2	2	3	2	3	3	3	2	3	1	2	1	1
Fundamentals of Immunology	3	3	2	2	2	3	2	3	3	3	2	3	3	2	1	1
Lab I- Genetic Engineering	3	3	2	2	2	3	2	3	3	3	2	3	2	2		2
Lab II- Computer Applications and Bioinformatics	3	3	2	2	2	3	2	3	3	3		3		3		3
Lab III- Basic Microbiology	3	3	2	2	2	3	2	3	3	3		3		1		

Lab IV- Molecular Biology	3	3	2	2	2	3	2	3	3	3	2	3	1	3	1	1
Lab V- Fundamentals of Immunology	3	3	2	2	2	3	2	3	3	3	2	3	1	2	1	1
Waste Management (Skill Development course)	3	3	2	2	2	3	2	3	3	3	2	3	3	3	1	2
Fermentation and Food Microbiology (Skill Development course)	3	3	2	2	2	3	2	3	3	3	2	3	3	1	3	1
Mushroom Cultivation (Skill Development course)	3	3	2	2	2	3	2	3	3	3	3	3	3	3	1	3
Herbal Drug Technology (Skill Development course)	3	3	2	2	2	3	2	3	3	3	1	3	3	3	1	2
Research Methodology & Biostatistics-common	3	3	2	2	2	3	2	3	3	3	1	2	3	3	1	1
Medical Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	3	3	3	1
Physiology	3	3	2	2	2	3	2	3	3	3	2	2	1	2	3	1
Lab I-Medical Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	3	3	3	1
Lab II- Physiology	3	3	2	2	2	3	2	3	3	3	2	2	1	2	3	1
Nutritional Biochemistry & Metabolism	3	3	2	2	2	3	2	3	3	3	2	2	2	3	3	1
Bioenergetics	3	3	2	2	2	3	2	3	3	3	3	2	1	3		2
Lab-I- Nutritional Biochemistry & Metabolism	3	3	2	2	2	3	2	3	3	3	2	2	2	3	3	1
Lab II- Bioenergetics	3	3	2	2	2	3	2	3	3	3	3	2	1			

Dissertation Phase	3	3	2	2							3	3	3	3		

I					2	3	2	3	3	3						
IPR & Entrepreneurship	3	3	2	2	2	3	2	3	3	3	2	3	2	2	1	1
Scientific writing and communications	3	3	2	2	2	3	2	3	3	3	3			3		2
Value Added Course- Clinical Laboratory Techniques	3	3	2	2		3	2	3	3	3						
Omics Biology and its Tools	3	3	2	2	2	3	2	3	3	3	3	3	3	3	2	3
Agriculture Technology (Elective)	3	3	2	2	2	3	2	3	3	3	3	3	3	2	2	2
Nanobiology (Elective)	3	3	2	2	2	3	2	3	3	3	3		2			
Bioresource Management (Elective)	3	3	2	2	2	3	2	3	3	3	1	2	2	3	1	1
Dissertation Phase II	3	3	2	2	2	3	2	3	3	3						
	3	3	2	2							3	3	3	3	3	3

DETAILED SYLLABUS THEORY COURSES

BCBM0010: MEDICAL BIOCHEMISTRY (3-0-0)

Course Outcomes

- CO 1: Define the different disorders of the body related to carbohydrate metabolism, lipid metabolism, Nitrogen metabolism and digestive disorders (Remembering)
- CO 2: Develop an understanding of how the different metabolism are interconnected (Understanding)
- CO 3: Classify disorders of each metabolism (Understanding)
- CO 4: Compare all metabolic disorders with their symptoms and etiology (Applying)
- CO 5: Examine the normal level of glucose, glycogen, protein, amino acid, nitrogen, diagnostic enzymes (Analysing)
- CO 6: Evaluate the genetic relation of each metabolic disorder with corresponding metabolism (Evaluating)
- CO 7: Discuss the link between the metabolic disorders and genetic make of patients (Creating)
- CO 8: Gain the knowledge on the molecular diagnostic test used in various infectious diseases (Understanding)

Module I (10 Lectures)

Disorders of Carbohydrate Metabolism - Diabetes mellitus, glucose and galactose tolerance tests, sugar levels in blood, renal threshold for glucose, factors influencing blood glucose level, glycogen storage diseases, pentosuria, galactosemia.

Disorders of Lipids – Plasma lipoproteins, cholesterol, triglycerides and phospholipids in health and disease, hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease, ketone bodies

Module II (10 Lectures)

Abnormalities in Nitrogen Metabolism – Uremia, hyperuricemia, porphyria and factors affecting nitrogen balance.

Disorders of liver and kidney – Jaundice, fatty liver, normal and abnormal functions of liver and kidney. Inulin and urea clearance

Inborn Errors of metabolism – Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch- Nyhan syndrome, sickle cell anemia, histidinemia, disorders of blood

Module III (10 Lectures)

Digestive diseases – Maldigestion, malabsorption, creatorrhoea, diarrhoea and steatorrhoea.

Electrolytes and acid-base balance – Regulation of electrolyte content of body fluids and maintenance of pH, reabsorption of electrolytes.

Diagnostic Enzymes – Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, CPK, cholinesterase, LDH.

Module IV (15 Lectures)

Molecular diagnostics: Basic techniques used in molecular diagnostics, Molecular diagnostics of HIV, Tuberculosis, cholera and pathogenic E. coli

Cancer and Ageing –Molecular basis of carcinogenesis, Oncogene and signal transduction, oncogene and G-proteins, oncogene and cell survival, carcinogens and cancer therapy, Cancer pathways, Diagnosis, prevention and treatment of cancer. Ageing: Antioxidants and ageing, DNA repair, Heat shock proteins, role of dopamine receptors in ageing.

Disorders of Signal transduction: Disorders of cell surface receptors, Antibodies to receptors, Disorders of Intracellular receptors

Oxidative stress related diseases: Role of oxidative stress in various cancers, role of free radicals in diabetic I and diabetic II type of diseases, various inflammatory disorders associated with free radicals, oxidative stress in neurodegenerative diseases; Alzheimer's disease, Parkinson's disease, Huntington's disease. Mitochondrial free radical theory of aging.

Suggested Readings

Medical Biochemistry, 7th Edition, Chatterjee MN and Shinde R, 2007, Jaypee Brothers Medical Publishers P (Ltd)

Biochemistry, 5th Edition, Jeremy M Berg, John L Tymoczko, and Lubert Stryer, 2002, W.H. Freeman and Co.

Text-book of Biochemistry with clinical correlations, 7th Edition, Devlin TMJ, 2010, Wiley and Sons.

Textbook of Medical Physiology, 12th Edition, Guyton AC and Hall JE, 2012, Elsevier Health Sciences

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	
CO 2	H	H	H	
CO 3	H	H	H	
CO 4	H	H	H	H
CO 5	H	H	H	H
CO 6	H	H	H	
CO 7	H	H	H	H
CO 8				H

BCPY0011: PHYSIOLOGY (3-0-0)**Course Outcomes**

CO 1: Define and have an enhanced knowledge of the fundamentals of physiology by recalling and relating (Remembering).

CO 2: Summarize how the separate systems interact to yield integrated physiological responses (Understanding).

CO 3: Implement the acquired knowledge of the various mechanisms in executing and constructing experiments and apply in their day to day life (Applying).

CO 4: Analyze and report on experiments and observations in physiology (Analysing).

CO 5: Evaluate by presenting and defending opinions by making judgments about the mechanisms and functioning of organs and organ systems (Evaluating).

CO 6: Appreciate, compile and generate new ideas on physiology (Creating).

Part A: Plant Physiology Module I (13 lectures)

Electron transport system in plants - Oxidative phosphorylation, mitochondrial respiratory complexes, order and organization of electron carriers, electrochemical gradient, chemiosmotic theory, ATP synthase and mechanism of ATP synthesis.

Nitrate assimilation - Structural features of nitrate reductase and nitrite reductase, incorporation of ammonia into organic compounds, regulation of nitrate assimilation.

Photosynthesis – Photosynthetic apparatus, pigments of photosynthesis, role of carotenoids,

photosystems I and II, their location; Hill reaction, photosynthetic electron transport and generation of NADPH & ATP, cyclic and non-cyclic photo-phosphorylations, complexes associated with thylakoid membranes; light harvesting complexes, path of carbon in photosynthesis – C₃ and C₄ pathway of carbon reduction and its regulation, Photorespiration.

Module II (10 lectures)

Special features of secondary plant metabolism - Terpenes (classification, biosynthesis), lignin, tannins, pigments, phytochrome, waxes, alkaloids, biosynthesis of nicotine, functions of alkaloids, cell wall components.

Toxins of plant origin – Mycotoxins, phytohemagglutinins, lathrogens, nitriles, protease inhibitors, protein toxins.

Stress metabolism in plants - Environmental stresses, salinity, water stress, heat, chilling, anaerobiosis, pathogenesis, heavy metals, radiations and their impact on plant growth and metabolism, criteria of stress tolerance.

Antioxidative defence system in plants – Reactive oxygen species and their generation, enzymic and non-enzymic components of antioxidative defense mechanism.

Part B: Human Physiology Module III (12 lectures)

Blood and Circulatory system - Composition and functions of plasma, erythrocytes including Hb, Leucocytes and thrombocytes, plasma proteins. Blood Coagulation – mechanism and regulation. Transfer of blood gases – Oxygen and carbon dioxide, role of 2,3-diphosphoglycerate, Bohr effect and chloride shift. Digestive system – Composition, functions and regulation of saliva, gastric, pancreatic, intestinal and bile secretions. Digestion and absorption of carbohydrates, lipids, proteins, & nucleic acids. Respiratory system– Air passages and lung structure, pulmonary volumes, alveolar surface tension, work of breathing and its regulation.

Module IV (10 lectures)

Endocrine system – Secretion and functions of hormones of thyroid, pituitary and gonads. Role of hormones in reproduction. Mechanism of action of hormones.

Nervous system-Muscle proteins, molecular mechanisms of muscle contraction (skeletal and smooth), nerve conduction, chemical regulation of synapses, neurotransmitters, neurons, resting membrane potential and action potential.

Excretory system – Structure of nephron, glomerular filtration, tubular reabsorption of glucose, water and electrolytes. Tubular secretion. Homeostatic regulation of water and electrolytes, Acid-base balance.

Suggested Readings

1. Harper's Illustrated Biochemistry, 31st Edition, Rodwell VW, Bender DA, Botham KM, Kennelly PJ, Weil PA, 2009, MHLMP 2. Textbook of Biochemistry with clinical correlations, 7th Edition, Devlin TM, 2010, WLP

Ganong's Review of Medical Physiology, 25th Edition, Barrett KE, Barman SM, Boitano S, Brooks HL, 2017, MHE

Textbook of Medical Physiology, 11th Edition, Guyton AC, Hall JE, 2015, EI

Principles of Biochemistry, 5th Edition, Voet D, Voet JG, Pratt CW, 2018, WP

Lehninger's Principles of Biochemistry, 7th Edition, Nelson DL, Cox MM, 2017, ML

Medical Biochemistry, 2nd Edition, Bhagavan N V, 2015, AP

Biochemistry, 6th Edition, Garret RH, Grisham CM, 2017, SCP

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	L	L	L	L
CO2	H	M	H	H
CO3	M	M	M	M
CO4	L	H	L	L
CO5	L	M	M	M
CO6			M	M

BCFB0013: FUNDAMENTALS OF BIOCHEMISTRY (4-0-0)

Course Outcomes

CO 1: Relate of the structural and functional aspects of biomolecules (Remembering)

CO 2: Compare and draw the chemical structures of different biomolecules (Understanding)

CO 3: Identify the monomers and polymers of biomolecules (Applying)

CO 4: Analyse the interaction and importance of equilibrium maintenance of different biomolecules for health related issues
(Analysing)

CO 5: Estimate the different concentrations of biomolecules for biological applications (Evaluating)

CO 6: Elaborate the biological applications of different biomolecules in drug discovery (Creating)

Module I (6 lectures)

Introduction to Biochemistry, water as biological solvent, weak acids and weak bases, pH and pK, buffers, Henderson- Hasselbalch equation, physiological buffers, fitness of the aqueous environment for living organisms

Module II (14 lectures)

Classification, basic chemical structure, general reactions and properties, biological significance of monosaccharide, Sugar derivatives, deoxy sugars, amino sugars, and sugar acids, Mutarotation of sugar, Anomeric effect of sugar (Methylation effect), Inversion (hydrolysis) of cane sugar

Polysaccharides - occurrence, structure, isolation, properties and functions of homoglycans - starch, glycogen, cellulose, dextrin, inulin, chitins, xylans, arabinans, galactans

Occurrence, structure, properties, and functions of heteroglycans - bacterial cell wall polysaccharides, glycoaminoglycans, agar, alginic acid, pectins, blood group substances and sialic acids, Glycoprotein and their biological applications, Lectins structure and functions

Module III (14 lectures)

Definition and Classification - (simple, complex, derived lipids - structure and example). Saturated and unsaturated fatty acids, Nomenclature of fatty acids, General chemical reactions of fatty acids – esterification, hydrogenation and halogenations

Phospholipids - classification, structure and functions, Ceramides and Sphingomyelins, Eicosanoids, structure and functions of prostaglandins, thromboxanes, leukotrienes, Types and functions of plasma lipoproteins, Amphipathic lipids - membranes, micelles, emulsions and liposomes.

Steroids - cholesterol structure and biological role - bile acids, bile salts.

General chemical reactions of fats: Hydrolysis, Saponification number, I2 number, acetylation, acetyl number, and volatile fatty acid number, Rancidity of fat.

Module IV (4 Hours)

Porphyrins: the porphyrin ring system, chlorophyll, hemoglobin, myoglobin and cytochrome.

Module V (10 lectures)

Watson-Crick Model of DNA structure: A, B and Z – DNA. Chemical Properties: Hydrolysis (acid, alkali), enzymatic hydrolysis of DNA. Cruciform structure in DNA, formation and stability of cruciform, HDNA, palindrome, secondary and tertiary structure of RNA, hnRNA, si RNA, Cot value curve, hypochromic and hyperchromic effect, DNA-protein interactions, Viscosity, Buoyant density, Tm

Module VI (12 lectures)

Definition, classification, structure, stereochemistry and reactions of amino acids;

Classification of proteins on the basis of solubility and shape, structure, and biological functions. Primary structure - determination of amino acid sequences of proteins, the peptide bond, Ramachandran plot.

Secondary structure - weak interactions involved - alpha helix and beta sheet and beta turns structure, Pauling and Corey model for fibrous proteins, Collagen triple helix, and super secondary structures - helix-loop-helix.

Tertiary structure - alpha and beta domains. Quaternary structure - structure of haemoglobin, Solid state synthesis of peptides, Protein-Protein interactions, Concept of chaperones.

Suggested Readings

Biochemistry, 5th Edition, Jeremy M Berg, John L Tymoczko, and Lubert Stryer, 2002, W.H. Freeman and Co.

Fundamentals of Biochemistry, 4th Edition, Voet D, Voet JG and Pratt CW, 2012, John Wiley and sons NY.

Lehninger's Principle of Biochemistry, 7th Edition, David L Nelson and Michael M Cox, 2017, W. H. Freeman and Co.

Biochemistry, 4th Edition, Zubey GL, 1998, WCB London.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1		H	H	H	H	H
CO 2		H	H	H	H	H
CO 3		H			H	H
CO 4	H	M	H	H		
CO 5	H	H	H		H	H
CO 6	M	M	M	H		H

BCAT0014: ANALYTICAL TECHNIQUES (4-0-0)**Course Outcome**

CO 1: Define the basic principles, concepts and applications of various analytical techniques used in biological sciences (Remembering)

CO 2: Apply the knowledge of centrifugation to separate a constituent from a complex mixture (Applying)

CO 3: Choose a suitable microscopic, electrophoretic, and chromatographic technique to identify and purify a target molecule from a complex mixture (Applying)

CO 4: Select an opposite spectroscopic technique to characterize a sample (Analysing)

CO 5: Ability to appraise the various techniques and formulate an appropriate plan for research studies (Evaluating)

Module I (12 lectures)

Principle of centrifugation, concept of RCF, different types of instruments and rotors, preparative, differential and density gradient centrifugation, analytical ultra-centrifugation, determination of molecular weights and other applications, subcellular fractionation

Module II (9 lectures)

Concepts of spectroscopy; Beer-Lambert's law, Principles and applications of colorimetry, Visible and UV spectroscopy, CD, IR and NMR

Module III (11 lectures)

Concepts of chromatography; Principles and applications of paper, thin layer, ion exchange, affinity, gel permeation, adsorption, partition and high-performance liquid chromatography

Module IV (13 lectures)

Principles of electrophoretic separation, types of electrophoresis viz. paper, cellulose, Native PAGE, SDS PAGE, Pulse field gel electrophoresis

Module V (15 lectures)

Basic concepts of microscopy, transmission electron microscopy, scanning electron microscopy, Freeze fracture technique. Principle and applications of Autoradiography

Suggested Readings

Instrumental Methods of Analysis. 6th Edition, H. H. Willard, L. L. Merritt Jr. and others 1986, CBS Publishers and Distributors.

Instrumental Methods of Chemical Analysis, Chatwal G and Anand, S., 1989, Himalaya Publishing House, Mumbai.

A Biologist's Guide to Principles and Techniques of Practical Biochemistry Williams, B.L. and Wilson, K., 1975

Spectroscopy, Volume 1B. B. Straughan and S. Walker Eds., Chapman and Hall Ltd.

Gel Electrophoresis of Proteins - A Practical Approach Hanes,

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H
CO 2	H				
CO 3			H	H	H

CO 4		H			
CO 5	H	H	H	H	H

BCMB0015: MOLECULAR BIOLOGY (4-0-0)**Course Outcomes**

CO 1: Define the principles of DNA replication, transcription and translation (Remembering)

CO 2: Explain the structural and functional properties of biological macromolecules and to understand the role of gene regulation (Understanding)

CO 3: To recognize Central Dogma from replication of DNA till translation of protein (Applying)

CO 4: Distinguish between replication, transcription and translation (Analysing)

CO 5: Execute quantitative analysis to interpret biological data (Evaluating)

CO 6: Design a scientific process, gain insight into the most significant molecular methods to expand our understanding of biology (Creating)

Module I (15 lectures)

Nucleic acid as genetic material: its proof; Different modes of replication (conservative, semi-conservative and dispersive); DNA replication in prokaryotes, eukaryotes and virus (rolling circle model): General features and enzymology; detailed mechanisms of initiation, elongation and termination; experiments underlying each step and role of individual factors; proofreading and processivity of DNA polymerase; telomerases: mechanism of replication, maintenance of integrity and role in cancer; effect of different inhibitors on replication.

Module II (15 lectures)

Basic concepts of promoter, operator, terminator, enhancer; RNA polymerases and its sub-Modules; different sigma factors and their relation to stress, viral infections etc; initiation, elongation and termination (rho-dependent and independent) mechanism of RNA synthesis; post transcriptional modification of RNA - capping, splicing and poly A tailing; effect of different inhibitors on prokaryotic and eukaryotic transcription.

Module III (20 lectures)

The genetic code and its nature; structure of t-RNA, ribosomal structure; activation of amino acids; initiation, elongation and termination mechanism of polypeptide chain synthesis; role of r-RNA in polypeptide chain synthesis; differences between prokaryotic and eukaryotic translational processes; post-translational modification of peptide, its transportation; non-ribosomal peptide synthesis with special reference to cyclic polypeptide antibiotics synthesis in bacteria; effect of different inhibitors on protein synthesis in both prokaryotes and eukaryotes.

Module IV (10 lectures)

Positive and negative control; catabolite regulation-definition and mechanism; effect of anti-termination and attenuation on the process of gene regulation; various protein motifs involved in DNA-protein interactions during gene regulation. Epigenetics - definition and mechanism.

Suggested Readings

Lewin's Genes XII, 12th Edition, Krebs JE, Kilpatrick ST, Goldstein ES, 2017, JB

Molecular Biology of the Gene, 7th Edition, Watson JD, Baker TA, Bell SP, Gann A, Levine M, Bell SP, Losick R, Harrison SC, 2020, PP

Molecular Biology, 5th Edition, Weaver RF, 2011, MGHC.

Molecular Biology, 3rd Edition, Clark DP, Pazdernik NJ, 2014, API 5. Molecular Biology, 5th Edition, Freifelder D, 2004, NPHPL.

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	L	L	L	
CO 2		M	M	H
CO 3	H	H	H	

CO 4	M	M	H	
CO 5		L	L	
CO 6				H

BCFI0016: FUNDAMENTALS OF IMMUNOLOGY (4-0-0)**Course Outcomes**

- CO 1: Course begins with general overview of immunity to get you adjusted to the basics in the field. To demonstrate comprehension of general terms associated with immunological responses and the roles of nearly every cell associated with the immune system. Understand the differentiation of hematopoietic stem cells (HSCs) into lymphoid or myeloid immune cells (Understanding)
- CO 2: To understand the immunological defense against intruders Cellular basis for innate immunity against all types of pathogens. To describe different mechanisms exist in body to recognize pathogens nonspecifically (Understanding)
- CO 3: To demonstrate comprehension of antibody structure, composition, and classes. Understand antibodies associated with particular immunological responses. Gain insights into the coordination of innate and adaptive immune response (Understanding)
- CO 4: Major Histocompatibility Complex (MHC), which determines how individuals display, present, and respond to foreign antigens. To understand the importance of MHC in determining transplant eligibility and autoimmune disease. Understand antigen transport through exogenous or endogenous location and attachment on MHC molecule on the cell surface. (Understanding)
- CO 5: Understand how T cells develop, rearrange T-cell receptor. To develop insights into key differences between rearrangements and Differential pathways that a T cell undergoes (Understanding)

Module I (10 lectures)

General overview of Immunity, Introduction to Metaphors, Pathogens and Immunity, Surveying the cells and organs of Immune system- Innate and adaptive cells, Hematopoietic Stem Cell, primary and secondary organs; Innate and Adaptive Immune response

Module II (7 lectures)

Ubiquity of Innate immune response, Anatomic Barriers-Skin, Mucosa and GI defenses; Apoptosis, Inflammation- Extravasation, Lymphocyte Extravasation, Trafficking, and Homing, Inflammatory Mediators, Inflammatory Cytokines and Chemokines, Clinical Considerations, Chronic Inflammatory Response; Innate Targeting of Pathogens-Pathogen Recognition System, PAMPs (Pathogen Associated Molecular Patterns), TLR, Cell Types and Function

Module III (14 lectures)

Introduction to models in immune system, Immunoglobulin Superfamily, Structure of Immunoglobulin Receptors (BCR) and Antibodies, Immunoglobulin Classes, Antigen Binding, Antibody Dependent Cell Mediated Cytotoxicity (ADCC), Monoclonal

Antibodies

Complement System: Overview and Terminology of the Complement System, Complement Activation, Classical, Alternative and Lectin pathway, Consequences of Complement Activation

Module IV (14 lectures)

Structure of the MHC Locus, Class I MHC, Class II MHC and Class III MHC, Haplotypes, Recombinant Haplotypes, MHC Protein Structure, Specifics of Peptide Binding, Genetic Expression and Cellular Expression, Non-Classical MHC Genes, MHC and Disease Antigen Processing and Presentation: T Cell Antigen Recognition, Professional Antigen Presenting Cells (APCs), Self-MHC restriction, Cytosolic Pathway: Class I Processing and Presentation, Transport to the RER, Exogenous Pathway: Class II Processing and Presentation, Variations- Cross presentation, T-cell receptor-Structure and Roles, $\alpha\beta$ versus $\gamma\delta$ receptors, Common Elements, Functional Differences, T-Cell Receptor Genes, Gene Rearrangement- Alpha Rearrangement-, Beta Rearrangement, Delta Rearrangement

Module V (8 lectures)

Maturation in the Thymus, Double Negative Transitions, Double Positive (DP) Events Completing the Receptor, Displaying Co-Receptors, Beginning Selection; Positive and Negative Selection, CD4+ TH Cells: Types and Functions, Determination of Subclass, Superantigens, TH Cell Activation Pathway

Module VI (2 lectures)

Central and Peripheral Tolerance, Malnutrition, SCID, HIV

Module VII (5 lectures)

Types of hypersensitivity reactions 1,2,3 and 4, Autoimmunity and autoimmune diseases

Suggested Readings

Cellular and Molecular Immunology, 7th edition by Abbas, et al. 2012, Elsevier/Saunders.
Janeway Immunobiology, Kenneth Murphy, Casey Weaver, 9th edition, Norton & Company
Molecular Biology of the Cell, Alberts et al., 5th edition, 2014, W. W. Norton & Company
Kuby Immunology, Judy Owen, 6th and 7th editions, W H. Freeman

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module6	Module VII
CO 1	L						
CO 2		M					
CO 3			H				
CO4				M			
CO5					H	L	L

BCHD0017: HERBAL DRUG TECHNOLOGY (1 - 0 - 0)**Course Outcomes**

Explain steps of herb selection, identification, raw material preparation, extraction and phytochemical study (Evaluating)

Perceive the application of herbs in formulation of herbal products and their multifarious application (Evaluating)

Design procedure of various plant-based products (Creating)

Definition of herb, source of herbs, selection, identification and authentication of herbal materials, processing of herbal raw material, Preparation of plant extracts and oil extraction. Phytochemical screening techniques. Herbal Products-Herbal cosmetics, Herbal Excipients, Herbal Formulations, Nutraceuticals

Activity:

Base preparation and herbal soap

Herbal Tea and/or green tea

Herbal incense sticks with mosquito and/or fly property

Herbal spray with insecticidal and/or pesticidal property

Herbal colourant

Herbal drink with health beneficial property

Suggested Readings

Herbal Drug Technology Mohan Lal Kori, Santram Lodhi, Tushar A Deshmukh, Rageeb Md. Usman, Vaibhav M Daryheka, NiraliPrakashan Publication

Herbal Drug Technology, Paridhavi Agarwal, Universities Press Private Ltd.

BCBE0018: BIOENERGETICS (3-0-0)**Course Outcomes**

CO 1: Summarise the basic concepts of free energy, standard free energy, redox potential and other thermodynamic concepts about biological systems (Understanding)

CO 2: Use principle of transmembrane transport and its various types with special emphasis to mitochondrial respiratory chain and its carriers (Applying)

Module I (15 lectures)

Concept of free energy, standard free energy, determination of ΔG for a reaction, Relationship between equilibrium constant and standard free energy change, biological standard state & standard free energy change in coupled reactions. Biological oxidation

- reduction reactions, redox potentials, relation between standard reduction potentials and free energy change (derivations included). High energy phosphate compounds – introduction, phosphate group transfer, free energy of hydrolysis of ATP and sugar phosphates along with reasons for high ΔG . Energy charge.

Module II (15 lectures)

Chemotaxis and chemoreceptors chemo-osmotic theory, ion transport across energy transducing membranes, Influx and efflux mechanisms, Proton circuit and electrochemical gradient, the transport and distribution of actions, anions and ionophores, Uniport, antiport and symport mechanisms, shuttle systems.

Module III (15 lectures)

The mitochondrial respiratory chain, order and organization of carriers, proton gradient, iron sulphur proteins, cytochromes and their characterization, The Q cycle and the stoichiometry of proton extrusion and uptake; P/O and H/P ratios, Reversed electron transfer, respiratory controls and oxidative phosphorylation, uncouplers and inhibitors of energy transfer.

Fractionation and reconstitution of respiratory chain complexes, ATP- synthetase complex, Microsomal electron transport, partial reduction of oxygen, superoxides.

Suggested Reading

Biochemistry, M. Berg, J. L. Tymoczko, L. Stryer, Freeman Publication

Biochemistry, Voet and Voet, John Wiley and Sons

Bioenergetics: A practical approach, paperback Brown and Cooper, Oxford University Press

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	H

BCNM0019: NUTRITIONAL BIOCHEMISTRY & METABOLISM (3-0-0)

Course Outcomes

CO 1: To acquire the knowledge of the dietary requirement of vitamins and minerals in human body (Remembering).

CO 2: To describe the various pathways that describes the metabolism of breakdown and synthesis of carbohydrates, amino acids and lipids in a biological system (Understanding)

CO 3: Interpret the significance of nutritional distribution of the carbohydrates, amino acids, and fats and their disturbances in the absence of its regulatory enzymes (Applying)

CO 4: Infer the deficiency diseases and abnormalities in response to the dysfunction of enzymes associated with carbohydrates, lipids and amino acids metabolism (Analysing)

CO 5: Compare the linkage of carbohydrate, amino acids and lipid metabolism in a biological system (Evaluating)

Module I (11 lectures)

Brief account on carbohydrates; Glycolysis; Fates of pyruvate under aerobic and anaerobic conditions; Regulation of glycolysis; Pentose phosphate pathway; Oxidative and Non-oxidative phases of PEP; Citric acid cycle; Production of acetyl CoA, Pyruvate dehydrogenase complex, Regulations of the Citric Acid Cycle; Gluconeogenesis pathway and its regulation; Glycogen biosynthesis and its regulation.

Module II (11 lectures)

Brief account of amino acids; essential and non-essential amino acids; metabolic fates of amino acids; amino acid metabolism: transamination, deamination; amino acid pathway and its degradation; nitrogen excretion and urea cycle; linkage of urea cycle and citric acid cycle

Module III (10 lectures)

Brief account of lipids, Synthesis and storage of triacylglycerol, Transport and mobilization, Essential fatty acids, Fatty acid oxidation, Biosynthesis of cholesterol and steroids.

Module IV (8 lectures)

Importance of carbohydrates, lipids and amino acids in our daily diet; essential and non essential amino acids; dietary input of carbohydrates, lipids and amino acids; deficiency diseases associated with carbohydrates, lipids and amino acids; distribution process of carbohydrates, fats and proteins in the human body once injected.

Module V (5 lectures)

Importance of vitamins in our diet; nutritional significance of minerals and trace elements; dietary sources of vitamins and minerals; requirements and deficiency diseases associated with Vitamins (fat soluble and water soluble vitamins) and minerals

Suggested Readings

Biochemistry, 5th edition, M. Berg, J. L. Tymoczko, L. Stryer, 2002, Freeman Publication.

Biochemistry, 4th edition, Voet and Voet, 2002, John Wiley and Sons.

Lehninger's Principle of Biochemistry, 7th edition, David L. Nelson and Michael M. Cox, W. H., 2017, Freeman and Co.

Text Book of Biochemistry with Clinical Correlation, 6th edition, Thomas M. Devlin, John Wiley- Liss, ed. Hoboken, 2006, NJ publishers

Nutritional biochemistry and metabolism: with clinical applications, 2nd edition, M.C. Linder, 1991.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1					H
CO 2	H	H	H	L	
CO 3				H	
CO 4	M	M	M	H	
CO 5	L	L	L	H	L

BCOB0020: OMICS BIOLOGY AND ITS TOOLS (4-0-0)**Course Outcomes**

CO 1: Recall mapping and sequencing of genomes, transcriptome, proteome and metabolome (Remembering)

CO 2: Illustrate the different sequencing techniques (Understanding)

CO 3: Apply the tools of bioinformatics to analyze biological data (Applying)

CO 4: Analyze the data with biostatistics software (Analysing)

CO 5: Decide the type of spectroscopic method for sample analysis (Evaluating)

CO 6: Construct phylogenetic tree after analysis of biological samples (Creating)

Module I (15 Lectures)

Mapping and sequencing genomes: Genetic and physical mapping, Sequencing genomes different strategies, High- throughput sequencing, next-generation sequencing technologies, comparative genomics, population genomics, epigenetics.

Human genome project, pharmacogenomics, genomic medicine, genome editing, applications of genomics to improve public health, drug discovery and agriculture, metagenomics.

Module II (15 Lectures)

Transcriptome, analysis of gene expression - ESTs, SAGE, recent developments in RNA sequencing; metatranscriptomics, applications in gene regulation: alternative splicing, non- coding RNA.

Introduction to proteomics, techniques to study proteomics such as 1D and 2D PAGE, X- ray crystallography, Mass spectrometry including MALDI-TOF, protein microarrays, protein database analysis, comprehensive analysis of protein- protein interactions in different cell types.

Module III (10 Lectures)

Metabolomics, metabolome and metabolite, Structural diversity, number of metabolites in biological system, basic concept of metabolic channeling or metabolons, new approaches to analyze metabolic pathways.

Sample preparation, strategy and techniques used for metabolomic studies viz. GC-MS, LC-MS, NMR; data analysis (PDA, PLSDA), Lipidomics, Glycomics, Phenomics, etc.

Module IV (20 Lectures)

Technical writing: Preparation of scientific report. Thinking and planning, information, ideas, order of paragraph writing; Presentation of a review; Objective and its importance; design of the experiment; parameters used; data interpretation; compilation of experimental record.

Case studies derived from scientific literature (genomics, transcriptomics, proteomics and metabolomics) including comparisons between healthy and diseased tissues.

Bioinformatics: Databases, phylogenetic tree, critical analysis of -omics data using advanced tools.

Biostatistics tools: Data analysis with excel and software (SPSS).

Suggested Readings

Principles of Proteomics, 2nd Edition, Twyman RM, 2013, Garland Science

Metabolome Analysis: An introduction, 1st Edition, Villas-Boas SG, Roessner U, Hansen MAE, Smedsgaard J, Nielsen J, 2007, Wiley

Bioinformatics - From genomes to drugs, 1st Edition, Langauer T, Mannhold R, Kubinyi H, Timmerman H, 2002, Wiley VCH

Principles of gene manipulation, 7th Edition, Primrose SB, Twyman RM, 2006, Blackwell Publishing

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	M
CO 2	H	H	H	M
CO 3	M	M	M	H
CO 4				H
CO 5		H	H	
CO 6				H

BCBM0021: BIORESOURCE MANAGEMENT (2-0-0)**Course Outcomes**

CO 1: Gain an enhanced knowledge of the fundamentals of bioresources and realize the impact of human activity on the environment Summarize how nature works regarding the climate, biodiversity, and the flow of natural resources, and realize the impact of human activity on the environment (Understanding).

CO 2: Acquire knowledge of bioresources eg., sericulture, captive breeding, integrated pest management etc., through different conservation methods, which will open scope for future research (Applying).

CO 3: Able to think innovatively and apply the understanding of bioresources, critically think through hands-on activities viz., biocosmetics, bioinsecticides etc, and industrial field visits which will motivate research, and entrepreneurship (Analyzing and Evaluating).

Module 1 Bioresource Management – approaches and tools

Definition of Bioresources and types, Bioresource and sustainability, Bioresource management through land use planning, Post-harvest management of agricultural produce, Sustainable agriculture, Earthworm technology, Integrated farming, Induced breeding, Captive breeding, Sericulture, Integrated pest management, Concepts of hot spots and red data book, Conservation of biodiversity in seed banks, gene banks and germplasm reserves, Habitat restoration. Application of remote sensing technology for bioresource management, Bio prospecting and bio piracy issues with particular reference to India's biodiversity Sustainable agriculture, Climate change and its impact on crop productivity

Module 2 Bioresource utilization and sustainability

Formulation of biopesticides, bio insecticides, bio weedicides, bio manure, bio cosmetics, bioplastics, Green energy, and biofuel generation from natural sources. Green building, Green walls Sustainable approach in floriculture and horticulture. Organization/Policy role and objectives -Indian Bioresources Information Network, Convention of Biological Diversity and Ramsar Convention, Hands-on Training and Industry/Field Visit with Report writing

Suggested Readings

Bioresource Management and climate change, 1st Edition, R. N. Kumar, 2015, OBC
 Bioresources and their management, 1st Edition, Trivedi SP, Jahageerdar S, Rajendran KV, Kumar D, 2012, AP
 Bioresources Conservation and Management, 1st Edition, Raju AJS, 2009, TTPP
 Bioresources of the Eastern Ghats: Their Conservation and Management, 1st edition, Krishnamurthy KV, Murugan R, 2014, NHBS
 Forest Management, 4th Edition, Davis LS, 2001, MHI
 Human resource Management, 16th Edition, Dessler G, Varrkey B, 2020, PP
 Research trends in Bioresource Management, 1st Edition, Maiti R, 2018, APC
 Biofertilizer and biopesticide, 1st Edition, Lakshman HC, Channabasava A, 2014, PP

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	
CO 2	M	H
CO 3		M
CO 4		M
CO 5		M
CO 6		M

BCSL0200: SERVICE LEARNING IN BIOSCIENCES (2-0-0)**Course Outcomes**

CO 1: To understand the essence of learning through community service
 CO 2: To realise and identify the needs of community
 CO 3: To apply subject related knowledge for service to the community

Module I (8 lectures)

Service learning: Definitions; Principles of Service Learning; Awareness of Community; Involvement with Community; Commitment to service

Module II (12 hours)

Fermentation and food microbiology; Herbal Drug Technology; Waste Management; Mushroom cultivation; Principles of Floriculture and Horticulture; Health -hygiene and disease awareness

LABORATORY COURSES**BCIM6004: MEDICAL BIOCHEMISTRY LAB****Course Outcomes**

CO 1: Practically estimate lipoprotein, bilirubin, blood urea, creatine phosphokinase from a serum sample (Applying)
 CO 2: Perform glucose tolerance tests and understand the normal and abnormal constituents of urine (Applying)

List of Experiments

Estimation of lipoproteins

Glucose tolerance test
 Estimation of bilirubin
 Estimation of blood urea
 Estimation of creatine phosphokinase
 Normal and abnormal constituents of urine

Suggested Readings

1. Medical Biochemistry, 7th Edition, Chatterjee MN and Shinde R, 2007, Jaypee Brothers Medical Publishers P (Ltd)

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6
CO 1	H		H	H	H	H
CO 2		H				

***P: Practical**

BCPY6005: PHYSIOLOGY LAB

Course Outcome

CO 1: To be able to understand and master the conceptual and practical physiological functions of systems (Understanding)

CO 2: To acquire basic knowledge and perform experiments in physiology (Applying)

CO 3: To be able to determine, estimate and report on experiments and observations in physiology (Evaluating)

CO 4: To be able to perform an assay, analyse and report on experiments and observations in physiology (Analysing)

CO 5: To equip students with skills and techniques related to physiology to design experiments necessary for careers in research (Creating)

List of Experiments

1. Estimation of urea in serum
2. Estimation of cholesterol in serum.
3. Estimation of calcium in serum.
4. Assay of Serum glutamate oxaloacetate transaminase (SGOT) and serum glutamate pyruvate transaminase (SGPT)
5. Assay of alkaline phosphatase
6. Assay of amylase in serum
7. Estimation of glucose in serum by glucose oxidase-peroxidase method.
8. Assay of LDH activity in serum
9. Separation of plasma proteins by electrophoresis
10. Estimation of glycosylated hemoglobin
11. Counting white blood cells, red blood cells, platelets

Suggested Readings

Laboratory Manual for Practical Biochemistry, 2nd Edition, Ganesh MK, Shivaraja SYM, 2013, JB
 Textbook of Practical Physiology, 5th Edition, Pal GK, Pal P, 2001, UP

Mapping of COs to syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
CO 1	M	M	M	M	M	M	M	M	M	M	M
CO 2	M	M	M	M	M	M	M	M	M	M	M
CO 3	H	H	H	H	H	H	H	H	H	H	H
CO 4	M	M	M	M	M	M	M	M	M	M	M
CO 5	M	M	M	M	M	M	M	M	M	M	M

***P: Practical**

BCBM6006: BIOENERGETICS LAB**Course outcomes**

CO 1: Interpret how cells manufacture energy-ATP generation (Evaluating)

CO 2: Illustrate the mechanism of cellular respiration in yeast, plants and mitochondria (Understanding)

List of Experiments

Numerical solving related to determination of free energy, free energy determination from equilibrium

constants and standard reduction potentials

Demonstration of cellular respiration in yeast

Isolation of chloroplast from plant cells

Isolation of mitochondria from mouse liver tissue

Suggested Readings

1. Bioenergetics: A Practical Approach Brown, G. C. and Cooper, C. E. Oxford University Press

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4
CO1	H			
CO2		H	H	H

P: Practical*BCDI6007: DISSERTATION PHASE I (0-0-2)****Course Outcomes**

CO 1: Develop a scientific mindset with the capacity for analytical and innovative thinking (Creating).

CO 2: Develop writing skill, referencing and citations for effective communication (Applying).

CO 3: Improve communication and creative expression skills to articulate scientific ideas (Creating).

CO 4: Examine the research gap in the related field and formulate strategies to address the same (Analysing).

Syllabus

Familiarization with research topic and methodologies by a thorough literature review.

Writing of review of literature to brush up already existing knowledge on a given area.

Formulate a research hypothesis and a proposed work plan.

Presentation of the research topic at department level and submission of literature review.

Suggested Readings

1. Scientific review and research articles published in respective specialized area of research.

Mapping of Course outcomes to Syllabus

Course Outcomes	P1	P2	P3	P4
CO 1	H	H		
CO 2		H	H	
CO 3		H	H	H
CO 4	L	M	L	H

P: Practical*BCDI6008: DISSERTATION PHASE II (0-0-16)****Course Outcomes**

CO 1: Support the research hypothesis with experiments executed ethically (Evaluating).

CO 2: Develop skill to independently carry out a research in the laboratory (Creating).

CO 3: Examine the methodology, analyse results, and defend the research work (Analysing).

Syllabus

Execute a scientific dissertation based on the proposed plan in Phase 1 through bench work.

Present and report data at various stages of the research work to the assigned supervisor.

Analysing the results, correlating it with different experiment performed during the dissertation.
Present the findings in a department level to internal and external examiners, and submission of completed thesis.

Suggested Readings

1. Scientific review and research articles published in respective specialized area of research.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4
CO 1	H	L	M	
CO 2	H	M	H	L
CO 3		H	H	H

***P: Practical**

BCFB6009: FUNDAMENTALS OF BIOCHEMISTRY LAB

Course Outcomes

CO 1: Estimate and prepare buffer solutions for different experiments

CO 2: Quantify various biomolecules at different concentrations for future research experiments

CO 3: Apply the technique based on spectrophotometer for analysis of various biomolecules

List of Experiments

Preparation of buffers

Determination of pKa and pl of acidic, basic, and neutral amino acids

Estimation of amino acids by Ninhydrin method

Estimation of DNA by DPA method

Estimation of RNA by Orcinol method

Estimation of proteins by Bradford method

Estimation of proteins by Lowry method

Isolation and estimation of lipids from seeds

TLC of plant pigments

TLC of lipids

Suggested Readings

The Protein Protocols Handbook, 3rd Edition, Walker, JH, 2009, Humana Press

Biochemical methods, 2nd Edition, Sadasivam and Manickam, 2004, New Age International (P) Limited Publishers, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
CO 1	H	H	H							
CO 2			H	H	H	H	H	H	H	H
CO 3			H	H	H	H	H			

***P: Practical**

BCAT6010: ANALYTICAL TECHNIQUES LAB

Course Outcome

CO 1: Recall and perform the laboratory analysis in accordance with Good Laboratory Practices, in conditions of hygiene and safety (Remembering)

CO 2: Describe the principles and the theoretical concepts of the instruments (Understanding)

CO 3: Choose an appropriate separation technique for analysis of the samples (Applying)

CO 4: Ability to undergo a comparative analysis of different identification and purification protocols that can best suit a particular experiment (Analysing)

CO 5: To evaluate the spectrophotometric parameter for understanding the nature of the biological sample (Evaluating)

CO 6: Design an analytical work flow to characterize a biological sample (Creating)

List of Experiments

Study of UV absorption spectra of biological macromolecules-proteins, nucleic acids

Separation of bacterial lipids/amino acids/sugars/organic acids by TLC

Separation of bacterial lipids/amino acids/sugars/organic acids by Paper Chromatography

Study of nucleic acids using Agarose gel electrophoresis.

Study of serum proteins by vertical gel electrophoresis

Separation of haemoglobin or blue dextran by gel filtration

Quantitative estimation of hydrocarbons/pesticides/organic solvents/methane by gas chromatography 8.

Demonstration of PCR and its application

Suggested Readings

The Protein Protocols Handbook, Walker, J.H. (Ed.) Humana Press

Principles and Techniques of Biochemistry and Molecular Biology Wilson, K. and Walker, J., Cambridge University Press

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8
CO 1	H	H	H	H	H	H	M	M
CO 2	H	H	H	H	H	H	H	H
CO 3		H	H	H	H			
CO 4	M	M	M			H	H	
CO 5	H							
CO 6	H	H	H	H	H	H	H	H

*P: Practical

BCRT6012: REMEDIAL TEACHING & NET COACHING

BCNM6013: NUTRITIONAL BIOCHEMISTRY & METABOLISM LAB

Course Outcomes

CO 1: To discuss the effect of pH and temperature on enzyme activity (Understanding).

CO 2: To analyze the saponification value (Analysing)

CO 3: To measure the content of vitamins in food sample (Evaluating)

CO 4: To estimate the acidity in milk and evaluate its causes (Evaluating)

CO 5: Design a protocol to study how pH and temperature effects the regulation of enzymes (Creating)

List of Experiments

1. Determination of saponification value of fats/oils

2. Estimation of acidity in milk

3. Estimation of vitamin C from biological sources

4. Effect of pH on amylase activity.

5. Effect of temperature on amylase activity

Suggested Readings

Fundamentals of Biochemistry, 5th edition, Voet, D., Voet, J. G., & Pratt, C. W., 2007. John Wiley.

Biochemistry, 4th Edition, Zubey, G. L., 1998, WCB London.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1				H	H
CO 2	H				
CO 3			H		
CO 4		H			
CO 5				H	H

BCMB6013: MOLECULAR BIOLOGY LAB**Course Outcomes**

- CO 1: Define the principles for isolation of DNA from bacteria, plant and animal (Remembering)
- CO 2: Demonstrate the knowledge of laboratory practices in molecular biology and conduct independent work in laboratory (Understanding)
- CO 3: Apply practical knowledge to perform isolation of genomic and chromosomal DNA from bacteria (Applying)
- CO 4: Test for DNA amplification by PCR and observe the amplicons of gel electrophoresis (Analysing)
- CO 5: Execute quantitative analysis to interpret clear and concise communication of biological data and evaluate student progress with guided enquires (Evaluating)
- CO 6: Design a scientific process, think critically and employ the scientific method in the formal practices of observation and experimentation (Creating)

List of Experiments

Isolation of genomic DNA from bacteria/plant/animal

Isolation of chromosomal DNA from bacteria.

DNA amplification by PCR and visualization of DNA by gel electrophoresis

Restriction digestion of DNA

Suggested Reading

1. Molecular Biology Techniques, A Classroom Laboratory Manual, 4th Edition, Carson S, Heath M, Melissa S, Witherow DS, 2019, AP

Mapping of COs to syllabus

Course Outcomes	P1	P2	P3	P4
CO 1	M	M		
CO 2	H	H	H	H
CO 3	H	H		
CO 4			H	H
CO 5			H	
CO 6	M	M		

*P: Practical

BCFI6014: FUNDAMENTALS OF IMMUNOLOGY LAB**Course Outcomes**

- CO 1: Visualize the types of cells present in the blood and understand their normal and abnormal percentage as a sign of infection
- CO 2: Analyze the basic difference between serum and blood plasma
- CO 3: Determine antigen antibody interaction
- CO 4: Determine immunodiagnostic application
- CO 5: Understand the type and detection of antibodies present in body secretions
- CO 6: Understand the principles for isolation of various blood cell types

List of Experiments

Microscopic examination of blood cells

Isolation of serum and plasma from blood

Antibody capture ELISA

Antigen capture ELISA

Blood grouping through agglutination

Antibody IgG purification

Detection of secretory IgA from saliva

Apoptosis determination using standard kits

Separation of peripheral blood mononuclear cells by Ficoll-Hypaque

Mapping of COs to syllabus

Course Outcomes	P 1	P2	P3	P4	P5	P6	P7	P8	P9
CO 1	H								
CO 2		H							
CO 3			H						
CO4				H	H				
CO5						H	H	H	
CO6									H

*P: Practical

BCRT6015: REMEDIAL TEACHING & NET COACHING**BCSC6017: SCIENTIFIC WRITINGS AND COMMUNICATIONS (0-0-1)****Course Outcomes**

- CO 1: Assess published data, critically read, interpret, and present it (Analysing)
 CO 2: Compare the strengths and weaknesses of publications (Evaluating)
 CO 3: Develop skills in interpreting and evaluating scientific data (Creating)
 CO 4: Demonstrate ethics in research and related good laboratory practices (Understanding)
 CO 5: Relate the relevance of personality for boosting overall confidence (Understanding)
 CO 6: Design paper writing based on advanced fields of research (Creating)

Activities-Lecture/Talk by students/Faculty/Outsourcing

Introduction to Good Laboratory practices

Development of personality skills and refinement of communication skills for scientific presentation and interviews

Presentation of research articles/classical papers by 3rd Semester

Problem solving and critical thinking session by giving the research problem and allow them to present strategy. Scientific communication and its ethics

Invited Talk

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P 3	P4	P5	P6
CO1	H	M	M			
CO2	H	M	M			
CO3	H	M	M			
CO4	M	M	M	H		
CO5	M	M	M		H	
CO6	M	M	M			H

PROGRAMME: MASTER OF SCIENCE (MSC) BIOTECHNOLOGY

PROGRAMME OUTCOMES

- PO 1:** Critical Thinking: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
- PO 2:** Knowledge Skill: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge.
- PO 3:** Scientific Communication Skills: Imbibe effective scientific and/or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.
- PO 4:** Ethics: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects.
- PO 5:** Enlightened Citizenship: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.
- PO 6:** Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
- PO 7:** Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".
- PO 8:** Lifelong Learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self-paced and self-directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling.
- PO 9:** Leadership Qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.
- PO 10:** Research Skills: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations, problem solving and interpretation.

PROGRAMME SPECIFIC OUTCOMES:

- PSO1: Confidence:** Demonstrate a comprehensive understanding of chemical and biological structure, principles, techniques, and applications
- PSO2: Knowledge based Skill:** To develop better understanding and improve skills that would enable them to begin a career in research laboratories, industries as well as to generate self-employability
- PSO3: Scientific Social Responsibility:** To develop linkages between scientific community and society to build trust, partnership and responsibility of science towards achieving social goals

PSO4: Cell culture handling and transgenic technology: The programme will help in gaining knowledge on *in vitro* culture techniques for plant and animal cells which contributes in the development of transgenic plants and animals.

PSO5: Grasp of industrial and environmental aspects of Biotechnology: The programme will help in the understanding the application and working of pharmaceutical, and fermentation industry for healthcare and food products. It will also emphasise on environment protection and its long-term sustainability

PSO6: Scale-up and connect to advanced and modern concepts: The programme will update students about the most recent developments in the fields of OMICS, genome editing, systems biology, nanobiotechnology and nano-materials to stimulate scaling up to advanced learning.

MAPPING OF COURSES WITH POS/PSOS

Courses	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
Thermodynamics and Enzymology	3	3	2	2	2	3	2	3	3	3	3	2	1	2		
Cell Biology and Genetics	3	3	2	2	2	3	2	3	3	3	3	2	1	2	1	1
Fundamentals of Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	1	3	2	1
Analytical Techniques	3	3	2	2	2	3	2	3	3	3	3	3	2	3	1	1
Lab I- Fundamentals of Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	1	3	2	1
Lab II- Thermodynamics and Enzymology	3	3	2	2	2	3	2	3	3	3	3	2		2		
Lab III- Cell Biology and Genetics	3	3	2	2	2	3	2	3	3	3	3	3	1	3	2	1
Lab IV- Analytical Techniques	3	3	2	2	2	3	2	3	3	3	3	3	2	3	1	1
Industrial/ Laboratory visit											2	3		3	2	3
Genetic Engineering	3	3	2	2	2	3	2	3	3	3	2	3	2			1
Computer Applications and	3	3	2	2												

Bioinformatics					2	3	2	3	3	3	2	3	1	2		3
Basic Microbiology	3	3	2	2	2	3	2	3	3	3		3		1		
Molecular Biology	3	3	2	2	2	3	2	3	3	3	2	3	1	2	1	1
Fundamentals of Immunology	3	3	2	2	2	3	2	3	3	3	2	3	3	2	1	1

Lab I- Genetic Engineering	3	3	2	2	2	3	2	3	3	3	2	3	2	2		2
Lab II- Computer Applications and Bioinformatics	3	3	2	2			3	2	3	3		3		3		3
Lab III- Basic Microbiology	3	3	2	2	2	3	2	3	3	3		3		1		
Lab IV- Molecular Biology	3	3	2	2	2	3	2	3	3	3	2	3	1	3	1	1
Lab V- Fundamentals of Immunology	3	3	2	2	2	3	2	3	3	3	2	3	1	2	1	1
Waste Management (Skill Development course)	3	3	2	2	2	3	2	3	3	3	2	3	3	3	1	2
Fermentation and Food Microbiology (Skill Development course)	3	3	2	2	2	3	2	3	3	3	2	3	3	1	3	1
Mushroom Cultivation (Skill Development course)	3	3	2	2	2	3	2	3	3	3	3	3	3	3	1	3
Herbal Drug Technology (Skill Development course)	3	3	2	2	2	3	2	3	3	3	1	3	3	3	1	2
Research Methodology & Biostatistics-common	3	3	2	2	2	3	2	3	3	3	1	2	3	3	1	1
Medical Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	3	3	3	1
Physiology	3	3	2	2	2	3	2	3	3	3	2	2	1	2	3	1
Lab I-Medical Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	3	3	3	1
Lab II- Physiology	3	3	2	2	2	3	2	3	3	3	2	2	1	2	3	1

Nutritional Biochemistry & Metabolism	3	3	2	2	2	3	2	3	3	3	2	2	2	3	3	1
Bioenergetics	3	3	2	2	2	3	2	3	3	3	3	2	1	3		2
Lab-I- Nutritional Biochemistry & Metabolism	3	3	2	2	2	3	2	3	3	3	2	2	2	3	3	1
Lab II- Bioenergetics	3	3	2	2	2	3	2	3	3	3	3	2	1			
Dissertation Phase I	3	3	2	2	2	3	2	3	3	3	3	3	3	3		
IPR & Entrepreneurship	3	3	2	2	2	3	2	3	3	3	2	3	2	2	1	1
Journal Club and scientific communications	3	3	2	2	2	3	2	3	3	3	3			3		2
Value Added Course- Clinical Laboratory Techniques	3	3	2	2	2	3	2	3	3	3	2	3			3	
Omics Biology and its Tools	3	3	2	2	2	3	2	3	3	3	3	3	3	3	2	3
Agriculture Technology (Elective)	3	3	2	2	2	3	2	3	3	3	3	3	3	2	2	2
Nanobiology (Elective)	3	3	2	2	2	3	2	3	3	3	3		2			
Bioresource Management (Elective)	3	3	2	2	2	3	2	3	3	3	1	2	2	3	1	1
Dissertation Phase II	3	3	2	2	2	3	2	3	3	3	3	3	3	3	3	3

Detail Syllabus

BTRM0003: RESEARCH METHODOLOGY AND BIostatISTICS (4-0-0)

Course Outcomes

- CO 1: Recall and classify the different forms of research – basic, applied, interdisciplinary, etc. Scientific literatures (Remembering)
- CO 2: Summarize an understanding of various kinds of research, objectives of doing research, research process, research design and sampling, scientific problems (Understanding)
- CO 3: Apply statistical methods of data analysis and interpretation. (Applying)
- CO 4: Explain ethical conduct of research and its communication. (Analysing)
- CO 5: Recommend adequate knowledge of hypothesis testing procedures, measurement, scaling techniques and quantitative data analysis (Evaluating)
- CO 6: Produce a manuscript by conducting research work on original ideas, formulating research synopsis, research report, data analysis and meaningful interpretation of data (Creating)

Module I (15 lectures)

Scientific research- Definition, types: basic and applied research, interdisciplinary research, Steps involved in scientific research

Scientific literature primary and secondary literature, biological abstract, current content, review, monograph, peer-reviewed journals, e-resources; research and review articles; scientific communication- scientific paper, scientific posters

Scientific problems: What is scientific problem? Methods and techniques, research conditions, data types, techniques, repeatability, reproducibility and reliability, validity, effect measure and choice of statistical test, experimental protocol, experimental routine

Research design: Meaning, need for research design, features of a good design, Types of research design

Module II (5 lectures)

Brief introduction to ethics, scientific conduct and misconduct-plagiarism, authorship issues, investigation and punishment of scientific misconduct, ethics of animal and human research

Module III (15 lectures)

Introduction to Biostatistics: definition and applications of biostatistics;

Data-types and presentation: types of biological data, accuracy and significant figures;

Population and samples: populations, samples from populations, random sampling, variables and attributes, statistical errors.

Frequency distributions

Graphical representation of data: line diagram, bar diagram, pie chart, histogram

Measures of central tendency: the arithmetic mean, median and mode

Measures of dispersion: range, mean deviation, variance, standard deviation, standard error of mean, standard score

Module IV (6 lectures)

Permutations and combinations, sets

Probability: Introduction, counting possible outcomes, probability of an event, adding and multiplying probabilities

Probability distributions: Binomial, Poisson and Normal distribution

Module V (19 lectures)

Testing of hypothesis and goodness of fit: Null hypothesis, level of significance, errors of influence, Student's t-test, paired t-test, Fischer's test, Chi-square test, linear correlation and linear regression

Analysis of variance: variances of samples and their means, F distribution, partitioning of the total sum of squares and degrees of freedom, models and types of ANOVA

Suggested Readings

Educational Research Planning, conducting and evaluating quantitative and qualitative research, 6th Edition, Creswell JW, 2019, PP

Research Methodology in the medical and biological sciences, 1st Edition, Laake P, Benestad HB and Olsen BR. 2007, Academic Press, EP.

Research Methodology: Methods and technique, 2nd Edition, Kothari CR, 2008, NAIP

Research Methodology for Biological sciences. 5th Edition, 2011, Gurumani N, MJPP

Introduction to Biostatistics, 5th Edition, Banerjee PK, 2014, SCCL

Biometry: The principles and practices of statistics in biological research, 3rd Edition, Sokal RR and Rohlf FJ, 1995, SFWHF

Biostatistical Analysis, 5th Edition, Zar JH, 2010, PPH.

Statistical Methods in Biology, 2nd Edition, Bailey NTJ, 1980, HP

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				M
CO 2	H	M			M

CO 3			H	H	M
CO 4	M	H			H
CO 5			H	H	H
CO 6	L		M	M	M

BTGE0005: GENETIC ENGINEERING (3-0-1)**Course Outcomes**

To understand the properties and function of different enzymes used in genetic engineering

(Understanding)

To compare the different types of cloning and expression vector used in genetic engineering and its limitations (Analysing)

To understand the concepts regarding different hybridization techniques and applications (Understanding)

To acquire theoretical knowledge in the techniques, tools, and application of genetic engineering

(Remembering)

To develop an ability to design and conduct genetic engineering experiments, as well as to analyse and interpret data (Applying)

Module I (10 lectures)

Restriction nucleases: Exo and Endonucleases: History, Restriction endonuclease nomenclature, classification of restriction endonuclease—type I, type II, and type III, cleavage patterns— sticky ends, blunt ends, applications; Modifying enzymes—ligases, kinases, RNase, polymerases, phosphatases and methylases, RNA dependent DNA polymerase, Terminal Deoxynucleotidyl transferase

Module II (13 lectures)

Cloning vectors: Plasmids and plasmid vectors, phagemids, cosmids, artificial chromosome vectors, (YAC, BAC), E. Coli plasmid vectors— pBR322, pUC18, pET21, Bacterio-phage vectors—λ and M13, Cosmids, phagemids and Phasmids, Shuttle vectors-Yeast vectors, Baculo virus vector. Intein-based vectors; Inclusion bodies; Plant based vectors, Ti and Ri as vectors, Yeast vectors, Insertion and Replacement vectors, Expression vectors; Strategies for production of foreign proteins in E.coli, Yeast, animal cell, pMal; GST; pET-based vectors; Protein purification; His-tag; GST-tag; MBP-tag

Module III (12 lectures)

Isolation of genomic and plasmid DNA, DNA cloning; Strategies for construction of genomic and cDNA libraries, chromosome walking; screening of libraries; Oligonucleotide, cDNA and antibody probes; The Southern, Northern, Western, North-Western, Zoo blots, Southwestern, Farwestern blotting and Colony hybridization, yeast-two hybrid system, c-DNA synthesis and cloning: mRNA enrichment, reverse transcription, DNA primers, linkers, adaptors and their chemical synthesis; Cloning interacting genes two-hybrid systems, cloning differentially expressed genes. Site directed mutagenesis and protein engineering

Module IV (10 lectures)

Maxam and Gilbert method and Sanger's method, Next generation sequencing, Applications of genetic engineering: Transgenic animals and plants, production of recombinant pharmaceuticals, gene therapy, disease diagnosis, Transgenic and gene knockout technologies: Vector engineering, strategies of gene delivery, gene replacement/augmentation, gene correction, gene editing, gene regulation and silencing

Suggested Readings

Principles of Gene Manipulation and Genomics, 7th Edition, Primrose SB and Twyman R, 2006, Wiley-Blackwell

Genomes 4, 4th Edition, Brown TA, 2017, Garland Science

Molecular Cloning: A Laboratory Manual, 3rd Edition, Sambrook J and Russell DW, 2001, Cold Spring Harbor Laboratory Press

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	

CO 4				H
CO 5	M	M	L	

BTBE0007: BIOPROCESS ENGINEERING (3-0-1)**Course Outcomes**

Outline the principles of fermentation, design and operation of bioreactors for production of biomass and products (Understanding)

Compare strategies of bioprocess development for industrial production of bioproducts and specialized applications (Analysing)

Relate fermentation and related bioprocess development in food, industry and environment (Understanding)

Estimate the contribution and prospect of bioprocess engineering in commercial biotechnology (Evaluating)

Module I (8 lectures)

Introduction to bioprocess engineering; Isolation, preservation and maintenance of industrial microorganisms, strain improvement strategies media formulation for industrial fermentation, air and media sterilization; kinetics of microbial growth, Fermenter/bioreactor- types and classes, Designing of a fermenter/Bioreactor.

Module II (10 lectures)

Kinetics of operation of bioreactors -batch, fed batch and continuous bioreactor; Measurement and control of bioprocess parameters in a bioreactor – heat and mass transfer, aeration and agitation, scale up and scale down; Biotransformation, Mixed microbial cultures, immobilized cells, Specialized bioreactors (pulsed, fluidized, photo bioreactors); Advanced and non- conventional bioprocesses (animal and plant cell culture, genetic engineering, tissue engineering)

Module III (12 lectures)

Downstream processing: Product recovery and purification, removal of microbial cells and solid matters, precipitation, filtration, centrifugation, cell disruption, extraction and purification-, chromatography, drying and crystallization, ; Industrial production of chemicals using biological aid: alcohols, acids (citric, acetic and gluconic), solvents (glycerol, acetone, butanol), antibiotics (penicillin, streptomycin, tetracycline) amino acids (lysine, glutamic acid), biotransformation of steroids and non-steroid compounds.

Module IV (15 lectures)

Food: Bakery and dairy products, wine, beer and other alcoholic beverages and formulated bio-products, Conventional and molecular breeding of plants for food production; Mushroom production; Single cell proteins; Probiotics; Food spoilage and preservation process

Environment: Techniques of bioremediation of industrial and medical effluent disposal; Phyto- remediation and myco- remediation; Bioremediation of heavy metals, oil spills, dyes and plastics.

Suggested Readings

Principles of Fermentation Technology. 2nd Edition, Stanbury PF, Whitaker A, Hall SJ., 1995, Butterworth Heinemann.

Bioprocess Engineering: Basic Concepts. 2nd Edition, Shuler, ML and Kargi, F., 2002, Prentice Hall, PTR. Industrial Microbiology, 1st Edition, Casida LE., 2007, John Wiley and Sons.

Microbial Biotechnology, 2nd Edition, Glazer AN and Nikaldo H., 2007, WH Freeman & Co.

Prescott and Dunn's Industrial Microbiology. 4th Edition, Reed, G., 2004, CBS Publishers, New Delhi

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	M	
CO 2	M	H	H	
CO 3	M	M	H	H
CO 4	H	H	H	H

BTTE0009: THERMODYNAMICS AND ENZYMOLOGY (3-0-1)**Course Outcomes**

To relate the entropy to law of thermodynamics and Free energy and its relation to chemical equilibria (Evaluating)

To understand the fundamentals of enzyme structure, properties and function (Understanding)

To compare the different types of methods for protein purification (Analysing)

To understand the rate of reactions and order of reactions, and inhibitions and their kinetics (Understanding)

To describe the structure, functions and the mechanism of different enzymes (Evaluating)

To understand the application of enzymes (Understanding)

Module I (5 lectures)

Laws of thermodynamics, reversible and irreversible processes, entropy, enthalpy, internal energy, free energy and equilibrium constant, Gibbs free energy equation, determination of free energy change of under standard and non-standard conditions, high energy compounds, coupled reactions, determination of feasibility of reactions.

Module II (5 lectures)

Classification, nomenclature and general properties like effects of pH, substrate and temperature on enzyme catalyzed reactions. Isolation and purification of enzymes, Salting out of proteins, Isoelectric point, Electrophoresis of protein.

Module III (7 lectures)

Kinetics of enzyme catalyzed reaction: Single substrate reactions, bi-substrate reactions, concept of Michaelis-Menten, Determination and significance of kinetic constants, Limitations of Michaelis-Menten Kinetics, Briggs Haldane relationship

Module IV (10 lectures)

Activation energy and Arrhenius concept, Binding energy, Enzyme catalysis: enzyme specificity and the concept of active site, determination of active site. Stereospecificity of enzymes, Mechanism of catalysis: Proximity and orientation effects, general acid-base catalysis, concerted acid – base catalysis, nucleophilic and electrophilic attacks, catalysis by distortion, metal ion catalysis. Theories on mechanism of catalysis, Inhibition of enzyme activity: Competitive-inhibition: succinate on Malonate dehydrogenase as an example, non-competitive-inhibition: Iodoacetamide on triose phosphate dehydrogenase and EDTA as example: Suicide inactivation-action of penicillin on bacterial cell wall biosynthesis as an example.

Module V (9 lectures)

Mechanism of enzymes action: mechanism of action of lysozyme, chymotrypsin, carboxypeptidase and DNA polymerase. Multienzymes system, Mechanism of action and regulation of pyruvate dehydrogenase and fatty acid synthetase complex. Coenzyme action.

Module VI (9 lectures)

Enzyme regulation: Allosteric enzymes, Feedback Regulation, Sigmoidal kinetics and their physiological significance, Symmetric and sequential modes for action of Allosteric enzymes. Reversible and irreversible covalent modification of enzymes, cascade systems, Immobilised enzymes and their industrial applications, Ribozyme (catalytic RNA) and Abzyme (use of antibody as enzyme) - definition only.

Suggested Readings

Lehninger Principles of Biochemistry, 6th Edition, Nelson DL and Cox MM, 2013, W. H. Freeman

Physical Chemistry, Rakshit P C, 2014, Sarat Book House

Biochemistry (Biochemistry (Berg)), 6th Edition, Berg JM, Tymoczko JL and Stryer L, 2006, W. H. Freeman

Fundamentals of Biochemistry: Life at the Molecular Level, 4th Edition, Voet D, 2012, John Wiley & Sons Inc

Textbook of Biochemistry with Clinical Correlations, 7th Edition, Devlin TM, 2010, Wiley-Liss

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2	M	H				
CO 3		H				
CO 4			H	H		
CO 5					H	H

CO6						M

BTCA0010: COMPUTER APPLICATIONS AND BIOINFORMATICS (3-0-2)**Course Outcomes**

To recall the basics of operation of computer and its related softwares, languages (Remembering)

To utilize concepts of C- programming language for preparing application based programs.(Applying)

To demonstrate the working principle of the World Wide Web and the internet protocols involved

(Understanding)

To inspect the role of the biological resources in sequence alignment, methods of gene prediction, phylo-genetic tree construction and other tools (analysing)

To perceive the importance of methodologies involved in protein structure prediction, structure analysis tools and drug designing (evaluating)

Module I (10 lectures)

Basic computer organization, Processor and memory, secondary storage devices, Input-Output devices, Computer software, Computer language; Basic Ideas in Programming in C: Variables, data types, Constants, Keywords, Input/output, Control Statements, Functions, Structures; Operating system–Basic commands in Linux.

Module II (5 lectures)

Introduction to Spreadsheet, presentation software, document and word processing. WorldWideWeb, Client-server organization; Internet Protocols-FTP, HTTP, Telnet; Search engines- search concepts

Module III (12 lectures)

Concept of databases: Biological Databases-Primary, secondary, composite databases; Databases for Literature, Sequence and structure; Searching and their retrieval. DNA and Protein sequence alignments- Pairwise alignment, dot plot, global and local alignment algorithms-Needleman and Wunsch algorithm, Smith-Waterman algorithm; Multiple sequence alignment – progressive alignment and alternative alignment algorithms; PAM and Blosom scoring matrices; Multiple sequence alignment-based database searching– PSI-Blast

Module IV (9 lectures)

Gene prediction approaches in prokaryotic and eukaryotic genomes, Methods of gene prediction, Introduction to gene prediction tools, Regulatory sequence analysis, Oligo design and analysis tool. Bioinformatics for phylogenetic analysis. Character based and distance based phylogenetics tree, interpretation of phylogenetic tree, Construction of phylogenetic tree from distance matrix Human genome project; concept of microarray and principles of microarray data analysis

Module V (9 lectures)

Structural biology and Protein structure prediction, Methods of protein structure prediction: Homology modeling, Threading and Ab initio methods, Molecular visualization tools- Rasmol, Pymol and Swiss pdb viewer. Structure analysis tools -VAST and DALI. Stages of Drug development , Definition of drug, target and its properties Steps in Drug Designing, Lead identification, Types of drug de s i g n i n g , ADME along with concept of Lipinski rule of five and drug likeliness, Molecular docking, QSAR

Suggested Readings

Bioinformatics: Sequence and Genome analysis, Mount D, Cold Spring Harbor Laboratory Press.

Essential Bioinformatics. Xiong J, Cambridge University Press

Introduction to Bioinformatics, Attwood TK and Parry-Smith DJ, Pearson Education

C- Programming made easy. Rajaram R. Universities Press.

Bioinformatics Principles and Applications, Ghosh Z and Mallick B. Oxford University Press

Bioinformatics-Students Companion. Kalbulla Syed Abrahin, Guruswami Gurusubmanian, Zothansanga, Ravi Prakash Yadav, Nachimuthu Senthil Kumar, Shunmugiah karutha Pandian, Probodh Borah, Surendra Mohan, Springer

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H	M			

CO2	H	M			
CO3	M	H			
CO4			H	H	M
CO5			M	M	H

BTPB0011: PLANT BIOTECHNOLOGY (3-0-2)**Course Outcome**

To inspect the relevance of plant tissue culture and their application in *in vitro* propagation of indigenous as well genetically manipulated plants (Analysing)

To perceive the techniques of gene transfer by biological and non- biological methods in developing transgenic plants (Evaluating)

To examine the role of transgenic plants in developing plants carrying desirable traits and its related advanced techniques (Analysing)

Module I (15 lectures)

Definition, brief history, principle and significance of tissue culture; Cellular totipotency: Cytodifferentiation: Organogenic Differentiation: induction, factors affecting shoot bud differentiation; Cell suspension Culture, Callus Culture, Embryo Culture,

Haploid Culture: microspore and macrospore culture. Triploid culture: Endosperm Culture, Protoplast: isolation, Culture and Fusion; Somatic hybridization and cybridization; Somatic Embryogenesis and Synthetic Seed Production; Androgenesis and its applications in genetics and plant breeding; Germplasm conservation and cryopreservation.

Module II (15 lectures)

Introduction to transgenic plants, methods of gene transfer – Agrobacterium tumefaciens mediated, Agrobacterium rhizogenes mediated; Direct gene transfer methods – Chemical, Physical and alternative methods. Selectable markers, reporter gene and promoter in plant vectors

Module III (15 lectures)

Transgenic plants, characterization of transgenics; chloroplast transformation; marker-free methodologies; advanced methodologies- cisgenesis, intragenesis and genome editing .Strategies for Introducing genes of biotic and abiotic stress resistance in plants (Herbicide resistance; drought, Salinity, thermal stress, flooding and submergence tolerance, insect resistance, virus resistance) longer shelf life (including strategies for suppression of endogenous genes), male sterility, enhanced nutrition (golden rice), edible vaccines molecular pharming - concept of plants as biofactories, production for industrial enzymes and pharmaceutically important compounds.

Suggested Readings

Plant tissue and Organ culture fundamental methods. Gamburg OL, Philips GC., Narosa publications

Text book of Bio technology Singh BD., Kalyani publishers

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III
CO I	H		
CO 2		H	M
CO 3	M	M	H

BTAB0012: ANIMAL BIOTECHNOLOGY (3-0-1)**Course Outcomes**

Have a basic understanding on different types of media composition, different cell culture and its characteristics (Understanding)

Applications of various techniques involved in improvement of animal (Applying)

Application of Genetic engineering methods for production of important compounds and treating diseases (Applying)

Module I (10 lectures)

General considerations of cell culture: Aseptic condition, Media, Balanced salt solution, Carbon dioxide incubator, feeder layer, serum, growth factors; Types of culture media (defined and undefined media), culture media composition; role of different media. Types of cell culture –organ, Organotypic, single cell, Histotypic/3D, primary cells, cell lines, adherent, suspension cell cultures, stem cell culture, embryonic stem cell culture; Characteristics of cells in culture; measurement of cell viability, apoptosis, senescence; Scaling up of animal cell culture.

Module II (8 lectures)

Embryology: Collection and preservation of embryos; culturing of embryos; micromanipulation technology and fertilization in animals; Equipment used in micromanipulation; Sperm sorting; Enrichment of semen for x (female) or y (male) sperm; Biotechnology Techniques in Animal Breeding: Artificial Insemination, In Vitro Fertilization and embryo transfer.

Module III (12 lectures)

Transgenic animal: methods of production and application; transgenic animals as models for human diseases; transgenic animals in livestock improvement; industry, biomedicine chimera mice production; Gene knockouts, production of human antibodies in animals; gene therapy for animal diseases; Animal cloning and ethical issues.

Suggested Readings

Animal Biotechnology, 2nd Edition, Ranga MM, 2018, Agrobios India Limited

Culture of Animal Cells: A Manual of Basic Technique, 5th Edition, Freshney IR, 2005, Wiley

Plant tissue and Organ culture fundamental methods, Gamburg OL, Philips GC, 2005, Narosa publications

Text book of Biotechnology, 5th Edition, Singh BD, 2016, Kalyani publishers

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III
CO 1	H		
CO 2		H	M
CO 3			H

BTFF0013: FERMENTATION AND FOOD MICROBIOLOGY (1-0-0)

Course Outcomes

Demonstrate the understanding of the principles of fermentation and food microbiology in skill development (Understanding)

Construct experimental platforms with fermentation systems to learn the making of commercial food products (Applying)

Analyze experimental data interpret results to arrive at credible conclusions (Analysing)

Module I (2 lectures)

Production of wine from fruit juice (Monitoring of sugar reduction during wine production; Estimation of alcohol concentration in wine)

Module II (2 lectures)

Production of traditional rice beer of ethnic communities of NE region (microbial isolation; growth monitoring, alcohol concentration)

Module III (1 lecture)

Estimation of vicinal diketone in beer

Module IV (1 lecture)

Microbial production of curd (assay milk quality by MBRT test; Isolation and identification of *Lactobacillus* from fermented dairy products; lactic acid estimation)

Module V (2 lectures)

Making of bread and other bakery products by fermentation

Module VI (1 lecture)

Pickled products: Making of traditional pickles of India (NE region); production of Sauerkraut; fermented fish and other products

Module VII (2 lectures)

Fermentation in flavour and fragrance (tea processing; essential oil)

Module VIII (2 lectures)

Microbial enzyme production *via* liquid and solid-state fermentation

Module IX (1 lecture)

Sterility testing in food products (microbial examination of food)

Suggested Readings

Principles of Fermentation Technology. 2nd Edition, Stanbury PF, Whitaker A, Hall SJ. 1995, Butterworth Heinemann

Industrial Microbiology, 1st Edition, Casida LE., 2007, John Wiley and Sons.

Prescott and Dunn's Industrial Microbiology. 4th Edition, Reed, G. 2004, CBS Publishers, New Delhi

Mapping of COs to Syllabus

Course outcomes	Module 1	Module 2	Module 3	Module 4	Module 5	Module 6	Module 7	Module VIII	Module 9
CO 1	H	H	H	H	H	H	H	H	H
CO 2	H	H		H	H	H	H		H
CO 3	H	H	H	H	H	H	H	H	H

BTIE0014: IPR AND ENTREPRENEURSHIP (1-0-0)

Course Outcomes

Interpret different IPR, laws governing IPR and their management in biosciences (Understanding)

Relate the fundamentals of business and entrepreneurship to biosciences (Understanding)

Apply the understanding of IPR and entrepreneurship in innovation management and start-up (Applying)

Module I (9 lectures)

Concept of Intellectual Property; Introduction to intellectual property rights and its types: patents, trademarks, copyright and related rights, industrial design, geographical indications, Protection of new varieties of plants and plant breeder's rights; World Intellectual Property Organization (WIPO) and its role, PCT; Indian Patent Act 1970 Rules and amendments thereof; Drafting and filing patent applications; management and practical use of IP rights, including licensing, enforcement and ethics.

Module II (6 lectures)

Entrepreneurship essentials: opportunities, ideas and Innovation; feasibility and market research; business plan; Building a business: business models, teams, pitching and investment, finance; Start-up ecosystem; Technology and bio-entrepreneurship – case studies.

Suggested Readings

Biotechnology and Intellectual Property Rights: Legal and Social Implications, 1st Edition, Singh, KK., 2015, Springer, India.

IPR, Biosafety and Bioethics, 1st Edition, Goel D, Parashar S, 2013, Pearson Publishers.

Fundamentals of Entrepreneurship. 3rd Edition, Nandan H, 2007, Phi Learning, New Delhi,.

Entrepreneurship and Small Business Management, 2nd Edition, Mariotti S and Glackin C, 2016, Pearson Publishers.

Mapping of COs to Syllabus

Course outcomes	Module I	Module II
CO 1	H	
CO 2		H
CO 3	M	M

BTPE0015: PHARMACEUTICAL & ENVIRONMENTAL BIOTECHNOLOGY (3-0-0)

Course Outcomes

Choose suitable methods to distinguish the sources, types and composition of waste with methods of handling and sampling strategies (Remembering)

Demonstrate the concepts of environment, regulation of population and associated factors (Understanding)

Explain the basic concepts of pharmacology used in drug formulation (Understanding)

Inspect the working structure of pharmaceutical industries and role of regulatory bodies (Analysing)

Plan the management of the environmental pollution load with respect to its physical properties and associated critical considerations in view of emerging technologies (Applying)

Appraise the various steps involved in clinical trials and various approaches for toxicity studies (Evaluating)

Interpret and infer the relationships among the different constituents of the environment (Analysing)

Module I (9 lectures)

Pharmacology – history, nature and source of drug, classification of drugs, Dosage forms, Routes of drug administration, site of action of drug, Factors modifying drug action. Concept of Pharmacodynamics, Mechanism of action of drug, drug Interaction, adverse drug reaction, Pharmacogenetics, Principles of pharmacokinetic, models of pharmacokinetics, Transmembrane transport of drug, Drug absorption pathway, Bio-availability of drug, Drug metabolizing enzyme, Excretion of drug. Biological half-life of the drug, Bioassay and therapeutic drug monitoring

Module II (7 lectures)

Hit to lead optimization by Preclinical studies and clinical trials, Approaches to screen lead molecules, source of lead molecules, Clinical trials- Ethical considerations, regulatory requirements of clinical trials and phases of clinical trials. Preclinical Toxicology- Acute, subacute and chronic toxicity, Animal tests, prodrug, Formulation and drug delivery systems.

Module III (7 lectures)

Regulatory Authorities and regulatory application- Overview, policies and Procedure. Role of various regulatory organization- USFDA, WHO, CSDA. ICMR guidelines for drug discovery. Drug and Cosmetic Act, India. Good manufacturing Practices, Structure of Pharmaceutical Industry, Manufacturing small molecule APIs and large molecule APIs, Pharmacogenomics -the scope of personalized medicine

Module IV (10 lectures)

Basic concepts of environment viz. atmosphere, hydrosphere, lithosphere; biotic environment; biotic and abiotic interactions; energy flow and nutrient cycling (C,N,P); Concept of habitat and niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement; Population-environment relationship modules viz. Characteristics of a population; Survivorship graph curves; population dynamics; population density curves; population regulation strategies (r and K selection); meta population; age structured population.

Module V Environmental monitoring and pollution treatment (12 lectures)

Pollution types and monitoring approaches: Environmental pollution; sources (air, water, soil); pollutants and its types; standard criteria of pollution monitoring; biotechnological approaches of environmental monitoring viz. plant based, animal based, cell biology based, molecular biology-based approaches; pollution management.

Pollution treatment methodologies: sewage/waste water treatment; primary, secondary and tertiary methods of treatment; sources and characteristics of solid waste; Solid waste stabilization (aerobic and anaerobic treatment); Bioremediation strategies (in-situ and ex situ bioremediation); role of microorganisms in bioremediation; Significance of genetic engineering in degradation of toxic compounds

Suggested Readings

Microbial Ecology, 2nd edition, Campbell, R., 1983, Blackwell.

Microorganisms Function, Form and Environment, 2nd Edition, Hawker, L. E. and Linton, A. H., 1989, Edward Arnold.

Environmental Microbiology, 2nd edition, Mitchell, R., 1992, John Wiley & Sons.

Rang & Dale's Pharmacology 9th Edition James Ritter Rod Flower Graeme Henderson Yoon Kong Loke
 David MacEwan Humphrey Rang. Elsevier Publishing, 2019
 Essentials of Medical Pharmacology, 8th Edition, KD Triparthi. Jaypee Brothers Medical Publisher
 Biotechnology and Biopharmaceuticals: Transforming Proteins and Genes into Drugs. 2nd Edition,
 Rodney J Y Ho., Wiley Publishers, 2013

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV	Module V
CO1				H	M
CO2				H	H
CO3	H	M	M		
CO4	M	M	H		
CO5				M	H
CO6		H	L		
CO7				H	H

BTTB0016: TRENDS IN BIOTECHNOLOGY (4-0-0)

Course Outcomes

Recall the fundamentals of biotechnology, biochemistry, molecular biology to better comprehend the recent topics in biotechnology (Remembering)

Relate with developments in Omic, particularly Genomics, Transcriptomics, Proteomics, Metabolomics and other emerging fields of study (Understanding)

Assess the global and Indian scenario of innovation and commercial biotechnology and their impact on human life and environment (Evaluating)

Examine the new and emerging frontiers in biotechnology at an interdisciplinary level (Analysing)

Module I (30 lectures)

Genomics: Genome sequencing, History of sequencing, Next Generation Sequencing (NGS), whole genome sequencing, model organisms, genome projects, microarrays; epigenomics, pharmacogenomics, comparative genomics, metagenomics, and their applications

Transcriptomics ESTs, SAGE, NGS(RNASeq); metatranscriptomics, alternative splicing, non- coding RNA

Proteomics: 2D PAGE, X-ray crystallography, Mass spectrometry including MALDI-TOF, protein microarrays, recent developments in secretomics, interactomics; applications of proteomics in drug discovery

Metabolomics: Metabolome diversity; Metabolite profiling; High throughput analytical techniques for metabolome analysis (GC- MS, LC-MS, NMR), applications

Other emerging Omics – Lipidomics, Glycomics, Phenomics, etc.

Bioinformatics and statistical analysis in Omics (PCA, HCA, PLSDA, Heatmap and other tools of analysis and data representation)

Module II (10 lectures)

Genome editing, synthetic biology, molecular evolution, nanobiotechnology and advanced biomaterials, structural and computational biology, gene ontology, systems biology

Module III (10 lectures)

Global and Indian biotech sector, Segments of biotech market, Bioprospecting in biotechnology, ethical concerns; Commercial production of industrial bio-molecules; bio-products from both natural and synthetic source and their commercialization, vaccines and therapeutics, diagnostics; commercial plant tissue culture including automation, strategies for environment cleanup and their commercialization.

Module IV (10 lectures)

New colors of biotechnology: Blue (aquatic and marine life); Yellow (food and nutrition), White (gene-based bio-industry) Gold (bioinformatics and nanobiotechnology), Brown (extreme environments), Violet (bioethics and laws) Purple (Inventions and IPR), Dark (bio-terrorism, bio-weapons)

Suggested Readings

Principles of Gene Manipulation and Genomics, 7th Edition, Primrose, S.B. and Twyman, R., 2006, Wiley – Blackwell Publishers.

Genome, Transcriptome and Proteome Analysis. 1st Edition, 2001, Bernot, A., John Wiley & Sons Ltd.

Omics: Biomedical Perspectives and Applications. 1st Edition, Barh, D, Blum, K and Madigan, MA, 2012, Taylor & Francis Group.

Industrial Biotechnology: Products and Processes, 1st Edition, Wittman, C and Liao, JC, 2016, Wiley Publishers

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	H	M		
CO 3	M		H	
CO 4		H		H

BTAT0017: AGRICULTURE TECHNOLOGY (2-0-0)

Course Outcomes

Relate with agriculture as a multidisciplinary field of scientific study (Understanding)

Analyze the concepts of farming and agricultural technology and their impact on agriculture. (Analysing)

Apply principles of agriculture in farm and agribusiness management (Applying)

Module I (9 lectures)

Scope of agriculture and agro-economy of India, History of Indian agriculture, Green Revolution, Food security, Agencies involved in agricultural development (India and Global)

Introduction to disciplines of agricultural sciences: Agronomy, Horticulture, Plant Breeding and Genetics, Agricultural Biotechnology, Biochemistry and Microbiology, Physiology, Plant Pathology, Entomology, Soil Science, Water technology, Agricultural extension, Agricultural engineering, Agricultural economics and statistics, Meteorology, Seed technology, Plantation crops, Animal husbandry and Fishery

Module II (14 lectures)

Nature of soil, Soil chemistry, biology and biochemistry, Soil fertility and nutrient management, Soil analysis techniques, bio- fertiliser, organic farming, soil conservation

Principles of irrigation and water management, Water analysis techniques, Water stress, Dryland agriculture and watershed management; Flood stress, Salinity stress

Nutrition, Food testing, Crop varietal improvement, Crop breeding techniques, Seed technology, Crop production and protection techniques including biotech, post-harvest management, Farm machinery and equipment; Innovation in agriculture

Module III (7 lectures)

Farm management principles, integrated farming systems, agricultural market, agro-based industry, agribusiness and local farm economy, Government schemes, Credit, Crop insurance, Soil health cards.

Suggested Readings

Handbook of Agriculture, 6th Edition, ICAR, 2016, Indian Council of Agriculture and Research, New Delhi.

Fundamentals of Agriculture, 1st Edition, Singh KP, 2014, Kalyani Publishers, New Delhi.

Agricultural Microbiology, 2nd Edition, Rangaswami, G., Bagyaraj, D.J. 2005, Prentice Hall India Learning Private Limited, New Delhi.

Textbook of Agricultural Biotechnology, 1st Edition, Nag, A., 2008, Prentice Hall India Learning Private Limited, New Delhi.

Mapping of COs to Syllabus

Course outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	
CO 3		M	H

LABORATORY COURSES**BTAP6003: ANIMAL BIOTECHNOLOGY LAB****Course Outcomes**

To understand the principle of the techniques (Understanding)

To prepare culture media and cell cultures (Analysis)

Analysis of the data (Analysis)

To develop research aptitude (Applying)

To develop writing skill (Applying)

To develop technical skills (Applying)

List of Experiments

Isolation of lymphocytes

Cell viability by using trypan blue.

Isolation of genomic DNA from animal cells

Preparation of animal cell culture media and Filter sterilization

Preparation of single cell suspension from spleen/liver/thymus

Quantitation of animals cells using hemocytometer

Suggested Readings

John R W Masters Animal Cell Culture: A Practical Approach, Fifth Edition

Hirenkumar Sherathiya (Author), 2012, Practical manual for Plant Tissue Culture, Munich, GRIN Verlag,

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6
CO 1	H	H	H	H	H	H
CO 2				H		
CO 3	L	H	M			H
CO 4	L	L	L	L	L	L
CO 5	L	L	L	L	L	L
CO 6	H	M	H	H	H	H

***P: Practical**

BTGE6004: GENETIC ENGINEERING LAB**Course Outcomes**

To understand the different types of techniques used in genetic engineering experiments(Understanding)

To develop technical skills (Applying)

To interpret experimental datas (Evaluating)

To develop research aptitude (Applying)

To develop writing skill (Applying)

List of Experiments

Transformation

Cloning in plasmid/ Phagemid vectors

Gene expression in *E. coli* and analysis of gene product

Silver staining of gels (protein)

RFLP (Restriction fragment length polymorphisms)

RAPD (Random Amplification of Polymorphic DNA)

Suggested Readings

Molecular Cloning: A Laboratory Manual,3rd Edition, Sambrook J and Russell DW, 2001, Cold Spring Harbor Laboratory Press

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6
CO 1	H	H	H	H	H	H

CO 2	H	H	H	H	H	H
CO 3	M	M	H	M	H	H
CO 4	M	M	M	M	M	M
CO 5	L	L	L	L	L	L

***P: Practical**

BTBE6006: BIOPROCESS ENGINEERING LAB

Course Outcomes

Recall the theoretical topics in bioprocess engineering (Remembering)

Experiment with fermentation systems for estimation of biomass and product formation (Applying)

Analysing data from the scientific experiments and interpret results (Analysing)

Syllabus

Parts and design of fermenter

Media for Industrial Fermentation

Isolation, preservation and maintenance of industrial microorganisms

Solid state fermentation

Submerged fermentation

Production and estimation of protease

Production and estimation of amylase

Growth kinetics for batch culture

Production and quantification of alcohol using yeast

Lactic acid fermentation process

Suggested Readings

Principles of Fermentation Technology. 2nd Edition, Stanbury PF, Whitaker A, Hall SJ., 1995, Butterworth Heinemann.

Bioprocess Engineering: Basic Concepts. 2nd Edition, Shuler, ML and Kargi, F., 2002, Prentice Hall, PTR.

Industrial Microbiology, 1st Edition, Casida LE., 2007, John Wiley and Sons.

Microbial Biotechnology, 2nd Edition, Glazer AN and Nikaldo H., 2007, WH Freeman & Co.

Prescott and Dunn's Industrial Microbiology. 4th Edition, Reed, G., 2004, CBS Publishers, New Delhi

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
CO 1	H	H	H	H	H	H	H	H	H	H
CO 2			H	H	H	H	H	H	H	H
CO 3				M	M	H	H	H	H	H

***P: Practical**

BTDI6007: DISSERTATION PHASE I (0-0-2)

Course Outcomes

Develop a scientific mindset with the capacity for analytical and innovative thinking (Creating).

Develop writing skill, referencing and citations for effective communication (Applying).

Improve communication and creative expression skills to articulate scientific ideas (Creating).

Examine the research gap in the related field and formulate strategies to address the same (Analysing).

Syllabus

Familiarization with research topic and methodologies by a thorough literature review.

Writing of review of literature to brush up already existing knowledge on a given area.

Formulate a research hypothesis and a proposed workplan.

Presentation of the research topic at department level and submission of literature review.

Suggested Readings

Scientific review and research articles published in respective specialized area of research.

Mapping of Course outcomes to Syllabus

Course outcomes	P1	P2	P3	P4
CO 1	H	H		
CO 2		H	H	
CO 3		H	H	H
CO 4	L	M	L	H

P: Practical*BTDI6008: DISSERTATION PHASE II (0-0-16)****Course Outcomes**

Support the research hypothesis with experiments executed ethically (Evaluating).

Develop skill to independently carry out a research in the laboratory (Creating).

Examine the methodology, analyse results, and defend the research work (Analysing).

Syllabus

Execute a scientific dissertation based on the proposed plan in Phase 1 through bench work.

Present and report data at various stages of the research work to the assigned supervisor.

Analysing the results, correlating it with different experiment performed during the dissertation.

Present the findings in a department level to internal and external examiners, and submission of completed thesis.

Suggested Readings

Scientific review and research articles published in respective specialized area of research.

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4
CO 1	H	L	M	
CO 2	H	M	H	L
CO 3		H	H	H

P: Practical*BTTE6009: THERMODYNAMICS AND ENZYMOLOGY LAB****Course Outcomes**

To understand the principle of the experiments on enzyme activity (Understanding)

To conduct an experiment on enzyme activity (Applying)

To analyse the effect of different physicochemical condition on enzyme activity (Analysing)

To interpret experimental datas (Evaluating)

To develop research aptitude (Applying)

To develop writing skill (Applying)

Syllabus

Effect of pH on amylase enzyme activity

Effect of temperature on amylase enzyme activity 3.

Determination of K_m and V_{max} of salivary amylase enzyme

Assessment of inhibitor on enzyme activity.

Assessment of activator on enzyme activity.

Suggested Readings

Introductory Practical Biochemistry, Sawhney SK and Singh R, 2001, Narosa Publishing

An Introduction to Practical Biochemistry, 3rd Edition, Plummer D, 2017, McGraw Hill Education

Mapping of COs to Syllabus

Course outcomes	P 1	P 2	P 3	P 4	P 5
CO 1	H	H	H	H	H

CO 2	H	H	H	H	H
CO 3	H	H	H	M	M
CO 4	H	H	H	H	H
CO 5	M	M	M	M	M
CO 6	L	L	L	L	L

*P: Practical

BTCA6010: COMPUTER APPLICATIONS AND BIOINFORMATICS LAB

Course Outcomes

To construct various application program by using the concepts of C programming (Applying)
 To demonstrate the usage of basic commands for operation in LINUX systems (Understanding)
 To execute sequence alignment, primer designing, gene prediction phylogenetic tree construction by utilizing the various biological database and tools (Evaluating)
 To build the 3D protein structures by homology modeling methods, visualize it to subject to molecular docking experiments (Creating)

Syllabus

Programs of C language
 Introduction to basic commands used in LINUX operating systems
 Introduction to various databases available, their usage in sequence searching, retrieval available in databases. Sequence alignment
 Introduction to Gene prediction tools
 Primer designing and analysis
 Phylogenetic Analysis based on sequence alignment data and RAPD/ protein profile data
 Visualization of structures of protein, ligands in databases and their molecular docking
 Homology modeling

Suggested Readings

Bioinformatics. A Practical Approach. Shui Qing Ye, Chapman and Hall/CRC

Mapping of COs to Syllabus

Course out-comes	P1	P2	P 3	P 4	P5	P 6	P 7	P 8	P 9
CO1	H								
CO2		H							
CO3			M	H	H	H	H		
CO4			M					H	H

*P: Practical

BTIV6011: INDUSTRIAL/LABORATORY VISIT

BTBP6011: PLANT BIOTECHNOLOGY LAB

Course Outcome

To design the composition of plant media and solution (Creating)
 To develop various techniques of plant tissue culture. (Applying)
 To determine the application of the various techniques used in plant tissue culture (Analysing)

Syllabus

Preparation of Plant tissue culture media and Stock solutions
 Callus induction, Shoot/ Root induction – organogenesis
 Cell suspension culture
 Haploid production – Anther and ovule culture
 Artificial seed production
 Protoplast fusion by PEG

Suggested Readings

Hiren Kumar Sherathiya Practical manual for Plant Tissue Culture, Munich, GRIN Verlag.

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6
CO 1	H	M	M	M	M	M
CO 2	M	H	H	H		
CO 3					H	H

***P: Practical**

BTPE6012: PHARMACEUTICAL & ENVIRONMENTAL BIOTECHNOLOGY LAB**Course Outcomes**

Experiment with handling animals and the routes of injections (Applying).

Determine the techniques of evaluation of sterility of pharmaceutical products (Evaluating)

Design experiments for testing cyto-toxicity of pharmaceutical products (Creating)

Test for the physical properties of wastewater and solid waste (Analysing)

Design protocol to estimate the level of pollution in water and solid (Creating)

Determine an appropriate method for waste management (Evaluating).

Syllabus

Demonstration of method of injecting drugs by various routes.

Sterility testing methods for pharmaceutical products

Assessment of cyto-toxicity of drug by mitotic index

Assay of vitamin B₁₂ in commercially available capsules/tablets.

Determination of pH and conductivity of wastewater.

Determination of pH and conductivity of solid waste.

Determination of BOD of wastewater samples. • Determination of COD of wastewater samples.

Suggested Readings

Chandrakant Kokare. Pharmaceutical Biotechnology Experiments and Techniques, Nirali Prakashan, Fifth Edition

Microorganisms Function, Form and Environment, 2nd Edition, Hawker, L. E. and Linton, A. H., 1989, Edward Arnold.

Environmental Microbiology, 2nd edition, Mitchell, R., 1992, John Wiley & Sons.

Mapping of COs to Syllabus

Course outcomes	P1	P2	P3	P4	P5	P6	P7	P8
CO1	H							
CO2		H	M					
CO3		M	H	M				
CO4					H	H		
CO5							H	H
CO6					M	H	M	M

***P: Practical**

BTCL6014: CLINICAL LABORATORY TECHNIQUES (0-0-1)**Course Outcome**

Perform the experiments necessary for careers in research and diagnostic laboratories. (Applying)

Detect Inflammation which could help them in diagnoses of underlying health condition (Analyzing)

These diagnostic tests will help learner to analyze the presence of pathogenic agents and guide them for further screening (Analyzing)

Analyze and correlate hemoglobin with different health conditions and can guide the patient for further diagnostic test (Analyzing)

Developing methods of identification of clinically important microorganisms and study response to

antibiotics (Applying).

Syllabus

Good Laboratory practices

Determination of blood groups (A, B, O and Rh system)

Determination of total erythrocyte count, total leucocyte count and determination of platelet count

Estimation of sugar by DNS Assay

CRP estimation in blood

Antigen and antibody detection ELISA

Haemoglobin estimation in blood

Preparation of microbiological media

Isolation of microorganisms from a clinical sample.

Staining techniques and microscopic examination of microbial cells.

Antibiotic susceptibility testing

Suggested Readings

Laboratory Manual for Practical Biochemistry, 2nd Edition, Ganesh MK, Shivaraja SYM, 2013, JB

Textbook of Practical Physiology, 5th Edition, Pal GK, Pal P, 2001, UP

Practical Microbiology, Maheshwari DK, 3rd Edition, 2002, SCP

Mapping of COs to syllabus

Course outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11
CO 1	H	H	H	H							
CO 2					H						
CO 3						H					
CO 4							H				
CO 5								H	H	H	H

***P: Practical**

BTBB6015: BASIC BIOINFORMATICS (0-0-1)

Course Outcome

To recognize the importance of various types of biological databases (Remembering)

To apply the bioinformatics tools for performing the different types of sequence alignments (applying)

To construct the phylogenetic tree by using various strategies (Creating)

Module I

Definition of Bioinformatics and introduction to Biological databases, classification, Concept of nucleotide sequence, protein sequence and sequence alignments, types

Module II

Features of Phylogenetic tree, types of trees, interpretation of tree.

Module III

Nucleic acid databases, Protein databases, Small molecules/ Ligand databases and literature databases, Searching of sequences and retrieval of sequences, Pairwise sequence alignment and multiple sequence alignment using BLAST, Introduction to MEGA sequence alignment tool

Module IV

Sequence based phylogenetic tree construction using BLAST, Phylogenetic tree construction from chromatogram of sequencing results using MEGA & BIOEDIT tool and tree construction from RFLP profile and protein profile using DendroUPGMA

Suggested Readings

Introduction to Bioinformatics, Attwood T K and Parry-Smith DJ, Pearson Education.

Bioinformatics-Students Companion. Kalbulla Syed Abrahin, Guruswami Gurusubmanian, Zothansanga, Ravi Prakash Yadav, Nachimuthu Senthil Kumar, Shunmugiah karutha Pandian, Probodh Borah, Surendra Mohan, Springer

Mapping of COs to syllabus

Course outcomes	M1	M2	M3	M4
CO1	H	M	H	M
CO2	H	M	H	M
CO3	M	H	M	H

PROGRAMME: MASTER OF SCIENCE (MSC) MICROBIOLOGY

PROGRAMME OUTCOMES

PO 1: Critical Thinking: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an openminded and reasoned perspective.

PO 2: Knowledge Skill: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge.

PO 3: Scientific Communication Skills: Imbibe effective scientific and/or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.

PO 4: Ethics: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects.

PO 5: Enlightened Citizenship: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.

PO 6: Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.

PO 7: Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".

PO 8: Lifelong Learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self- paced and self- directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/skill development/ reskilling.

PO 9: Leadership Qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.

PO 10: Research Skills: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations, problem solving and interpretation.

PROGRAM SPECIFIC OUTCOMES

PSO1: Confidence: Demonstrate a comprehensive understanding of chemical and biological structure, principles, techniques, and applications

PSO2: Knowledge based Skill: To develop better understanding and improve skills that would enable them to begin a career in research laboratories, industries as well as to generate self-employability

PSO3: Scientific Social Responsibility: To develop linkages between scientific community and society to build trust, partnership and responsibility of science towards achieving social goals

PSO4: Knowledge of microbial diversity – Students develop the understanding of microbial life in diverse environmental ecosystems for sustainability and economic benefit.

PSO5: Molecular diagnostic skills: Students shall develop and demonstrate competence in laboratory safety, practical quantitative and qualitative research skills that help evaluate the public health research affecting our own community, molecular diagnosis of infectious diseases caused by fungi, viruses and bacteria, Identification of new disease markers, Phage therapy.

PSO6: Industrial applications – Students learn to how to scale-up microbial cultures to an industrial setup for production of medicine, solvents, biofuel, biofertilizers and food - quality control, safety regulations and ethics form an integral part of the same.

MAPPING OF COURSES WITH POS/PSOS

Courses	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6
Thermodynamic s and Enzymol- ogy	3	3	2	2	2	3	2	3	3	3	3	2	1	2		
Cell Biol- ogy and Genetics	3	3	2	2	2	3	2	3	3	3	3	2	1	2	1	1
Funda- mentals of Bio- chemistry	3	3	2	2	2	3	2	3	3	3	3	3	1	3	2	1
Analytical Tech- niques	3	3	2	2	2	3	2	3	3	3	3	3	2	3	1	1
Lab I- Funda- mentals of Biochem- istry	3	3	2	2	2	3	2	3	3	3	3	3	1	3	2	1
Lab II- Thermo- dynamic s and Enzymol- ogy	3	3	2	2	2	3	2	3	3	3	3	2		2		
Lab III- Cell Biology and Genetics	3	3	2	2	2	3	2	3	3	3	3	3	1	3	2	1
Lab IV- Analytical Tech- niques	3	3	2	2	2	3	2	3	3	3	3	3	2	3	1	1
Industrial/ Labora- tory visit											2	3		3	2	3
Genetic Engineer- ing	3	3	2	2	2	3	2	3	3	3	2	3	2			1
Computer Applica- tions and	3	3	2	2												

Bioinformatics					2	3	2	3	3	3	2	3	1	2		3
Basic Microbiology	3	3	2	2	2	3	2	3	3	3		3		1		
Molecular Biology	3	3	2	2	2	3	2	3	3	3	2	3	1	2	1	1
Fundamentals of Immunology	3	3	2	2	2	3	2	3	3	3	2	3	3	2	1	1

Lab I- Genetic Engineering	3	3	2	2	2	3	2	3	3	3	2	3	2	2		2
Lab II- Computer Applications and Bioinformatics	3	3	2	2								3		3		3
Lab III- Basic Microbiology	3	3	2	2	2	3	2	3	3	3		3		1		
Lab IV- Molecular Biology	3	3	2	2	2	3	2	3	3	3	2	3	1	3	1	1
Lab V- Fundamentals of Immunology	3	3	2	2	2	3	2	3	3	3	2	3	1	2	1	1
Waste Management (Skill Development course)	3	3	2	2	2	3	2	3	3	3	2	3	3	3	1	2
Fermentation and Food Microbiology (Skill Development course)	3	3	2	2	2	3	2	3	3	3	2	3	3	1	3	1
Mushroom Cultivation (Skill Development course)	3	3	2	2	2	3	2	3	3	3	3	3	3	3	1	3
Herbal Drug Technology (Skill Development course)	3	3	2	2	2	3	2	3	3	3	1	3	3	3	1	2

Research Methodology & Biostatistics-common	3	3	2	2	2	3	2	3	3	3	1	2	3	3	1	1
Medical Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	3	3	3	1
Physiology	3	3	2	2	2	3	2	3	3	3	2	2	1	2	3	1
Lab I-Medical Biochemistry	3	3	2	2	2	3	2	3	3	3	3	3	3	3	3	1
Lab II- Physiology	3	3	2	2	2	3	2	3	3	3	2	2	1	2	3	1
Nutritional Biochemistry & Metabolism	3	3	2	2	2	3	2	3	3	3	2	2	2	3	3	1
Bioenergetics	3	3	2	2	2	3	2	3	3	3	3	2	1	3		2
Lab-I- Nutritional Biochemistry & Metabolism	3	3	2	2	2	3	2	3	3	3	2	2	2	3	3	1
Lab II- Bioenergetics	3	3	2	2	2	3	2	3	3	3	3	2	1			
Dissertation Phase I	3	3	2	2	2	3	2	3	3	3	3	3	3	3		
IPR & Entrepreneurship	3	3	2	2	2	3	2	3	3	3	2	3	2	2	1	1
Journal Club and scientific communications	3	3	2	2	2	3	2	3	3	3	3			3		2
Value Added Course- Clinical Laboratory Techniques	3	3	2	2	2	3	2	3	3	3	2	3			3	
Omics Biology and its Tools	3	3	2	2	2	3	2	3	3	3	3	3	3	3	2	3
Agriculture Technology (Elective)	3	3	2	2	2	3	2	3	3	3	3	3	3	2	2	2
Nanobiology (Elective)	3	3	2	2	2	3	2	3	3	3	3		2			
Bioresource Management (Elective)	3	3	2	2	2	3	2	3	3	3	1	2	2	3	1	1
Dissertation Phase II	3	3	2	2	2	3	2	3	3	3	3	3	3	3	3	3

MBVM0003: VIROLOGY AND MYCOLOGY (3-0-1)

Course Outcomes

To develop a comprehensive understanding about viruses in general
To gain insights on the infection pattern of viruses and to detect viral infection in vitro
Understand the in vitro models of viral infection (Understanding)
To gain deep insights into various types of viruses on the basis of its genetic material
To understand detail mechanism on different types of viral diseases prevalent across the globe
To understand about bacteriophages and how they play important role in the treatment of infections (understanding)
To understand basic principle behind how vaccine works and trace the history of vaccines
Understand diseases successfully recovered due to vaccination (Understanding)
Understand the risk and benefits of vaccination and develop vaccine schedule
To understand general overview and characteristics of fungi
To differentiate fungi on the basis of nutritional types and how fungi are important in plant growth (Understanding)
Fungi as a model to understand some of the human diseases
Understand how biotechnology helped in the exploitation of fungi industrially
Develop knowledge on various aspects of fungi from medicine to food security
Gain insights into the drug targets and antifungal agents (Analysing)

Module I (10 lectures)

Introduction to virology: Virus history, Diversity, shapes, sizes and components of genomes, Baltimore classification of Viruses Infectious cycle: Attachment and entry into the cells, entry of non-enveloped virions, Assay of virus infectivity, modes of transmission of viral diseases
Isolation and purification of viruses: animal cell culture, multiplicity of Infection, virus preservation

Module II (20 lectures)

Animal Viruses: + Stranded RNA viruses: Picornaviruses, Flaviviruses- West Nile virus and Dengue virus, Coronaviruses- SARS pathogenesis
–ve strand RNA viruses: Paramyxoviruses, Orthomyxoviruses: Influenza pathogenesis and Bird flu, Rhabdoviruses: Rabies pathogenesis
Retroviruses: structure, classification, life cycle; reverse transcription. Retroviruses: HIV, viral pathogenesis and AIDS
Bacteriophages: Phage basics, Infectious cycle: Lytic and lysogenic, regulation of switch between lytic and lysogenic cycle, assay of bacteriophages, Phage therapy

Module III (5 lectures)

Basic principles, Small pox and polio vaccine, subunit vaccine, Flu vaccination, how toxic are vaccines, Vaccine schedule

Module IV (10 lectures)

Introduction: Overview of fungi, general characteristics of fungi, fungal structure, Fungal Cell wall – architecture and biosynthesis, reproduction in fungi-vegetative, asexual and sexual, homothallism and heterothallism

Nutrition classification of fungi: fungi, saprophytic, parasitic, obligatory and facultative, biotrophic

Fungal-plant interactions: symbiotic and antagonistic interactions, ecto-mycorrhizae, endomycorrhizae and vesicular arbuscularmycorrhizae, Yeast as model for human diseases

Module V (5 lectures)

Importance of Fungi in biotechnology, industrially important enzymes from fungi, Fungal metabolites and their economic significance - mycotoxins, medicinal uses of fungi (antibiotics), Antifungal agents and their mode of actions, drug targets, Fungi as food - mushrooms, mushroom poisoning

Suggested Readings

Human Virology, 5th edition, Leslie Collier, John Oxford, and Paul Kellam, 2016, Oxford university press
Medical Mycology, 1st edition, Christopher C et.al, 2017, OUP Oxford

Clinical Virology manual, 5th edition, Michael Loeffelholz, Richard L. Hodinka, Benjamin Pinsky, Stephen Young, 2016, Wiley

The Mushroom Cultivator, 1st edition, Paul Stamets and J.S. Chilton, 1985, Richmond Publishing Co Ltd

Radical Mycology, 1st edition, Peter McCoy's, 2016, Chthaeus Press

Fantastic fungi, 1st edition, Paul Stamets and Schwartzberg, 2019, Earth Aware Editions

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				
CO 2		M			
CO 3			M		
CO4				M	
CO5					M

MBEM0009: ENVIRONMENT MICROBIOLOGY (3-0-1)

Course Outcomes

Outline the traditional and modern approaches of microbial biodiversity analysis (Understanding).

Relate the role of a habitat in natural selection of diverse microbial forms (Remembering).

Classify the different modes of microbial interaction in a micro- and macro-habitat (Understanding).

Apply the properties of microbes in agriculture and in wastewater remediation (Applying).

Module I (10 lectures)

Taxonomy: classical and modern - polyphasic approach, molecular chronometers, chemotaxonomy, genetic methods.

Biodiversity: structure and function of a microbial community, estimates of total number of species, measures, and indices of diversity (diversity, dominance, and species richness indices), culture dependent and culture independent methods, microbial biodiversity analysis and documentation.

Module II (10 lectures)

Ecology: Microbial ecology vs. macroecology, concept of habitat and niche, fundamental and realized niche, resource partitioning and character displacement, characteristics of microbial population growth curves, microbial population regulation, r and K selected strategies, microbial community succession.

Extremophiles: Molecular and physiological adaptation of acidophiles, alkalophiles, halophiles, thermophiles and hyperthermophiles, psychrophiles and barophiles.

Module III (15 lectures)

Microbial interaction: Brief account of the interactions - rhizosphere, phyllosphere, microbial interactions within community - mycorrhiza, epiphytic and endophytic microorganisms and their functional capability, microbial biofilm:

definition, development, and importance.

Biogeochemical cycles: microbial role in biogeochemical cycles (C, N, P, S), primary production and decomposition.

Application of bacteria in agriculture: nitrogen fixing organisms – nitrogenase system and nif genes. Bio fertilizers – Bacterial, Azotobacter and vermiform compost

Module IV (10 lectures)

Waste treatment: Types of waste – solid and liquid waste characterization, bioremediation - several sustainable approaches for remediation of xenobiotic compounds and hydrocarbons, Physical, chemical and biological treatment methods, wastewater remediation – trickling, activated sludge, oxidation pond. Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN tests, tests for faecal coliforms (b) Membrane filter technique.

Suggested Readings

A Textbook on Microbiology, 4th Edition, Dubey RC, Maheshwari DK, 2013, S Chand Publishing.

General Microbiology, 7th Edition, Schlegel HG, 1993, Cambridge University Press.

Applied Microbiology (Agriculture, Environmental, Food and Industrial Microbiology), 1st Edition, Reddy SM, Girisham S, Narendra Babu G, 2017, Scientific Publishers.

Mapping of Course outcomes to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	L	
CO 3		L	H	
CO 4			M	H

MBMM0010: MEDICAL MICROBIOLOGY (3-0-1)

Course Outcomes

Define the role of microflora in human body and its mode of transmission (Remembering).

Explain the mode of microbial pathogenesis in disease causation (Understanding).

Illustrate the differences in bacterial and fungal diseases (Understanding).

Examining different diagnostics methods and treatment options for microbial infections (Analysing).

Module I (5 lectures)

Human Microflora: Normal microbiota in human body, role of resident microbial flora.

Transmission: Routes of transmission, community and nosocomial infections, opportunistic infections

Detection strategies and protocol: Collection, transportation and processing of clinical samples, Quality control of a medical microbiology laboratory

Module II (15 lectures)

Toxigenesis: Account of several virulence factors – pili, fimbriae, flagella, lipopolysaccharide, exo-enzymes, adhesins, capsules and toxins; classification and action of endo-toxins and exo-toxins.

Mechanisms of pathogenesis: adhesion, colonization and invasion of host tissue – mucous membrane of respiratory, enteric and urogenital tracts; role of aggressins, depolymerizing enzymes, organotropisms, pathogenicity islands, cytoskeletal modulation of host cell.

Module III (15 lectures)

Bacterial diseases: Clinical features, transmission, characteristics of causative organism, pathogenesis, laboratory diagnosis, prevention and control of bacterial diseases and clinical syndromes – typhoid fever, cholera, diphtheria, tetanus, meningitis, septic arthritis, conjunctivitis, otitis media, pneumonia, gastroenteritis, urinary tract infections, wound infections, skin and soft tissue infections.

Fungal diseases: Clinical features, transmission, characteristics of causative organism, pathogenesis,

laboratory diagnosis, prevention and control of bacterial diseases and clinical syndromes – Cutaneous mycoses: Tinea pedis (Athlete's foot) Systemic mycoses: Histoplasmosis, Opportunistic mycoses: Candidiasis.

Module IV (10 lectures)

Antibiotic therapy: antibiotic sensitivity assays - Stokes method, Agar dilution method, Broth dilution method, E-strip method, efficacy; pharmacokinetics and side-effects, prophylaxis.

Microbial drug resistance: emergence and evolution of antibiotic resistance, current issues of MDR/XDR microbial strains, resistance tests – phenotypic and molecular, combination therapy.

Suggested Readings

Essentials of Medical Microbiology, 3rd Edition, Sastry AS, Bhat S, 2020, Jaypee Brothers Medical Publishers (P) Ltd.

Review of Medical Microbiology, 27th Edition, Jawitz, Melnick and Adelberg, 2015, Mc Graw Hill education.

Mapping of Cos to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	L	H		

CO 3		M	H	
CO 4			H	H

MBCG0011: CELL BIOLOGY AND GENETICS (4-0-1)**Course Outcomes**

Recall the fundamental concepts of cell biology and genetics (Remembering)

Relate cellular structure to function, physiology and communication (Understanding)

Examine the principles of genetics, mutation and recombination (Analysing)

Compare concepts in cell, developmental biology and genetics (Evaluating)

Module I (9 lectures)

Cell and its organelles: Structure of prokaryotic and eukaryotic cell and their organelle; Cell wall, nucleus mitochondria, chloroplast, ribosome, Golgi bodies, endoplasmic reticulum, lysosome; Plasma membrane: structure, transport across membrane, cell junction, Cytoskeleton and its role in topography, motility. Major cellular processes: protein synthesis, sorting and secretion, respiration and photosynthesis.

Module II (12 lectures)

Organization of genes and chromosomes: Structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin; Concept of gene, operons, gene families; Cell division and cell cycle and its regulation, Uncontrolled cell growth – cell cycle in cancer; oncogenes, tumor suppressor genes; Programmed cell death,; Basic concepts of development: stages and mechanisms of early and late development; differentiation, Stem cells.

Module III (15 lectures)

Cellular communication: General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation. Cell signaling: Hormones and their receptors, cell surface receptor, signal transduction pathways, second messengers and their roles in signal transduction, regulation of signaling pathways.

Module IV (15 lectures)

Mendelian principles: Mendel's laws, concept of allele, multiple alleles, pseudoallele, codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance, expressivity.

Linkage and crossing over, sex linkage, sex limited and sex influenced characters. Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes, maternal inheritance; Genetic disorders, Pedigree analysis; Gene Mapping- linkage maps, molecular markers; Basic principles of population and evolutionary genetics, Quantitative genetics- polygenic inheritance and biostatistics.

Module V (9 lectures)

Fine structure of a gene: Cistron, muton and recon; Basic genome organization (prokaryotic and eukaryotic); Bacterial genetics (transformation, transduction, conjugation)

Mutation: Types, causes and detection, mutant types– lethal, conditional, biochemical, loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy and their genetic implications. Transposable genetic elements;

Recombination: Homologous and non-homologous recombination, including transposition, site-specific recombination.

Suggested Readings

Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, 1st Multicolor Edition, Verma,PS and Agarwal, VK,2005,S. Chand& Co.

Cell and Molecular Biology,8th Edition, deRobertis,EDPanddeRobertis,EMF,2017, Wolters Kluwer Publishing

Principles of Genetics.8th Edition, Gardner, J., Snustad, D. P., Simmons, M. J., 2005, Wiley, India

Cell-A Molecular Approach. 6th Edition, Cooper, GM. and Hausman, RE, 2015, SinauerAssociatesInc.US.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	H	H	H

CO 2	H	H	H		
CO 3				H	H
CO 4	M	M	M	M	M

MBWM0012: WASTE MANAGEMENT (1-0-0)**Course Outcomes**

Choose an appropriate method to segregate and recycle different types of waste (Create)

Formulate a plan on recycling waste towards economic growth (Create)

Basic concepts and principle of waste management; sources of waste; waste management hierarchy; management strategies; challenges and opportunities; contribution to economic growth.

Activities:

Wastewater treatment technologies.

Reuse and recycling of plastic waste.

Solid organic waste conversion.

Preparation of liquid organic fertilizer.

Trainings/Field visit

MBMC0013: MUSHROOM CULTIVATION (1-0-0)**Course Outcomes**

To develop comprehensive understanding basics of mushroom and their importance to humans and environment (Remembering)

To develop skills on techniques of mushroom cultivation and understand global market and demand of mushrooms (Understanding)

To develop skills on preservation techniques for mushrooms, risk and benefits associated (Analysing)

Module I (5 lectures)

Definition of a Mushroom, Mushroom Hunting, Ecological Classification of Mushrooms, Food Supply through Mushroom, Enhance Human Health through Mushroom Derivatives, Benefit the Environment through Mushroom Mycelia

Module II (7 lectures)

Mushroom Cultivation: Both a Science and an Art, World Mushroom Production, Differences in Mushroom Production Patterns,

World Mushroom Market, Nutritive value of mushrooms, Poisonous Mushrooms

Phases of Mushroom Cultivation: Sterilization : Knowledge of General Safety, health and hygiene, Optimum growing condition Substrate: Preparation of beds for cultivation of various mushrooms and its maintenance, Problems in mushroom cultivation & its remedies Cultivation of selected mushrooms: Oyster Mushroom Cultivation, Milky Mushroom Cultivation, Button Mushroom cultivation, Shiitake Mushroom cultivation

Practical aspects: Sterilization process practice, morphological and microscopic identification of mushroom mycelium, Molecular identification of mushrooms, Spore printing technique, Growing and Identification of viable Spawn, microbial analysis of substrate and optimization,

Module III (3 lectures)

Economics of Mushroom cultivation, Post Harvesting care and processing, Packaging and storage

Practical aspects: Visits and trainings to research laboratories and Mushroom farms, mushroom trainings to community people

Suggested Readings

Paul Stamets. Growing Gourmet and Medicinal Mushrooms The Mushroom Cultivator by, 2000, Ten Speed Press

Paul Stamets and J.Chilton. A Practical Guide for Growing Mushrooms at Home, by, 1985, Richmond Publishing Co Ltd

Mapping of Course outcomes

Course Outcomes	Module I	Module II	Module III
CO 1	M		
CO 2		H	
CO 3			H

MBBM0014: BASIC MICROBIOLOGY (2-0-1)**Course Outcomes**

Differentiate and classify a significant number of common bacteria by their salient properties (Understanding).

Compare the nutritional needs of bacteria for growth and their metabolism (Understanding).

Identify key factors of the microbial growth curve and growth kinetics (Applying).

Define the physical and chemical methods of microbial growth control (Remembering).

Module I (5 lectures)

Historical perspective: Discovery of microbial world, Landmark discoveries relevant to the field of microbiology, controversy over spontaneous generation

Microbial taxonomy and diversity: Basis of microbial classification, Haeckel's 3 Kingdom concept, Whittaker's 5 Kingdom Concept, three Domain of Carl Woese, Archaeal taxonomy.

Staining techniques: Basic and acidic dyes, simple and differential staining, negative and positive staining, Grams' staining, acid fast staining, flagella and spore staining

Module II (10 lectures)

Nutritional classification: nutritional groups of bacteria - photoautotroph, photoorganotroph, chemolithotroph (ammonia, nitrite, sulfur, hydrogen, iron oxidizing bacteria), chemoorganotroph; classification based on - oxygen requirement, temperature, pH and salinity - and tolerance.

Microbial growth: Definition of growth and bacterial reproduction, microbial growth curve, mathematical expression of exponential growth phase, measurement of growth and growth yields - spectrophotometric method, microscopic counting, serial dilution and viable cell count, most probable number, synchronous and continuous culture

Microbial cultures: Concept of pure culture, methods of pure culture isolation, enrichment culturing techniques, single cell isolation, and pure culture development.

Culture media: chemically defined, complex, differential, and special selective media.

Transport of nutrients: Microbial nutrient uptake – diffusion, active transport (periplasmic binding protein and ABC transporters), group translocation and protein export system

Module III (10 lectures)

Photosynthesis: characteristics and metabolism of autotrophs, an-oxygenic photosynthetic bacteria and cyanobacteria,

CO₂ fixation and mechanism of photosynthesis

Metabolism: An overview of metabolism, Glycolysis, Pentose-phosphate pathway, Entner- Doudoroff pathway, Citric acid cycle; electron transport system, aerobic and anaerobic respiration.

Endospore – Structure, properties, and germination.

Module IV (5 lectures)

Sterilization: physical and chemical control of bacteria.

Antimicrobials: General characteristics of antimicrobial drugs – antibiotics, antifungals and antivirals,

classification and mode of action, antibiotic susceptibility testing - Kirby-Bauer's disc diffusion method; antiseptics and disinfectants

Suggested Readings

A Textbook on Microbiology, 4th Edition, Dubey RC, Maheshwari DK, 2013, S Chand Publishing.

General Microbiology, 7th Edition, Schlegel HG, 1993, Cambridge University Press.

Mapping of COs to syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV

CO 1	H	H		
CO 2		H	H	
CO 3			H	L
CO 4			L	H

MBIM0015: INFECTION AND MOLECULAR DIAGNOSTICS (3-0-0)**Course Outcomes**

Develop understanding on basic terminology associated with infection and diseases

Understand how far vaccines are effective in reducing the burden of infectious diseases

To understand various challenges faced in the developing world to reduce the burden of infectious disease (Analysing)

To gain knowledge on various types of infectious agents as a means of infection

To understand different mechanism for the transmission, pathology and control of infectious diseases (Understanding)

To understand changing paradigm of global health and strategies towards their control

To understand novel emerging infectious diseases which are constant threat to public health

To understand the problem multidrug resistance and solutions

Gain insights into the role of IPC in control of infections

To develop an understanding on how human-induced environmental changes, such as global warming, deforestation and land-use conversion, urbanization, international commerce, and human migration, are altering the ecology of infectious disease transmission (Evaluating)

To gain knowledge on antigen antibody based immunodiagnostic test as a primary screening for detection of infection

To understand the mechanisms and advancement in the techniques for screening of infectious diseases (Understanding)

To understand problems associated with traditional approaches for detection and how advancement in nucleic acid- based detection method decreased time and increased specificity

To understand the currently available molecular diagnostic approaches for detection of infectious diseases (Understanding)

Module I (10 lectures)

Acute infections, chronic infections, outbreak, epidemic and pandemic, epidemiology, endemicity, reproductive number,

Age dependent pattern of infection, herd immunity

Vaccines-Impact, questions, safety and challenges, disease eradication, Nutrition and infection in developing world

Module II (10 lectures)

Principles of the transmission of the infectious agents (viruses, bacteria, rickettsiae, mycoplasma, fungi, and protozoan),

The role of vectors, reservoirs, and environmental factors

Epidemiology of diarrheal diseases, TB, Hepatitis B, A, C and E, epidemiology and control of Malaria, meningococcal diseases: global problem and solutions, bioterrorism

Module III (15 lectures)

Nipah virus, SARS, COVID-19, Ebola, Plague, Diphtheria, Acute encephalitis syndrome (AES), Hantavirus Pulmonary Syndrome - causes, spread and control; Case studies, endemic, pandemic and epidemic diseases, Zoonotic diseases, Combating emerging infections, Viral mediated cancers, current issues of MDR/XDR microbial strains, concept of DOTS, emergence of antibiotic resistance, gut microbiota in health and disease, Role of Infection prevention and control (IPC)

Module IV (10 lectures)

Immunoelectrophoresis, agglutination, ELISA, immunofluorescence, Immunohistochemistry; Fluorescent Activated Cell Sorter (FACS); Single and double immunodiffusion, Immunofluorescence, RIA, ELISA, Western blot, FACS

Module V (10 lectures)

Non nucleic acid-based methods: Biotyping, Antimicrobial susceptibility testing, serotyping, bacteriophage typing, Nucleic acid- based methods - Agarose gel electrophoresis, RFLP, PFGE, PCR

Suggested Readings

Infectious Diseases, 4th Edition, Jonathan Cohen, William Powderly and Steven Opa, 2016, Elsevier
Oxford handbook of infectious diseases and microbiology, 2nd Edition, Estee Torok, Ed Moran and Fiona Cooke, 2010, Oxford University Press

Molecular diagnosis of infectious diseases, 2nd Edition, Jochen Decker and Udo Reischl, 2004, Springer

Clinical Immunodiagnosics, 1st Edition, Ian C Clift, 2020, Jones & Bartlett Learning

The elements of Immunology, 1st Edition, Fahim Halim Khan, 2009, Pearson Education India

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				
CO 2		M			
CO 3			M		
CO 4				M	
CO 5					M

MBNB0016: NANOBIOLOGY (2-0-0)**Course Outcomes**

To understand the history and concept of nanotechnology (Understanding)

To explain the different types of nanomaterials (Applying)

To compare the different types of methods involved in the synthesis of nanoparticles (Evaluating)

To analyse the properties of nanoparticles by using different instruments (Analysing)

Application of nanotechnology in different fields (Applying)

Module I (5 lectures)

Introduction to nanobiotechnology; History of nanotechnology; Types of nanomaterials- Quantum dots, Carbon based, Metal based, Dendrimer, Composite; Properties of nanomaterials

Module II (13 lectures)

Synthesis of Nanomaterials- Physical, Chemical, Biological (Bacteria, Fungus, Plants); Characterization of nanomaterials- UV-Vis Spectroscopy, Electron microscope- Energy Dispersive X-ray Spectroscopy, Mass Spectroscopy-Types-Nuclear Magnetic Resonance (NMR) Spectroscopy, FT-IR Spectroscopy- X-Ray Diffraction (XRD)

Module III (12 lectures)

Application of Nanotechnology- Drug delivery system; Disease treatment; Agriculture; Food industry; Detection system; Nanotechnology - Environmental and health effects

Suggested Readings

Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials, 1st Edition, Varghese T and Balakrishna KM, 2012, Atlantic

A Textbook of Nanoscience and Nanotechnology, Varghese PI and Pradeep T, 2003, Tata McGraw-Hill Education

Designing Hybrid Nanoparticles, Maria Benelmekki, 2015, Morgan & Claypool Publishers

A Textbook of Nanoscience and Nanotechnology, Bhattacharya SA, 2013, Wisdom Press

Textbook of Nanoscience and Nanotechnology, Murty BS, Shankar P, Raj B, Rath BB and Murday J, 2013, Springer

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H		
CO 2	H		
CO 3		H	

CO 4		H	
CO 5			H

MBIF0018: INDUSTRIAL AND FOOD MICROBIOLOGY (4-0-0)**Course Outcomes**

Recall methods of isolation and screening methods for industrially important microorganisms (Remembering).

Illustrate techniques for scaling of microbial fermentation for food and product formation (Understanding)

Develop methods for production of economically important products and its preservation (Applying).

Categorize important preservation and safety measures for food production in North-east India (Analysing)

Compare the diverse fermented food products and its mode of preparation in tribal population of North-East India (Understanding)

Module I (15 hours)

Microbes: Isolation and Screening of industrially important microorganisms, improvement of microbial strains, qualities of an industrially important microbe, preservation and maintenance of industrial strains.

Fermentation basics: Fermentation medium and sterility, types of fermentation process - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch (e.g. baker's yeast) and continuous fermentations, fermentation kinetics.

Industrial design: Bioreactor – design and components, bioreactor types - Laboratory, pilot- scale and production fermenters, constantly stirred tank and air-lift fermenters, fermentation process control. Post production techniques and down-stream processing.

Module II (15 hours)

Production: Microbial production of industrial products, micro-organisms involved, media formulation, fermentation conditions, upstream and downstream processing and uses - Citric acid, ethanol, penicillin, streptomycin, glutamic acid, Vitamin B12, Enzymes (amylase, protease, lipase), wine, beer.

Biofuel: Production of gaseous fuel – biohydrogen and biomethane; liquid fuel – bioethanol, biodiesel and biobutanol.

Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase).

Module III (15 hours)

Food preservation: Food as a substrate for microbes, microbial growth in food, characteristics of micro-organisms in food, food preservation – physical methods (dehydration, freeze drying, heat and irradiation), chemical methods (chemical preservatives and additives), canning.

Food Spoilage: characterization of contamination and spoilage of cereals, sugar products, vegetables, fruits, meat and meat products, milk and milk products, fish and sea foods, poultry, beer and wines; Spoilage of fermented foods and canned foods. Laboratory testing protocols and biosensors in food industry.

Module IV (15 hours)

Food safety: Microbiological quality standards of food, Food control agencies and their regulations – FDA, EPA, CDC and ISI. ISO and Hazard analysis and Critical Control point (HACCP) system, Food Safety Act and Trade Regulations.

Fermented food: Cultures for food fermentation, fermented foods and their production – bread, cheese, fermented vegetables, dairy products –acidophilus milk, yoghurt, single cell proteins, pickles, oriental foods and beverages, locally fermented alcoholic beverages, probiotics, prebiotics and symbiotic.

Suggested Readings

An Introduction of Industrial Microbiology, 1st Edition, Sivakumaar PK, Joe MM, Sukesh K, 2010, S Chand Publishing.

Food Microbiology, 5th Edition, Frazier WC, Westhoff DC, Vanitha NM, 2014, McGraw Hill Education.

Biotechnology, 1st Edition, Satyanarayana U, Chakrapani U, 2020, Books & Allied Ltd.

Mapping of COs to Syllabus

Course Outcomes	1	2	3	4

CO 1	H			
CO 2	H	H		
CO 3		H	L	L
CO 4			H	H

LABORATORY COURSES**MBCB6011: CELL BIOLOGY AND GENETICS LAB****Course Outcomes**

Recall the theoretical topics in cell biology and genetics (Remembering)

Apply the fundamental concepts of cell biology and genetics in laboratory (Applying)

Analyze data and numerical problems from experiments and interpret results (Analysing)

Syllabus

Methods of cell lysis and staining

Cell imaging and documentation

Study of mitosis and meiosis in plants/cultured cells

Isolation of DNA from animal and plant sources

Agarose gel electrophoresis of isolated genomic DNA

Determination of Tm of DNA

Isolation of auxotrophic mutants by replica plating

Numerical problems in genetics (Mendelian, population and bacterial genetics, mutation, recombination, etc.

Suggested Readings

Cell Biology, Genetics, Molecular Biology, Evolution & Ecology, 1st Multicolor Edition, Verma, PS and Agarwal, VK, 2005, S. Chand & Co.

Cell and Molecular Biology, 8th Edition, deRobertis, EDP and deRobertis, EMF, 2017, Wolters Kluwer Publishing

Principles of Genetics, 8th Edition, Gardner, J., Snustad, D. P., Simmons, M. J., 2005, Wiley, India

Cell-A Molecular Approach, 6th Edition, Cooper, GM. and Hausman, RE, 2015, Sinauer Associates Inc. US.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8
CO 1	H	H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H	H	H
CO 3					H	H	H	H

*P: Practical

MBBM6012: BASIC MICROBIOLOGY LAB**Course Outcomes**

Experiment with different microbial isolation techniques (Applying)

Examine cell structure through microscopy and microbial colonies for identification (Analysing).

Determine the factors that affect microbial growth (Evaluating).

Syllabus

Preparation of various routine laboratory media - differential, selective and enriched.

Isolation of microorganisms by serial dilution method

Isolation of pure cultures by streak plate method

Staining techniques and microscopic examination of bacteria – Gram's staining, negative staining, capsule staining, spore staining, acid fast staining of bacteria

Staining techniques and microscopic examination of fungi – Lactophenol cotton blue

Measurement of microbial growth curve by direct cell count method/turbidity method

Measurement of fungal growth by colony diameter method/biomass method

Preservation of bacterial cells by various techniques

Antibiotic susceptibility testing (disc diffusion/broth microdilution)

Suggested Readings

Practical Microbiology, 3rd Edition, Maheshwari DK, 2002, S Chand Publishing

Experiments in Microbiology, Plant pathology, tissue culture and Microbial Biotechnology, 5th Edition, Aneja KR, 2017, New Age International Publishers.

Mapping of COsto syllabus:

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9
CO 1	H	H	H						
CO 2			M	H	H				
CO 3						H	H	H	H

*P: Practical

MBVM6008: VIROLOGY AND MYCOLOGY LAB

Course Outcomes

Apply the knowledge on bacteriophages to isolate and quantify (Applying)

Learn the technical skills to isolate DNA from phages (Analysing)

Apply the knowledge on fungi to isolate, and identify (Applying)

Learn the technical skills to isolate DNA from fungi (Analysing)

Analyse different nutrients in macro fungi (Analysing)

Syllabus

Isolation of bacteriophage from natural sources

Cultivation and quantification of phages

Isolation of DNA from bacteriophage

Phage identification by PCR

Isolation of fungi from soil

Staining of fungus

Nucleic acid isolation of fungi

Spore printing of fungi

Detection of protein, minerals and vitamins in fungi

Suggested Readings

General Virology, 3rd edition, S. E. Luria, J. E. Darnell, 1978, John Wiley & Sons

Textbook of Virology, 2nd edition, A.J. Rhodes and C.E. Van Rooyen, 1953, The Williams & Wilkins Company

Virus-insect-plant Interactions, 1st edition, Kerry F. Harris, Oney P. Smith, James E, 2001 Duffus, Academic Press Inc

Principles of Virology: Molecular Biology, Pathogenesis, and Control, 1st edition, S. J. Flint, Lynn W. Enquist, Robert M. Krug, Vincent R. Racaniello, 2000, American Society for Microbiology

Introductory Mycology, 4th edition, Constantine J. Alexopoulos, Charles W. Mims, Meredith M. Blackwell, 1996, Wiley

Mapping of outcomes:

Course Outcomes	P 1	P2	P3	P4	P5	P6	P7	P8	P9
CO 1	H								
CO 2		H							
CO 3			H			H		H	
CO4				H			H		
CO5					H				H

*P: Practical

MBEM6009: ENVIRONMENT MICROBIOLOGY LAB

Course Outcomes

Experiment with different protocols for isolation of microbes from natural habitats (Applying)

Examine microbial interactions in soil, water, and plant systems (Analysing)

Evaluate the roles of microbes for its medicinal, plant growth promoting, and degradation properties (Evaluating).

Syllabus

Isolation of microbes (bacteria & fungi) from soil (28°C&45°C)
 Isolation of Cyanobacteria from natural sample
 Isolation of antibiotic producing microbes from soil sample.
 Determination of antimicrobial spectrum of isolate
 Isolation of anaerobic microorganisms
 Isolation of microbes (bacteria & fungi) from rhizosphere and rhizoplane
 Isolation of protease secreting bacteria from soil
 Isolation of xenobiotic compound degrading bacteria by enrichment culture technique
 Assessment of microbiological quality of water
 Microbial biofilm detection
 Isolation and identification of symbiotic bacteroids of *Rhizobium* sp. from root nodules of leguminous plants
 Isolation of phosphate solubilizing bacteria from soil and quantitative measurement of the phosphate solubilisation

Suggested Readings

Practical Microbiology, 3rd Edition, Maheshwari DK, 2002, S Chand Publishing
 Experiments in Microbiology, Plant pathology, tissue culture and Microbial Biotechnology, 5th Edition, Aneja KR, 2017, New Age International Publishers.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
CO 1	H	H	H	H	H	H	H	H	H	H	H	H
CO 2	M	L	H		H	H			L	H	H	H
CO 3			H	H			H	H			H	H

*P: Practical

MBMM6010: MEDICAL MICROBIOLOGY LAB**Course Outcomes**

Developing methods of identification of clinically important microorganisms (Applying).
 Categorize microbes based on their physiology to develop methods for diagnosis (Analysing).
 Assess the response of bacteria to antibiotics by *in vitro* assays (Evaluating).

Syllabus

Biochemical tests – IMViC tests – of enteric bacteria
 Isolation and biochemical characterization of pathogenic bacteria from any clinical sample
 Isolation and biochemical characterization of normal micro flora of skin, throat or oral cavity
 Isolation and identification of fungal pathogens from clinical specimens
 Isolation of hemolytic bacteria using blood agar media.
 Minimum inhibitory concentration (MIC) determination of antimicrobial compound against microorganism
 Isolation and screening of bacterial and fungal cultures for enzyme production – amylase or gelatinase
 Determination of presence of catalase and oxidase activity in bacteria
 Determination of the ability of bacteria to utilize sugars by oxidative or fermentative mode
 Demonstration of sugar fermentation – sucrose, lactose and glucose

Suggested Readings

Practical Microbiology, 3rd Edition, Maheshwari DK, 2002, S Chand Publishing
 Experiments in Microbiology, Plant pathology, tissue culture and Microbial Biotechnology, 5th Edition, Aneja KR, 2017, New Age International Publishers.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
CO 1	H	H	H	H	L		H	H	H	H
CO 2	H	H		M	H		H	H	H	H
CO 3					L	H				

P: Practical*MBIM6015: INFECTION AND MOLECULAR DIAGNOSTICS LAB****Course Outcomes:**

Analyse antibodies by different types of ELISA generated due to microbial infection (Analysing)
 Standardization of Indirect Immunofluorescence assay (Evaluating)
 Demonstrate practical knowledge on Single radial immune diffusion (Analysing)
 Demonstrate practical knowledge on Double immune diffusion method (Analysing)
 Demonstrate practical knowledge on Immunoelectrophoresis (Analysing)
 Standardize antimicrobial susceptibility test and learn analysing its result (Evaluating)

Syllabus

Detection of antimicrobial antibodies by ELISA
 Indirect Immunofluorescence assay
 Single radial immune diffusion
 Double diffusion method of Ouchterlony
 Immunoelectrophoresis
 Rocket electrophoresis
 DOT ELISA for the presence of specific antigen.
 Antimicrobial susceptibility testing

Suggested Readings

Practical Immunology, 4th edition, Drank C. Hay, 2002, Wiley-Blackwell
 Handbook of Practical and Clinical Immunology, 2nd edition, G.P. Talwar and S.K. Gupta, 2017, CBS
 Current diagnosis and treatment in infectious diseases, 2nd edition, Walter R. Wilson and Merle A. Sande, 2013, McGraw- Hill Education

Mapping of Course outcomes:

Course Outcomes	P 1	P2	P3	P4	P5	P6	P7	P8
CO 1	H						H	
CO 2		H						
CO 3			H					
CO4				H				
CO5					H	H		
CO6								H

P: Practical*MBDI6006: DISSERTATION PHASE I (0-0-2)****Course Outcomes**

Develop a scientific mindset with the capacity for analytical and innovative thinking (Creating).
 Develop writing skill, referencing and citations for effective communication (Applying).
 Improve communication and creative expression skills to articulate scientific ideas (Creating).
 Examine the research gap in the related field and formulate strategies to address the same (Analysing).

Syllabus

Familiarization with research topic and methodologies by a thorough literature review.
 Writing of review of literature to brush up already existing knowledge on a given area.
 Formulate a research hypothesis and a proposed workplan.
 Presentation of the research topic at department level and submission of literature review.

Suggested Readings

1. Scientific review and research articles published in respective specialized area of research.

Mapping of Course outcomes to Syllabus

Course Outcomes	P1	P2	P3	P4

CO 1	H	H		
CO 2		H	H	
CO 3		H	H	H
CO 4	L	M	L	H

***P: Practical**

MBDI6007: DISSERTATION PHASE II (0-0-16)

Course Outcomes

Support the research hypothesis with experiments executed ethically (Evaluating).

Develop skill to independently carry out a research in the laboratory (Creating).

Examine the methodology, analyse results, and defend the research work (Analysing).

Syllabus

Execute a scientific dissertation based on the proposed plan in Phase 1 through bench work.

Present and report data at various stages of the research work to the assigned supervisor.

Analysing the results, correlating it with different experiment performed during the dissertation.

Present the findings in a department level to internal and external examiners, and submission of completed thesis.

Suggested Readings

Scientific review and research articles published in respective specialized area of research.

Mapping of COs to Syllabus

Course Outcomes	P1	P2	P3	P4
CO 1	H	L	M	
CO 2	H	M	H	L
CO 3		H	H	H

***P: Practical**

**DEPARTMENT OF BOTANY
MASTER OF SCIENCE IN BOTANY**

MSc COURSE STRUCTURE

SEMESTER I				
Type of Course/Cate- gory	Course Code	Course Name	Credits T-L-P	Page No
Core Course (Theory)	BOMP0021	Mycology and Phycology	4-0-0	1938
Core Course (Theory)	BOBP0022	Bryophytes, Pteridophytes and Gymno- sperms	4-0-0	1940
	BOAN0023	Angiosperms	4-0-0	1941
Core Course (Lab)	BOMP6026	Mycology and Phycology Lab	0-0-3	1970
Core Course (Lab)	BOBA6027	Bryophytes, Pteridophytes and Gymno- sperms and Angiosperms Lab	0-0-3	1971
Value added course	BOBF6035	Bio-Fertilizer Technology	NC	1976
Value added course	BOBC6038	Biomass Conversion, Biorefinery & Circular Bioeconomy	NC	1976
Service Learning	BOSL0100	Service Learning on Ethno Botanical Prac- tices	NC	1979
Total Credits			18	
SEMESTER II				
Core Course (Theory)	BOCM0024	Cell and Molecular Biology	4-0-0	1942
Core Course (Theory)	BOPB0025	Plant Physiology and Biochemistry	4-0-0	1943
Core Course (Theory)	BOPP0026	Plant Microbiology and Plant Pathology	4-0-0	1945
Core Course (Theory)	BOER6031	Environmental Management, Research Methodology and Biostatistics	4-0-0	1946
Core Course (Lab)	BOCB6028	Cell and Molecular Biology and Plant Phys- iology and Biochemistry Lab	0-0-3	1972
Core Course (Lab)	BOPP6041	Plant Microbiology and Plant Pathology Lab	0-0-2	1973
Core Course (Lab)	BOER6033	Environmental Management, Research Methodology and Biostatistics Lab	0-0-2	1973
		MOOCS/NPTEL Course		
Service Learning	BOSL0100	Service Learning on Ethno botanical Prac- tices	NC	1979
Total Credits			23	
SEMESTER III				
Core Course (Theory)	BOCP0027	Cytogenetics and Plant Breeding	4-0-0	1947
Core Course (Theory)	BOBB0029	Biochemicals, Molecular Techniques and Bioinformatics	4-0-0	1949
Core Course (Theory)	BOPE0028	Plant Ecology and Phytogeography	4-0-0	1950
Core Course (Lab)	BOCT6040	Cytogenetics, Molecular Techniques Lab	0-0-2	1974
Core Course (Lab)	BOPE6042	Plant Ecology and Phytogeography Lab	0-0-3	1975
Value added course	BOHM6036	Herbal Medicine	NC	1978
Value added course	BOFI6037	Forest Inventory and Mensuration	NC	1978

Core Course (Lab)	BODI6032	Dissertation Phase I	0-0-4	1975
Service Learning	BOSL0100	Service Learning on Ethno botanical Practices	NC	1979
Total Credits			21	
SEMESTER IV				
		Plant Biotechnology		
Discipline Specific Elective	BOFP0032	Fundamentals of Plant Biotechnology	4-0-0	1951
Discipline Specific Elective	BOAB0033	Advances in Plant Biotechnology	4-0-0	1953
		Genetics and Plant Breeding		
Discipline Specific Elective	BOGT0034	Genetics, Plant Breeding and Transformation	4-0-0	1954
Discipline Specific Elective	BOMB0035	Molecular Genetics and Bioinformatics	4-0-0	1955
		Angiosperm Taxonomy		
Discipline Specific Elective	BOTS0038	Taxonomy of Angiosperms and Biosystematics	4-0-0	1956
Discipline Specific Elective	BOBE0039	Economic Botany and Ethnobotany	4-0-0	1957
		Plant Ecology		
Discipline Specific Elective	BOEG0040	Ecology, Environment and Global concerns	4-0-0	1959
Discipline Specific Elective	BORG0042	Restoration Ecology and Geoinformatics	4-0-0	1960
		Plant Pathology and Microbiology		
Discipline Specific Elective	BOPY0043	Plant Pathology	4-0-0	1962
Discipline Specific Elective	BOMA0044	Microbial Genetics and Applied Microbiology	4-0-0	1963
		Plant Physiology and Biochemistry		
Discipline Specific Elective	BOPP0045	Advanced Plant Physiology	4-0-0	1964
Discipline Specific Elective	BOBM0046	Plant Biochemistry and Metabolism	4-0-0	1966
		Advances in Plant Science		
Discipline Specific Elective	BOBB0047	Biomass, Biorefinery and Circular Bioeconomy	4-0-0	1967
Discipline Specific Elective	BOPD0048	Bioprospecting of Plant Diversity and Automation	4-0-0	1968
Service Learning	BOSL0100	Service Learning on Ethno Botanical Practices		1979
Core Course (Dissertation)	BODI6034	Dissertation Phase II	0-0-10	1976
Total Credits			18	
Total Programme Credits			80	

MASTER OF SCIENCE IN BOTANY DEPARTMENT OF BOTANY

Vision:

To motivate and encourage the students in effective ways to utilize the knowledge of 'Plant Sciences' in order to solve the future needs of Food, Fuel, Energy and Environment for the betterment of mankind and society.

Mission:

The department endeavours to make substantial contribution in the field of 'Plant Sciences' by new research innovations and producing competent students who are not only well versed with the subject but are also better adjusted socially, emotionally and intellectually.

MSC PROGRAM OUTCOMES

- PO 1:** Critical Thinking: Inculcate critical thinking to carry out scientific investigation objectively. Formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge development. Critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.
- PO 2:** Knowledge Skill: Equip the student with skills to analyse problems, formulate a hypothesis, evaluate and validate results, and draw reasonable conclusions thereof. Capacity to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems, rather than replicate curriculum content knowledge.
- PO 3:** Scientific Communication Skills: Imbibe effective scientific and/or technical communication in both oral and writing. Ability to show the importance of the subject as precursor to various scientific developments since the beginning of the civilization.
- PO 4:** Ethics: Continue to acquire relevant knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in the subject concerned. Ability to identify unethical behavior such as fabrication, falsification or misrepresentation of data and adoptive objective, unbiased and truthful actions in all aspects.
- PO 5:** Enlightened Citizenship: Create awareness to become an enlightened citizen with commitment to deliver one's responsibilities within the scope of bestowed rights and privileges.
- PO 6:** Analytical Reasoning: Ability to evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence and examples, and addressing opposing viewpoints.
- PO 7:** Multicultural Competence: Development of a set of competencies in order to enhance and promote the growth of multicultural sensitivity within universities. Integrating multicultural awareness such as race, gender, physical ability, age, income and other social variables, and by creating an environment that is, "welcoming for all students".
- PO 8:** Lifelong Learning: Ability to think, acquire knowledge and skills through logical reasoning and to inculcate the habit of self-learning throughout life, through self-paced and self-directed learning aimed at personal development, and adapting to changing academic demands of work place through knowledge/ skill development/ reskilling.
- PO 9:** Leadership Qualities: Capability for mapping out the tasks of a team or an organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination in a smooth and efficient way.
- PO 10:** Research Skills: Prepare students for pursuing research or careers in industry in concerned subject and allied fields. Capability to use appropriate software to solve various problems and to apply programming concepts of C++ and Mathematica/Matlab to various scientific investigations, problem solving and interpretation.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1: Acquire basic as well as in-depth knowledge on plant science in addition to understanding interdisciplinary fields such as molecular biology, cell culture, bioprocess engineering, computational biology, recombinant DNA technology, statistics etc, and their applications in healthcare, agriculture, environment, and industry.

PSO2: Acquire sound practical knowledge on plant science, molecular biology, microbiology, plant tissue culture, etc, and become well-trained for employment or self-employment.

PSO3: The students would be equipped and well-trained on applied sciences and also empowered to independently develop basic research projects on multidisciplinary fields.

PSO4: The students would be well-prepared for competitive examinations conducted by national and international organisations.

COURSES OFFERED IN M. SC BOTANY

SEMESTER	COURSE CODE	COURSE NAME
I	BOMP0021	Mycology and Phycology
	BOBP0022	Bryophytes, Pteridophytes and Gymnosperms
	BOAN0023	Angiosperms
	BOMP6026	Mycology and Phycology Lab
	BOBA6027	Bryophytes, Pteridophytes and Gymnosperms and Angiosperms Lab
	BOBF6035	Bio-Fertilizer Technology
	BOBC6038	Biomass Conversion, Biorefinery & Circular Bioeconomy
	BOSL0100	Service Learning on Ethno Botanical Practices
II	BOCM0024	Cell and Molecular Biology
	BOPB0025	Plant Physiology and Biochemistry
	BOPP0026	Plant Microbiology and Plant Pathology
	BOER0031	Environmental Management, Research Methodology and Biostatistics
	BOCB6028	Cell and Molecular Biology and Plant Physiology and Biochemistry Lab
	BOPP6029	Plant Microbiology and Plant Pathology Lab
	BOER6033	Environmental Management, Research Methodology and Biostatistics Lab
		MOOCS/NPTEL Course
	BOSL0100	Service Learning on Ethno botanical Practices
III	BOCP0027	Cytogenetics and Plant Breeding
	BOBB0029	Biochemicals, Molecular Techniques and Bioinformatics
	BOPE0028	Plant Ecology and Phytogeography
	BOCT6040	Cytogenetics and Molecular Techniques
	BOPE6042	Plant Ecology and Phytogeography Lab
	BOHM6036	Herbal Medicine
	BOFI6037	Forest Inventory and Mensuration
	BOSL0100	Service Learning on Ethno botanical Practices
	BODI6032	Dissertation Phase I
IV	BOFP0032	Fundamentals of Plant Biotechnology
	BOAB0033	Advances in Plant Biotechnology
	BOGT0034	Genetics, Plant Breeding and Transformation

BOMB0035	Molecular Genetics and Bioinformatics
BOTS0038	Taxonomy of Angiosperms and Biosystematics
BOBE0039	Economic Botany and Ethnobotany
BOEG0040	Ecology, Environment and Global concerns
BORG0042	Restoration Ecology and Geoinformatics
BOPY0043	Plant Pathology
BOMA0044	Microbial Genetics and Applied Microbiology
BOPP0045	Advanced Plant Physiology
BOBM0046	Plant Biochemistry and Metabolism
BOBB0047	Biomass, Biorefinery and Circular Bioeconomy
BOPD0048	Bioprospecting of Plant Diversity and Automation
BODI6034	Dissertation Phase II
BOSL0100	Service Learning on Ethno botanical Practices
	MOOCS/NPTEL Course

Mapping of Courses to POs and PSOs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PSO 1	PSO 2	PSO 3	PSO 4
BOMP0021	M	H	L	L	L	L	M	M	L	H	H	H	H	H
BOBP0022	H	H	M				L	H		H	H	M	H	H
BOAN0023	H	H	H	M	M	M	M	H	H	H	H	M	H	L
BOMP6026	M	L	L	L	L	H	L	H	M	M	H	H	H	H
BOBA6027	H	H	M				L	H		H	H	M	H	H
VAC	L	H	M					M		M	M		M	L
VAC	H	H	H	M	M	M	M	H	H	H	H	M	H	L
BOCM0024	H	M									H		H	H
BOPP0026	M	H	L	L	L	L	M	M	L	H	H	H	H	H
BOER0031	H	M				M					H		H	L
BOPB0025	H	H	H	H	H	H		H	M	H	H	H	H	H
BOCB6028	H	H	H	H	H	H		H	M	H	H	H	H	H
BOPP6029	M	L	L	L	L	H	L	H	M	M	H	H	H	H
BOER6033	H	M		L			L		M		H		H	L
BOCP0027	H	H						M		M	H	M	M	M
BOPE0028	H	H	M	L	L	M	M	H	M	H	H	M	H	H

BOBB0029	H	H	H	M	M	H	L	M	M	H	H	H	H	H
BOTC0030	H	H	H	H	H	H	H	H	M	H	H	H	H	H
BOPE6030	H	H	M	L	L	M	M	H	M	H	H	M	H	H
BOCT6031	H	H	H	L	M	H	L	M	M	M	H	H	H	H
VAC	H	H	M	L		L	M	H	M	H	H	M	H	H
BOFP0032	H	H	H	H	H	H	H	H	M	H	H	H	H	H
BOAB0033	H	H	H	H	H	H	H	H	M	H	H	H	H	H
BOGT0034	H	M									H	H	H	L
BOMB0035	H	M									H	H	H	L
BOTS0038	H	M	M								M		M	L
BOBE0039	M	M	M									M	M	L
BOEG0040	H	H	M	L		M	M	H	M	H	H	M	H	H
BORG0042	H	H	M	L		M	M	H	M	H	H	M	H	H
BOPY0043	M	H	H	H				M		M	M	H	H	M
BOMA0044	H	H	H	M				M		H	M	H	M	M
BOPP0045	H	H	H	H	H	H		H	M	H	H	H	H	H
BOBM0046	H	H	H	H	H	H		H	M	H	H	H	H	H
BOBB0047	H	H	H	M	M	M	M	H	H	H	H	M	H	L
BOPD0048	H	H	H	M	H	H	L	H	H	H	H	H	H	H

Detail Syllabus

THEORY COURSES

BOMP0021: MYCOLOGY AND PHYCOLOGY

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course outcomes

At the end of this course, student will be able to:

Understand general characteristics, classification and economic importance of fungi and algae
(Remembering)

Able to compare the vegetative and reproduction structures among groups of fungi and algae
(Understanding)

Able to tell the importance of algae in environment and agriculture (Evaluating)
Develop scientific skill sets in and implement in agriculture (Applying)

Module I: Introduction (4 Hours)

Introduction, history, general features and economic importance of fungi

Module II: Classification of fungi (20 Hours)

Myxomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina - important features; thallus organizations; modes of reproduction

Module III: Role of Fungi in agriculture and environment (4 Hours)

Mycorrhizal associations and Lichens-their importance to agriculture and environment; Fungi as bio-fertilizers

Module IV: Introduction to algae (4 Hours)

History; general description; systems of classification and economic importance of algae

Module V: Classification of algae (20 Hours)

Classification (Cyanophyta, Chlorophyta, Phaeophyta, Rhodophyta, Xanthophyta, Chrysophyta, Bacillariophyta, Pyrrophyta, Euglenophyta, Eustigmatophyta, Prasinophyta and Prochlorophyta); cell structure; thallus organization and mode of reproduction in algae

Module VI: Role of algae in agriculture and environment (4 Hours)

Algal blooms - its importance; Algae as feed; bio-fertilizers; pollution indicators

Module VII: Research on Fungi and algae (4 Hours)

Current and future research; Future prospects/scopes in these areas

Suggested Readings:

Alexopoulos CJ, Mims CW, Blackwell M. Introductory Mycology, Wiley.
Dube HC. An Introduction to Fungi, Scientific Publishers.
Aneja KR, Mehrotra RS. Introduction to Mycology, New Age International Publisher.
Peterson JH. The Kingdom of Fungi, Princeton University Press.
Smith AL. Lichens, Wentworth Press.
Sharma, O.P. Algae, McGraw-Hill Education.
Van Den Hoek, C., Mann, D. G. and Jahns, H.M. Algae: An Introduction to Phycology, Cambridge University Press.
Bilgrami, K.S. and Saha, L.C. A textbook of Algae, CBS.
Lee, R.E. Phycology, Cambridge University Press.
Bellinger, E.G. and Sigeo, D.C. Freshwater Algae: Identification, Enumeration and use as Bioindicator, Wiley Blackwell.
Dutta, T.C. and Dutta, A. C. A Class-Book of Botany. Oxford University Press

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	M		H	M		L
CO2	L	H		L	H		L
CO3		M	H		M	H	L
CO4	L	M	H	L	M	H	H

BOBP0022: BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS**(4 Credits-60 Hours) (L-T-P: 4-0-0)****Course Outcomes:**

At the end of this course, student will be able to:

Summarize the general characteristics, morphological and reproductive diversity among different groups of Bryophytes (Understanding)

Compare the general characteristics, morphological and reproductive diversity among different groups of Pteridophytes (Understanding)

Interpret the general characteristics, morphological and reproductive diversity among different groups of Gymnosperms (Understanding)

Identify the different economic importance of the Bryophytes, Pteridophytes and Gymnosperms (Applying)

Infer fossils and fossilization (Understanding)

Module I: Bryophytes (20 Hours)

General introduction, Classification of Bryophytes; evolutionary history and phylogenetic characterization of bryophytes; comparative account of gametophyte and sporophyte structure of *Hepaticopsida*, *Bryopsida* and *Anthocerotopsida*; Peristome structure and its significance in the classification of Mosses; Economic importance of Bryophytes

Module II: Pteridophytes (20 Hours)

General introduction, Classification and range of thallus of Pteridophytes; evolutionary history and phylogenetic characterization of pteridophytes; Early vascular plants; A brief account of the following classes of Pteridophytes: *Psilotopsida*, *Lycopsida*, *Sphenopsida*, *Pteropsida*; Telome concept, apogamy and apospory, heterospory and seed habit; Economic importance of Pteridophytes

Module III: Gymnosperms (15 Hours)

General introduction, Classification of Gymnosperms; Comparative study of *Cycadales*, *Ginkgoales*, *Coniferales*, *Ephedrales*, *Welwitschiales* and *Gnetales*; Economic importance of Gymnosperms

Module IV: Paleo-botany (5 Hours)

Introduction, Fossils, Kinds of fossils and process of fossilization; Geological time scale; Importance of fossils

Suggested Readings:

Alam, A. Textbook of Bryophyta, I K International Publishing House Pvt Ltd.

Johri, R.M, Lata, S, Tyagi, K. A Textbook of Bryophyta, Dominant Publishers and Distributors (Cornell University).

Vashishta, P.C., Sinha, A.K. and Kumar, A. Botany for Degree Students-Pteridophyta, S. Chand.

Mitra, J.N, Mitra, D. and Chowdhury, S.K. Studies in Botany (Vol I & Vol II), Moulik Library.

Sharma, O.P. Pteridophyta, McMillan India Limited.

Rashid, A. An Introduction to Pteridophyta, South Asia Books.

Verma, H.K.A Textbook of Pteridophyta. Random Pub.

Bhatnagar, S.P. Gymnosperms, New Age International Publishers

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			

CO2		H		
CO3			H	
CO4	M	M	M	
CO5				H

BOAN0023: ANGIOSPERMS
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Understand the concepts of plant identification, classification nomenclature (Understanding)

Understand the general morphology and distinguishing characteristics of different angiosperm families (Understanding)

Identification of dicotyledons and monocotyledons plants with reference to specific key characters (Applying)

Understand the internal organization of the tissue and cell structure of both vegetative and floral parts of angiosperm plants (Understanding)

Understand the development of gametophytes, fertilization, endosperm, embryo, apomixis and parthenocarpy in angiospermic families (Understanding)

Application of anatomy and embryology in taxonomy (Applying)

Module I: Taxonomy (12 Hours)

History of plant taxonomy; Methods of Plant identification; Taxonomic Keys: Single access and Multi-access; Field inventory; Collection; Herbaria: Functions of Herbarium, Preparation of Herbarium; Major systems of classification: Cronquist (1981); Takhtajan's System (1997), APG IV (2016) (merits and demerits). Principles and rules of Botanical

Nomenclature

Module II: Morphology (8 Hours)

Vegetative Characters: Modified Roots and Stems; Leaf Phyllotaxy, Vennation; Trichomes. Reproductive Characters:

Floral parts, Arrangements of flowers on the floral axis, Unisexual and Bisexual Flowers, Variation in fruit surface,

Placentation, Variation in seed coats

Module III: Angiospermic Families (15 Hours)

Dicotyledons: Magnoliaceae, Annonaceae, Tiliaceae, Sterculiaceae, Rutaceae, Meliaceae, Vitaceae, Sapindaceae, Anacardiaceae, Fabaceae, Caesalpinaceae, Mimosaceae, Oleaceae, Apocynaceae, Asclepiadaceae, Boraginaceae, Scrophulariaceae, Bignoniaceae, Acanthaceae, Euphorbiaceae, Moraceae. Monocotyledons: Orchidaceae, Musaceae, Araceae, Commelinaceae, Zingiberaceae, Cyperaceae, Poaceae

Module IV: Anatomy (10 Hours)

Meristem, Classification of meristems; Permanent tissue; Theory of shoot apical meristem and root apical meristem; Origin, structure and function of cambium; Primary and secondary structure of root and stem, Anomalous secondary growth in roots and stems. Cork cambium and its derivatives, function of cork and abscission layers. General structure of plants; cell wall, stomata and secretory structure; Anatomy of floral organs; Anatomy in relation to taxonomy

Module V: Embryology (15 Hours)

Structure of microsporangium, microsporogenesis and development of male gametophyte; Structure of ovule, megasporogenesis and development of female gametophyte; Pollen-Pistil interaction; Fertilization and its control; Endosperm types, structure and functions; Dicot and monocot embryo; Embryo endosperm relationship; Polyembryony and its induction, Apomixis, causes and significance; Parthenocarpy; Embryology in relation to taxonomy

Suggested Readings:

Pandey, B.P. A textbook of Botany: Angiosperms S. Chand.
 Sharma, O.P. Plant Taxonomy McGraw-Hill Education
 Nair, R. Taxonomy of Angiosperms APH Publishing Corporation
 Singh, G. Plant Systematics: An Integrated Approach. CRC Press.
 Lawrence, G.H.M. Taxonomy of Vascular Plants Scientific Publisher.
 Subramanyam, N.S. Modern Plant Taxonomy. Vikas Publishing House Pvt. Ltd. New Delhi.
 Sambamurty, A.V.S.S. Taxonomy of Angiosperms. I. K. International Publishing House Pvt. Ltd., New Delhi.
 Verma, B.K. Introduction to Taxonomy of Angiosperms. PHI Learning Private Limited, New Delhi.
 Pandey, B.P. Plant anatomy, S. Chand & Co., New Delhi
 Esau, Anatomy of Seed Plants. John Wiley & Sons, New York.
 Grewal, Plant anatomy. Campus Books International, New Delhi.
 Maheshwari, An Introduction to Embryology of Angiosperms. Tata McGraw Hill Publishing Co., New Delhi.
 Bhojwani, S.S., Bhatnagar, S.P. and Dantu, P.K. The Embryology Angiosperms, Vikas Publishing

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3			H		
CO4				H	
CO5					H
CO6				M	M

BOCM0024: CELL AND MOLECULAR BIOLOGY (4 Credits-60 Hours) (L-T-P: 4-0-0)**Course Outcomes**

At the end of this course, student will be able to:

Memorize the key concepts of cell and its structural organization (Remembering)
 Analyse the process of DNA replication and compare various repair mechanism (Analysing)
 Gain better understanding of gene cloning and DNA libraries (Understanding)
 Understand the basics of gene cloning and importance of genome evolution (Understanding)

Module I: Basics of Cell (4 Hours)

Cell: Concept, structural organization of plant cell.

Module II: Cellular Organelles: Their Organizations and Functions (15 Hours)

Mitochondria: structure, genome organization, protein import and mitochondrial assembly. Chloroplast: structure, genome organization, import and sorting of chloroplast proteins. Endoplasmic reticulum: structure, translocation of secretory proteins across ER membrane, insertion of protein into ER membrane,

protein folding and processing. Golgi apparatus: organization, protein glycosylation, protein sorting and export from Golgi, the vesicular transport mechanism. Nucleus: nuclear envelope, nuclear pore complex, trafficking between nucleus and cytoplasm.

Module III: Gene and Genome (6 Hours)

Gene and genome: fine structure of gene, genome organization

Module IV: Enzymes for Gene Manipulations (7 Hours)

DNA/gene manipulating enzymes, restriction enzymes: endonuclease, exonuclease, types of endonucleases, recognition sequences, ligase, polymerase, phosphatase, transcriptase, transferase, topoisomerase

Module V: DNA Replication (7 Hours)

Various models, enzymes for replication, structure of DNA polymerase, speed of replication, collaboration of proteins, process and termination of replication

Module VI: DNA Damage and Repair Mechanism (6 Hours)

Basic concept, types of DNA damage thymine dimer, 6-4 photoproducts, photo-reactivation, excision repair

Module VII: Transposons and Genetic Recombination (8 Hours)

Mobile genetic elements: Insertion elements, transposons. Genetic recombination: Holliday, Potter & Dressler, Meselson and Radding and Szostak model of genetic recombination

Module VIII: Basics of Gene Cloning (7 Hours)

Gene cloning: cloning vectors (types and characteristics), molecular cloning and construction of DNA libraries

Suggested Readings:

Lewin. Genes. Published by Pearson Prentice Hall

Albert. Molecular Biology of Cell

Singh, B. D. Fundamentals of Genetics Kalyani Publications

Brown TA. Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing

Watson J. Molecular Biology of Gene

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	H	H	L	L	L		H	L
CO2		L			H	H		
CO3	L					M	L	H
CO4		L	H	M				M

BOPB0025: PLANT PHYSIOLOGY AND BIOCHEMISTRY (4 Credits-60 Hours) (L-T-P: 4-0-0)

Course outcomes

At the end of this course, student will be able to:

Explain the concepts of plant water relation, transpiration, mineral nutrition, uptake and translocation of nutrients (Understanding)

Understand the process of photosynthesis and respiration (Understanding)

Analyze the role of photoreceptors, growth regulators in different physiological process and plants respond towards abiotic stress (Analyzing)

Explain the concepts of thermodynamics, enzyme kinetics and biomolecule metabolism (Understanding)

Module I: The Basic Concept and Transport Mechanism (4 Hours)

Water potential, theories supporting uptake of water: Bose theory, cohesion-adhesion theory, Comparison of xylem and phloem transports, phloem loading and unloading, passive and active transports

Module II: Photosynthesis and Transpiration (14 Hours)

Cyclic and non-cyclic photophosphorylation. PSI and PSII system, stages of photosynthesis, light reaction and dark reaction. C3, C4 and CAM pathways, photorespiration, photophosphorylation, factors effecting photosynthesis, types of transpiration, mechanism and factors effecting transpiration

Module III: Sensory Photobiology and Growth Hormones (8 Hours)

Discovery of phytochromes and cryptochromes and their photochemical and biochemical properties, molecular mechanism of action of photo morphogenetic receptors, physiological effects and mechanism of action of plant growth hormones, signal transduction and gene expression

Module IV: Photoperiodism and Physiological Stress (6 Hours)

The flowering process: endogenous clock and its regulation, ABA model physiological responses to abiotic stresses:

light, temperature, water and salts; acclimation of physiological processes under abiotic stresses

Module V: Thermodynamics and Bioenergetics: (8 Hours)

Laws of thermodynamics, Gibbs Free Energy, enthalpy, entropy, energy change in coupled reactions energy rich phosphate compounds, energetics of metabolic processes, energy rich phosphate compounds, ATP as universal currency of energy, ATP synthesis

Module VI: Properties of Water and Enzyme Kinetics (10 Hours)

Dissociation of water, ion product of water, pH, ionization of weak bases, biological buffers Henderson-Haselbach Equation. prosthetic groups and co-enzyme, mechanism of catalysis, kinetics, Michaelis-Menten Equation, bisubstrate reaction, active sites, factor contributing to catalytic efficiency, enzyme inhibition, regulatory enzyme, ribozyme

Module VII: Metabolism of Biomolecules (10 Hours)

Structures and functions of amino acids, peptides and proteins. lipid: synthesis of saturated and unsaturated fatty acids, oxidations of fatty acid. Carbohydrate- classification, structures, functions, biosynthesis and metabolism. glycolysis, gluconeogenesis, and the pentose phosphate pathway assimilation, transportation and metabolism of sulphur in plants

Suggested Reading:

Davies PJ. Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition, Kluwer Academic Publisher, Dordrecht, The Netherlands.

Nelson DL. and Cox MM. Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, USA.

Jordan BR. The Molecular Biology and Biotechnology of Flowering, 2nd Edition, CAB International, Oxfordshire, U.K.

Taiz L and Zeiger E. Plant Physiology, 4th Edition, Sinauer Associates Inc. Publishers, Massachusetts, USA.

Lodish H, Berk A, Kaiser CA and Krieger M. Molecular Cell Biology, 6th Edition, W.H. Freeman and Company, New York, USA.

Mapping of COs to Syllabus:

Course Out-comes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H	M				L	
CO2		H		L			L
CO3	M		H	H			
CO4	L		M		H	H	H
CO5		M	H	M	M	L	H

BOPP0026: PLANT MICROBIOLOGY AND PLANT PATHOLOGY
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Classify various microorganisms and their reproduction and isolation methods (Understanding)

Analyze the roles of microorganisms in environment (Analyzing)

Identify and detect microbial plant diseases and decide control strategies (Applying)

Asses and apply post-harvest controls measures and techniques (Evaluating)

Module I: Introduction to microbial world and microscopy (6 Hours)

A brief history of microbiology and its evolution; Microscopy-principle, types and applications

Module II: Microbial diversity and applications (10 Hours)

Bacteria & Archaeobacteria: properties, classification, nutritional types; Viruses- properties and classification, prions and bacteriophages; Role of microorganisms in the environment

Module III: Isolation and cultivation of bacteria and viruses (10 Hours)

Types of nutritional media (Liquid & solid), types of bacterial cultures- batch, continuous and synchronous, growth curve and pure culture of microorganism; Isolation methods of bacteria, virus and phages

Module IV: Microbial Genetics and its life cycle (8 Hours)

Genome organization in microorganism (DNA, RNA, Plasmids); mechanisms of transformation, conjugation and transduction in bacteria; Life cycle of viruses and bacteriophages

Module V: An insight into Plant Pathology (8 Hours)

Historical and developmental aspects of plant pathology, mode of infection and role of enzymes and toxins in plant disease, defense mechanisms of plants against infection

Module VI: Plant diseases & control measures (12 Hours)

Study of plant diseases caused by fungi, bacteria, viruses, nematodes and mycoplasma; approaches for plant disease control- cultural, chemical, biological, bio pesticides, breeding for resistant varieties, plant quarantine, integrated pest management; molecular and transgenic approach for crop protection

Module VII: Post-harvest Management (6 Hours)

Post-harvest pathology: Fungal deterioration of food commodities, mycotoxins and health hazards, control measures; overview of integrated pest management

Suggested Reading:

Pelczar MJ. Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
 Prescott L, Harley JP, Klein DA. Microbiology, McGraw Hill, India. 6th edition.
 Campbell NA, Reece JB, Urry. A., Cain L, Wasserman SA, Minorsky PV, Jackson
 Mehrotra RS, Aggarwal A. Plant Pathology, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd.
 Singh RP. Plant Pathology, 2nd Edition, Kalyani Publishers.
 Mehrotra RS, Aggarwal A. Fundamentals of Plant Pathology, Tata McGraw-Hill Publishing Company Ltd.
 Sambamurthy AVSS. A textbook of Plant Pathology, Dreamtech Press, Wiley.
 Gour HN. Physiological and Molecular Plant Pathology, Scientific Publishers India.
 Dickinson M. Molecular Plant Pathology, Garland Science

Mapping of COs to syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	M	M	H		L	M	
CO2	L	H			M	M	M
CO3			M	L	M	H	
CO4				M	M	M	H

BOER0031: ENVIRONMENTAL MANAGEMENT, RESEARCH METHODOLOGY & BIOSTATISTICS
(4 Credits-60 Hours) (L-T-P: 4-0-0)
Course Outcomes

At the end of this course, student will be able to:

Acquire the concepts of Environmental Management and Environmental Impact assessment (Understanding)

Understand the salient features of EIA and safety norms (Understanding)

Identify and argue the complex issues inherent in selecting a research problem, selecting an appropriate research design and implementing a research project (Applying)

Understand the principal concepts in biostatistics (Understanding)

Analyze the concepts of scientific research problems and its solutions (Analyzing)

Module I: Basics of Environmental Management & Impact Assessment (10 Hours)

Introduction and scope of environmental management; basic concepts of sustainable development; Environmental impact assessment (EIA); general guidelines for the preparation of environmental impact statement; scope and types of environmental audit; energy audit; cost benefit analysis

Module II: Environmental Management Plans and Safety Norms (10 Hours)

Environmental management plan; ISO 14000 standards and certification; environmental risk management and environmental safety norms; International summits and treaties related with environment

Module III: Introduction to Research Methodology (10 Hours)

Definition; basic and applied research; interdisciplinary research; Discriminative reading; reading and reviewing scientific literature; biological abstract; review; monograph; peer-reviewed journals; e-resources; research and review articles

Module IV: Introduction to Research Problems, Communication and Ethics (10 Hours)

Definition of scientific problems; scientific papers and posters; Introduction to ethics, scientific conducts and misconduct; plagiarism; authorship issues; ethics of animal and human research

Module V: Introduction to Biostatistics (5 Hours)

General concepts and terminology; measures of location; scale and shape; mean, median, mode, standard deviation, standard error and coefficient of variance; Binomial, Poisson and Normal distribution

Module VI: Hypothesis Tests, Multivariate Analysis and Sampling Design (15 Hours)

Contingency tables and chi-square test; comparison of means: t-test, multiple range tests, F-test, Run test, sign test, Karl Pearson coefficient of correlation, Kruskal-Wallis H test and Mann-Whitney U-test, Analysis of variance; Correlation and regression analysis; Introduction to multivariate methods; Sampling methods; Simple experimental design

Suggested Readings:

Gupta SC, Kapoor, V.K. Fundamentals of Mathematical Statistics, 11th Edition, Sultan Chand & Sons
 Krishnan V. Statistics for Beginners, Atlantic Publishers & Distributors Pvt. Ltd.
 Fuller WA. Sampling Statistics, Wiley.
 Easterling RG. Fundamentals of Statistical Experimental Design and Analysis, Wiley
 Bhattacharyya, D. K. (2005): Research Methodology, Excel Books, New Delhi
 Ahuja, R. (2001): Research Methods, Rawat Publications, Jaipur and New Delhi
 Sulphrey, M.M. and Safeer, M.M. (2015). Introduction to Environment Management (3rd edn.).
 PHI Learning Pvt.Ltd, New Delhi.
 Tiwari, M., Khulbe, K. and Tiwari A. (2007) Environmental Studies. I.K. International, New Delhi

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	L				
CO2	L	H				
CO3			H	H		L
CO4					H	
CO5				L	L	H

BOCP0027: CYTOGENETICS AND PLANT BREEDING

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Infer eukaryotic genome organization structure of nucleosome, its assembly and deassembly (Understanding)

Summarize the cytogenetics of haploids and their uses in plant breeding (Understanding)

Compare euploids with aneuploids and explain chromosomal banding patterns (Understanding)

Illustrate the role of plant breeding and transgenic research in crop improvement (Understanding)

Outline the various methods of gene transfer (Understanding)

Compare the different types of DNA and also interpret gene mapping (Understanding)

Module I: Overview of Gene and Genome Organization (10 Hours)

Organization of eukaryotic genetic material, Chromatin organization and replication: Chemical constituents-DNA and histones, nucleosome and higher order organization, DNA packaging and genetic activity, nucleosome assembly and deassembly, DNA content and adaptability, nuclear DNA and C-value paradox

Module II: Cytogenetics of Haploids (8 Hours)

Haploidy/monoploidy, meiosis and breeding behaviour of haploids, uses of haploids in plant breeding and genetic studies

Module III: Euploidy and Aneuploidy (10 Hours)

Induction and characterization of monosomics, trisomics and nullisomics, aneuploid gene mapping, inheritance pattern in autopolyploids, status of allopolyploids in plant evolution

Module IV: Chromosomal banding (6 Hours)

Chromosome banding patterns: Linear differentiation of chromosome segments, types of chromosome banding, uses of chromosome banding in cytogenetics

Module V: Plant Breeding and Crop Improvement (10 Hours)

Objectives and scope of plant breeding, hybridization in self- and cross-pollinated crops, genetic basis of inbreeding depression and heterosis, breeding for disease and insect resistance, transgenes and transgenic plants, bio-safety concerns & regulation of transgenic crops in India

Module VI: Gene Transfer Technology (6 Hours)

Alien gene transfer through chromosome: Transfer of gene through individual chromosome, characterization and utility of alien addition and substitution lines

Module VII: Types of DNA and Gene Mapping (10 Hours)

Repetitive DNA, split genes, overlapping genes, physical and genetic mapping using molecular markers

Suggested Reading:

Allard RW. Principles of Plant Breeding (2nd Edition), John Wiley and Sons

Hartwell LH, Hood L, Goldberg ML, Reynolds AE, Silver LM, Veres RC. Genetics –From Genes to Genomes, 3rd edition, McGraw Hill.

Acquaah G. Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. USA.

Hartl DL and Jones EW. Genetics – Analysis of Genes and Genomes, 7th edition, Jones and Barlett publishers.

Lewin B. Genes IX, Jones and Barlett Publishers.

Strickberger MW. Genetics, 3rd Edition, Pearson (Prentice Hall).

Mapping of COs to Syllabus:

Course Out-comes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H						
CO2		H					
CO3			H	H			
CO4					H		
CO5						H	
CO6							H

BOBB0029: BIOCHEMICALS, MOLECULAR TECHNIQUES & BIOINFORMATICS
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Interpret different molecular biology techniques (Understanding)

Compare various blotting techniques, summarize spectrometry and spectroscopy (Understanding)

Interpret RNAi (Understanding)

Demonstrate various chromatographic and microscopic techniques (Understanding)

Utilize the knowledge on bioinformatics to use various biological databases and software (Applying)

Module I: An introduction to Molecular Biology: methods & techniques (15 Hours)

Isolation and purification: Genomic and plasmid DNA; RNA; proteins. Electrophoresis: Polyacrylamide gel electrophoresis (PAGE), agarose gel electrophoresis, native PAGE, SDS- PAGE, 2D electrophoresis. DNA amplification and genome mapping: PCR, RT-PCR, RFLPs, RAPD, AFLP, SSR, ISSR, SNP, Isoelectric focusing (IEF): Principles, kinds of pH gradients used in IEF- free carrier ampholytes, immobilized pH gradients, genome expression analysis: Microarray, EST, SAGE. DNA sequencing: Various methods of DNA sequencing, protein and whole genome sequencing strategies. Isolation, separation and analysis of carbohydrate and lipid molecules, Bar-coding with references to plants

Module II: Immunotechniques & Biophysical methods (10 Hours)

Blotting: Principles, types of blotting, immunoblotting- Southern, Northern, Western and Dot blots, FISH, GISH, Mass spectrometry: GC-MS, LC-MS, Spectroscopy: basic concept, NMR & ESR spectroscopy

Module III: Basic principle of Gene silencing (5 Hours)

Gene silencing: RNA interference (RNAi)

Module IV: Chromatographic techniques (10 Hours)

Chromatography: Gel filtration, ion exchange & affinity chromatography, paper chromatography, TLC, HPLC, GC- basic concept

Module V: Microscopic techniques (10 Hours)

Resolving powers of different microscopes, Microscopy: Phase contrast, confocal, fluorescence, scanning & transmission electron microscopy

Module VI: Bioinformatics (10 Hours)

Basic concepts of computer hardware; Operating systems-Windows, Unix and Linux; use of common application software in biology: word processing, spread sheets, graphics and database; introduction to web browsing software and search engines with special reference to online bioscience resources; database, sequence analysis, phylogenetic inference package, sites and centres, Primer designing using various softwares, BLAST

Suggested Reading:

Hofmann A. Wilson and Walkers Principles and Techniques Of Biochemistry And Molecular Biology, 8th South Asia Edition, Cambridge University Press.

Carson S, Miller HB, Witherow DS. Molecular Biology Techniques: A Classroom Laboratory Manual, 4th Edition, Elsevier.

Agrawal and Suraksha. Techniques in Molecular Biology, 2008 Edition, IBDC Publishers.

Bajpai PK. Biological Instrumentation & Methodology, S. Chand.

Lesk AM. Introduction to bioinformatics, 4th Edition, Oxford Attwood TK, Parry-Smith DJ. Introduction to Bioinformatics, Pearson India

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H					
CO2		H				
CO3			H			M
CO4				H	H	H

BOPE0028: PLANT ECOLOGY AND PHYTOGEOGRAPHY

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Understand the concepts and scope of ecology (Remembering).

Understand about the fundamental structural and functional aspect of ecosystem (Understanding)

Analyze the characteristic feature of plant population, dynamics and interrelationships (Analysis)

Understand the concept of community, concept of climax, ecological succession (Understanding).

Understanding the concept of ecological stability and perturbations (Understanding)

Acquire detail knowledge on plant diversity, its status and threats, strategies for conservation (Remembering)

Understanding the concept of phytogeography and phyto-geographical division of India (Understanding)

Module I: Introduction to Ecology and Ecological Organization (12 Hours)

Introduction to ecology, scope of ecology, Ecosystem: concept, components and organization, structure and functions of ecosystem, energy dynamics (trophic organization, energy flow pathways, ecological efficiencies), eco-physiology, ecosystem nutrient cycles, ecological niche, ecosystem types, major ecosystems of the world

Module II: Population Ecology (14 Hours)

Population Ecology: Characteristics of population, population growth curves, population size and density, spatial distribution, Age structure, natality, mortality, biotic potential; life history strategies (r and k selection), population dynamics, competition and coexistence, population interaction, Intra-specific interactions, interspecific interactions, Mutualism and commensalism, Prey-predator interactions, Scramble and contest competition.

Module III: Community Ecology and Ecological Succession (12 Hours)

Concepts of community, species diversity and pattern diversity in community, Ecological succession: Trends of succession, Types and general process of succession, models and mechanisms of ecological succession, concept of climax, community evolution

Module IV: Ecosystem Stability (10 Hours)

Concept (resistance and resilience); ecological perturbations (natural and anthropogenic) and their impact on plants and ecosystems; ecology of plant invasion

Module V: Biodiversity and Phytogeography (12 Hours)

Plant diversity: Concept, status in India, utilization and concerns, Loss of diversity and causes, Indigenous medicinal systems, Strategies for conservation - in situ conservation and ex situ conservation: general account of the activities of Botanical Survey of India (BSI), Sustainable development, Phytogeography - Principles and importance of plant geography, phyto-geographic regions of world and India, biomes: Classification and components, Willis - Age and Area hypothesis. Continuous range, cosmopolitan circum polar, circum boreal and circum austral, Discontinuous distribution - Wagener theory - continental drift hypothesis, endemism

Suggested Readings:

Kormondy EJ. Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition

Odum EP. Fundamentals of ecology. Cengage Learning India Pvt. Ltd., New Delhi. 5th edition.

Singh JS, Singh SP, Gupta S. Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.

Wilkinson DM. Fundamental Processes in Ecology: An Earth Systems Approach. Oxford University Press. U.S.A.

Sharma PD. Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.

Ambasht, R.S. (1988). A text books of plant ecology. Students, Friends & Co., Varanasi

Kumar, H.D. (1997). General ecology, Vikas Publication company, New Delhi

Pandey, K. and Shukla, J.P. (2009). Elements of toxicology, Wisdom press, New Delhi

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				L
CO2	H				
CO3		H			
CO4		L	H		
CO5				H	
CO6					H
CO7					H

SPECIALIZATION: PLANT BIOTECHNOLOGY
BOFP0032: FUNDAMENTALS OF PLANT BIOTECHNOLOGY
(4 Credits-60 Hours) (L-T-P: 4-0-0)
Course Outcomes

At the end of this course, student will be able to:

Grasp the insight of plant biotechnology (Remembering)

Comprehend the underlying concept of tissue culture (Understanding)

Learn and analyse the importance of genetic engineering in crop improvement (Analysing)

Utilize biosafety measures in handling GMOs and transgenics in laboratories (Applying)

Module I: Elementary Plant Biotechnology (5 Hours)

Historical background: plant cell and tissue and organ culture, principle of genetic engineering; totipotency and morphogenesis, scope and importance in crop improvement: plant tissue culture practical application and conventional plant breeding; Advantages - disadvantages

Module II: Basics of Organogenesis (7 Hours)

Organogenesis and somatic embryogenesis in plant tissue culture- development of whole plant - root formation, transfer of plant lets to the soil, hardening, principles of cellular regeneration, single cell culture and its applications, protoplast culture, factors effecting organogenesis, advantages-disadvantages and application

Module III: Micropropagation and Virus Indexing (8 Hours)

Shoot-tip meristem culture - raising virus free plants for rapid, methods of virus indexing *in vitro* mutagenesis; *in vitro* fertilization; *in vitro* germplasm conservation; hybrid embryo rescue, production of secondary metabolites, synthetic seed production technology, production of industrial phytochemicals, advantages of micropropagation in agriculture and horticulture

Module IV: Principles of Genetic Engineering (15 Hours)

Principles of recombinant DNA technology, restriction enzymes; vectors for gene transfer – gene cloning, viral vectors and their benefits, screening and selection of transformants; DNA profiling and blotting techniques, types, procedure, application, advantages-disadvantages, nanobiotechnology and its application

Module V: Genetically Modified Organisms (GMOs) and Transgenics (15 Hours)

GMOs and their significance in biotechnology, transgenic plants and its application in agriculture, different methods of plant genetic transformation, *Agrobacterium tumefaciens*, infection and molecular mechanism of tumor formation, Ti plasmids and RI plasmids, binary vectors, genetic markers, reporter genes and its application in genetic engineering, other methods of plant genetic transformation, environmental issues associated with transgenic crops

Module VI: Biosafety, IPR and Bioethics (10 Hours)

Biosafety and risk assessment issues; national biosafety policies and law, General principles for the laboratory and environmental biosafety; creation of superweeds/superviruses, ecological aspects of GMOs and impact on biodiversity; food and feed safety issues associated with transgenic crops, intellectual properties, copyrights, trademarks, trade secrets, patents; Indian patent act and amendments, patent filing, Implications of intellectual property rights on the commercialization of biotechnology products

Suggested Readings:

Singh BD. Biotechnology: Expanding Horizon. Kalyani Publication

Pierik RLM. *In Vitro* Culture of Higher Plants. Kluwer Academic Publishers

George EF, Hall MA, Geert-Jan De Klerk. Plant Propagation by Tissue Culture (3rd Edition), Springer, Netherlands.

Herman EB. Media and Techniques for Growth, Regeneration and Storage Agritech Publications, New York, USA.

Brown TA. Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing

Watson J. Molecular Biology of Gene

Mapping of COs to Syllabus:

Course Out-comes	Module I	Module II	Module III	Module IV	Module V	Module VI

CO1	H	H	H	H	H	H
CO2	H	H	H		L	
CO3	M			H	M	L
CO4	L	L	M	H	H	H

BOAB0033: ADVANCES IN PLANT BIOTECHNOLOGY
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course outcomes

At the end of this course, student will be able to:

Apply the concept of plant biotechnology into practice (Applying)

Work out the significance of tissue culture technique (Understanding)

Learn and analyze the importance of molecular techniques in up-scaling crop improvement (Understanding)

Figure out the importance of molecular farming in transforming secondary metabolites (Analysing)

Module I: Haploid Production and Cybridization (7 Hours)

Haploid production and uses, anther and microspore culture, pathways of development, factors affecting androgenesis, diploidization of haploids applications of haploids, limitations of haploids, cytoplasmic hybrids: technique of cybridization, application of cybrids, limitations, transgenics developed through cybridization and haploid productions

Module II: Biotransformation (7 Hours)

Hairy root cultures; screening of high yielding cell lines; procedures for extraction of high value industrial products, fractionation, bioassays; growth and production kinetics of cell cultures in shake flasks; scale-up procedures in bioreactors, types of bioreactors for plant cell cultures; Manipulation in production profile by biotic and abiotic elicitation; biotransformation of secondary metabolites

Module III: Molecular Farming and Energy Crops (7 Hours)

Aims and scope, strategies of molecular farming, production of industrial enzymes, biodegradable plastics, antibodies, edible vaccines; manipulation of metabolic pathways for production of secondary metabolites, transplastomics plants; energy crops: concept, types and examples, advantages-disadvantages of biofuels, application

Module IV: Molecular Markers in Crop Improvement (15 Hours)

DNA marker techniques, PCR and hybridization-based methods, methods of physical mapping – restriction mapping, DNA fingerprinting and foot printing methods, Development of sequence based molecular markers - SSRs and SNPs; advanced methods of genotyping, QTL mapping, Marker assisted selection (MAS)

Module V: Advanced Molecular Techniques (12 Hours)

Gel electrophoresis- agarose and PAGE (nucleic acids and proteins), isolation of high molecular weight DNA and analysis, southern hybridization; northern hybridization; western blotting and ELISA RNAi, antisense RNA, biosensor, Microarray studies, Marker-free transgenic development strategies

Module VI: Transgenics and Their Applications (12 Hours)

Target traits and transgenic crops, Genetic engineering for resistance against abiotic and biotic stresses; genetic engineering for increasing crop productivity by manipulation of photosynthesis, nitrogen fixation and nutrient uptake efficiency; genetic engineering for quality improvement; Discussion on application of molecular, transformation and genomic tools for the genetic enhancement in some major field crops such as rice, wheat, cotton, maize, soybean, oilseeds, sugarcane

Suggested Readings:

Singh BD. Biotechnology: Expanding Horizon. Kalyani Publication

Pierik RLM. *In Vitro* Culture of Higher Plants. Kluwer Academic Publishers

George EF, Hall MA, Geert-Jan De Klerk. Plant Propagation by Tissue Culture (3rd Edition), Springer, Netherlands.

Herman EB. Media and Techniques for Growth, Regeneration and Storage Agritech Publications, New York, USA.

Brown TA. Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing Watson J. Molecular Biology of Gene

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	H	H	H	H	H
CO2	H	H	H	-	-	M
CO3	-	-	L	H	H	H
CO4	-	H	H	-	-	L

SPECIALIZATION: GENETICS AND PLANT BREEDING**BOGT0034: GENETICS, PLANT BREEDING AND TRANSFORMATION
(4 Credits-60 Hours) (L-T-P: 4-0-0)****Course Outcomes**

At the end of this course, student will be able to:

Summarize the concepts of cell division and cell cycle (Understanding)

Interpret classical genetics (Understanding)

Illustrate the role of plant breeding in crop improvement (Understanding)

Outline the various techniques of plant genetic engineering (Understanding)

Infer the concept of cisgenics (Understanding)

Module I: Fundamentals of cell division and cell cycle (10 Hours)

Mitosis and meiosis: cell cycle, stages, synaptonemal complex, cytokinesis, molecular basis of cell cycle: cyclin dependent kinases (Cdks) and cyclins, cell cycle and cancer

Module II: Plant Genetics: an overview (10 Hours)

Mendelian genetics, multiple alleles, linkage and crossing over, sex linked traits and sex determination, cytoplasmic inheritance, structural and numerical changes in chromosome, mutation

Module III: Plant breeding for crop improvement (20 Hours)

Hybridization techniques in self- and cross-pollinated crops, molecular markers and their applications, role of association mapping and allele mining in crop improvement

Module IV: Recombinant DNA technology and genetic engineering (20 Hours)

Gene cloning, methods of plant transformation, biosafety issues and regulation of GMOs, generation of marker free transgenic lines: cre-lox system, co-transformation, FLP/FRT recombination system, AC/DS transposon system, twin TDNA binary vector, cisgenics

Suggested Reading:

Alberts B, Johnson A, Lewis J, Morgan D, Raff M, Roberts K, Walter P. Molecular Biology of the Cell, 6th Edition, W.W. Norton & Co., U.S.

Acquaah G. Principles of Plant Genetics and Breeding, Blackwell Publishing Ltd. U.S.A.

Snustad DP, Simmons MJ. Principles of Genetics, 6th Edition, John Wiley & Sons, Inc., U.K.

Strickberger MW. Genetics, 3rd Edition, Pearson (Prentice Hall)

Singh BD. Plant Breeding: Principles and Methods, Kalyani Publishers, India

Brown TA. Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing

Primrose SB, Twyman R. Principles of Gene manipulation and Genomics, 7th Edition, Wiley-Blackwell

Nigel AS. Plant Biotechnology: The genetic manipulation of plants, 2nd Edition, Oxford University Press

Gupta PK. Molecular Biology and Genetic Engineering, Rastogi Publications

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H
CO5				H

BOMB0035: MOLECULAR GENETICS AND BIOINFORMATICS
(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Interpret the fundamental processes in biology (Understanding)

Summarize the concepts of gene silencing (Understanding)

Comprehend the notions of genome editing (Understanding)

Utilize the knowledge on bioinformatics to run various biological databases and soft-wares (Applying)

Module I: Understanding the fundamental processes (20 Hours)

DNA replication, repair and recombination, RNA and protein syntheses and their processing, regulation of gene expression

Module II: Gene silencing: Its concepts (10 Hours)

Transcriptional and post transcriptional gene silencing, RNAi: History, mechanism, enzymes involved; role of RNAi in crop improvement

Module III: Introduction to genome editing (15 Hours)

Genome editing: basic concepts, history, techniques of genome editing: TALENs, ZFNs, CRISPR/Cas (CRISPR/Cpf1), application of genome editing in crop improvement

Module IV: Bioinformatics (15 Hours)

Understanding the concepts of bioinformatics, its applications, introduction to online biological databases, phylogenetic inference package, sites and centers, BLAST, sequence alignment, primer designing, conceptual data modeling

Suggested Reading:

Watson J, Baker TA, Bell SP, Gann AAF, Levine M, Losick RM. Molecular Biology of the Gene, 7th Edition, Pearson Education

Lewin B. Genes IX, Jones and Barlett Publishers

Sohail M. Gene silencing by RNA Interference, 1st Edition, CRC Press

Hannon GJ. RNAi a guide to gene silencing, 2nd Edition, Cold Spring Harbor Laboratory Press, U.S.

Ridge Y. CRISPR: A powerful way to change DNA, Annick Press

Lesk AM. Introduction to bioinformatics, 4th Edition, Oxford Attwood TK, Parry-Smith DJ. Introduction to Bioinformatics, Pearson India

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H

SPECIALIZATION: ANGIOSPERM TAXONOMY

BOTS0038: TAXONOMY OF ANGIOSPERMS AND BIOSYSTEMATICS

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Understand the concepts of plant identification, classification, nomenclature and biosystematics (Understanding)

Identification of plant with the help of keys and their relevant literatures (Applying)

Comparison of classical plant taxonomy with modern experimental plant taxonomy (Analyzing)

Summarize taxonomic hierarchy and principles and rules of botanical Nomenclature (Understanding) 5.

Application of numerical taxonomy and phylogenetic systematic in angiosperms (Applying)

Module I: Taxonomy and Biosystematics (10 Hours)

Taxonomy: Components of taxonomy, Phases of taxonomy, Integrative taxonomy, Cyber taxonomy, DNA taxonomy,

Reverse taxonomy. Systematics: Development and scope, Aim and Objectives, Significance. Biosystematics: Objectives, Steps, Relationship with Classical Taxonomy

Module II: Identification and Taxonomic Literature (10 Hours)

Methods of Plant identification; Taxonomic Keys: Single access and Multi-access; Character and Character states; Field inventory; Collection; Herbaria: Functions of Herbarium, Preparation of Herbarium;

Important herbaria and botanical gardens of the World and India; Virtual herbarium. Taxonomic Literature: Flora, E-flora, Monographs, Revisions, Checklists, Periodicals; Taxonomic Indexes; Ret Data Book

Module III: Taxonomic Hierarchy and Botanical Nomenclature (15 Hours)

Concept of taxa (family, genus, species); Categories and Taxonomic Hierarchy; Infra-species; Species Concept (taxonomic, biological, evolutionary); Principles of Nomenclature (ICNafp); Rules of Nomenclature: Ranks and names; Typification, Priority of Publication; Nomenclature of Taxa; Effective Publication; Valid Publication; Author Citation; Rejection of Names, principle of priority and its limitations; Names of hybrids

Module IV: Systems of classification and Systematic evidences (10 Hours)

Major systems of classification: basis, merits and demerits: Cronquist (1981); Takhtajan's System (1997), APG Classification, with special reference to APG IV (2016). Systematic evidences: Morphology, Anatomy, Embryology, Palynology, Cytology, Phytochemistry, Molecular taxonomy–DNA barcoding

Module V: Numerical Taxonomy, Phylogenetic Systematic (Cladistics) (15 Hours)

Numerical Taxonomy: Principles, Methods, Characters, Variations; OTUs, Character Weighting, Coding, Cluster analysis, Phenogram, Merits and Demerits; Biometrics. Cladistics: Methodology of Cluster Analysis, Applications. Homology and Homoplasy; Monophyly, Paraphyly and Polyphyly; Primitive and Advanced; Phylogenomics

Suggested Readings:

Pandey, B.P. A textbook of Botany: Angiosperms S. Chand.
 Sharma, O.P. Plant Taxonomy McGraw-Hill Education
 Mandal, A.K. Advanced Plant Taxonomy New Central Book Agency
 Nair, R. Taxonomy of Angiosperms Aph Publishing Cooperation
 Gupta, R. Plant Taxonomy: Past, Present and Future The Energy and Research Institute TERI.
 Balfour, A. (Editor) Plant Taxonomy Syrawood Publishing House. 7. Singh, G. Plant Systematics: An Integrated Approach. CRC Press.
 Bhojwani, S.S., Bhatnagar, S.P. and Dantu, P.K. The Embryology Angiosperms, Vikas Publishing.
 Davis, P.H. and Heywood, V.H. Principles of Angiosperm Taxonomy, Scientific Publishers (India).
 Lawrence, G.H.M. Taxonomy of Vascular Plants Scientific Publisher.

Mapping of COs to Syllabus:

Course comes	Out-	Module I	Module II	Module III	Module IV	Module V
CO1		H				
CO2			H			
CO3		M			H	
CO4				H		
CO5						H

BOBE0039: ECONOMIC BOTANY AND ETHNO-BOTANY (4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Understand the nature of plant products, aspects and classification of economic important plants (Understanding)

Taxonomic status of food plants, industrial plants and drug plants and its uses (Understanding)

Understand the cultivation, extraction processes and uses of different economically useful plants (Understanding)
Understand the need to conserve floristic and cultural diversity of the region (Understanding)
Rescue and document Ethno-botanicals for sustainable use of plant resources (Analyzing)

Module I: Introduction to Nature of Plant Products (10 Hours)

Importance and Nature of Plant Products: Protoplasm and its Activities; Photosynthesis; Plant skeleton; Reserved food (Carbohydrates, Fats and Proteins); Secretions and Excretions (Essential Oils, Pigments, Tannins, Latex, Waxes, Alkaloids, Glycosides, Organic Acids, Enzymes, Vitamins, Hormones). Different Aspects of Economic Botany; Classification of Economically Important Plants

Module II: Fibers and Fibers Plants (5 Hours)

Economic Classification of Fibers: Textile Fibers; Surface Fibers; Soft Fibers; Structural Fibers; Brush Fibers; Plaiting and Rough Weaving Fibers; Filling Fibers; Natural Fabrics; Paper Making Fibers. Cotton, Jute, Flax and Agave
(Characteristics, Cultivation, Extraction, Uses)

Module III: Forest Products and Resources (5 Hours)

Importance and Structures of Wood; Mechanical Properties and Factors of Wood; General account with special reference to Teak, Sal, Pine and Bamboos

Module IV: Tanning and Dye materials (5 Hours)

Sources of Tanning Materials: Barks, Leaves, Fruits, Roots; Manufacture of Tannins inks. Sources of dye-stuffs: Barks, Leaves, Flowers, Fruits, Roots, Woods. General account with special reference to Indigo, Safflower and Lichens

Module V: Oil-Yielding, Sugar-Yielding and Rubber-Yielding Plants (5 Hours)

General account with special reference to Drying oils, Semi drying oils; Non-drying oils and Vegetables Fats. Sugarcane and Sugar beet (cultivation, extraction and uses); Para rubber and Assam Rubber: Tapping, Processing and Uses. Fatty oils and their extractions

Module VI: Cereals, Pulses, Beverages and Spices (5 Hours)

Staple food crops - cereals, pulses, millets; tropical, subtropical and temperate fruits; Tea, Coffee processing and uses;
Important spices, their family and part used

Module VII: Introduction to Ethno-botany (10 Hours)

Concept, Relevance, Scope and Status; Plant parts used in Ethno-medicine; Role of Ethno-medicine and its scope in modern times. Concept of Protected Areas; CITES, IUCN Red List Categories. Role of Ethno-botany in conservation and sustainable development; Centers of Ethno botanical studies in India; Contributions of AICRPE and FRLHT to ethnobiology of India

Module VIII: Methods and techniques in Ethno botany (15 Hours)

Field activities for data collection: Approach, Documentation, Consent forms, Forest productivity check by analyzing the log books of Forest, Authentication of plant species and Lab Procedures, Preparation of Data Sheet and Data Base. People Biodiversity Register (PBR). Impact of Ethno-botany in herbal medicine industry, land-use development, agriculture, forestry, betterment of rural livelihoods and education; Biodiversity and conservation of useful medicinal plants; Sharing of wealth concept with few examples from India; Plant used in ethno-medicine e.g.: *Emblica officinalis*, *Ocimum sanctum*, *Saraca asoca*, *Rauwolfia serpentina*, *Mentha piperita*, *Aloe vera*, *Eclipta alba*, *Azadirachta indica*, *Centella asiatica* preparation and their uses.

Suggested Readings:

Pandey B.P. Economic Botany, Revised edition, S. Chand Publishers, New Delhi References

Verma V. Textbook of Economic Botany, First edition, Ane Books Pvt. Ltd., New Delhi

The Wealth of India – Raw Materials Series. CSIR publications, New Delhi.

Sharma, O.P. Hill's Economic Botany. Tata McGraw Hill, New Delhi.

Kocchar, S.L. Economic Botany of the Tropics. McMillan India Ltd., Delhi.

Pandey, B.P. Economic Botany. S. Chand & Co., New Delhi.

Das, A.P. & Pandey, Advances in Ethno-botany. Bishen Singh Mahendra Pal Singh, Dehra Dun.

Saroya, A.S. Herbalism, Phytochemistry and Ethnopharmacology, CRC Press, UK

Jain, S. K. & Mudgal, V. A. Handbook of Ethno botany, Bishen Singh Mahendra Pal Singh, Dehra Dun.

Nair, M. N. B., Hamami, S. M. & Ashaari, Z. Sustainable Management of Non-Wood Forest Products. Sustainable management of non-wood forest products: proceedings of an international workshop. University Putra Press, Malaysia.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII	Module VIII
CO1	H							
CO2		M	M	M	M	M		H
CO3		H			H			
CO4							M	H
CO5							H	
CO6								H

SPECIALIZATION: PLANT ECOLOGY**BOEG0040: ECOLOGY, ENVIRONMENT AND GLOBAL CONCERNS****(4 Credits-60 Hours) (L-T-P: 4-0-0)****Course Outcomes**

At the end of this course, student will be able to:

Understand about the fundamental characteristic, structural and functional aspect of ecosystem (Understanding)

Understand environmental pollution its cause, effects and control (Understanding)

Understand the scenario and mechanism of climate change and also various mitigation initiatives undertaken (Understanding)

Addresses ecological resilience and its relationship to ecosystem services (Analyzing)

Module I: Ecology and Ecosystem Analysis (12 Hours)

Principles and Scope of Ecology Structure and Functions of Ecosystems - Abiotic and Biotic components; Energy dynamics; Niche concept; Eco-physiology; Ecosystem nutrient cycles; Ecosystems Types and Diversity; Concepts relating to limiting factors; Populations and communities characteristics; Population dynamics; Population interaction; Models and mechanisms of ecological succession; Ecosystem Stability

Module II: Environment and Pollution (18 Hours)

Energy and Environment; Components, types and segments of Environment; Environmental pollution: Origin of pollution, types of pollutions; Atmosphere: region and composition of atmosphere; Air pollution: classification and major air pollutants, sources and effect of air pollution; Water pollution: types of pollution and pollutants, sources and effect of water pollution; Soil pollution: sources and effect of soil pollution; Treatment and control of pollution

Module III: Climate Change and Awareness (18 Hours)

Basic concepts and mechanism: Climate change, ozone layer depletion, global warming and greenhouse effect, causes and consequences; Mitigation and adaptation: Carbon storage and sequestration, carbon management: biotic and abiotic, Carbon farming and carbon trading; International responses: Intergovernmental Panel on Climate Change (IPCC) and its role, United Nations Framework Convention on climate change (UNFCCC), CDM and Kyoto Protocol, REDD+, The Copenhagen Accord; India's response to climate change

Module IV: Ecological Resilience and Ecosystem Services (12 Hours)

Definitions and concepts of ecological resilience; Characteristics of Resilient Ecosystem; Ecological, General, and Spatial Resilience; Linkage between Resilience, Vulnerability and Adaptive Capacity; Components of Resilience-Based Management; Ecosystem service concept, model and classification; Factors and drivers determining ecosystem services; Mapping and assessment of ecosystem services, Ecosystem services in natural resource management

Suggested Readings:

Odum, E., & Barrett, G. (2009). Fundamentals of ecology. Australia: Cengage Learning.
 Kormondy, E., & Kormondy, E. (1986). Concepts of Ecology. Prentice Hall, New Delhi.
 Singh, J.S., Singh, S.P., & Gupta, S. (2014). Ecology Environment and Resource Conservation. Anamaya Publications, New Delhi, India.
 Sharma, P.D. (2012). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition
 Ahluwalia, V., & Malhotra, S. (2013). Environmental Science. New Delhi: Ane Books.
 Parry, M.L., et al. Climate change 2007: Impacts, Adaptation and Vulnerability, Cambridge University Press
 Singh, P., Singh, S., Rangabhashyam, S., & Srivastava, K.K. (2021). Global Climate Change. Elsevier Science, Netherlands
 Gunderson, L., Allen, C.R., & Holling, C.S. (2012). Foundations of Ecological Resilience, Island Press.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			L
CO2		H	M	
CO3		M	H	L
CO4			L	H

BORG0042: RESTORATION ECOLOGY AND GEOINFORMATICS
(4 Credits-60 Hours) (L-T-P: 4-0-0)
Course Outcomes

At the end of this course, student will be able to:

Understand the ecological perspectives of restoration including factors that regulate ecosystem function (Understanding)

Understand the ecological theories that have moulded restoration ecology (Understanding)

Relate restoration practices and efforts to different ecological levels (Applying)

Explores into the planning, execution, monitoring, and assessment of restoration work (Analysing)

Role of remote sensing as a tool for ecological restoration processes (Applying)

Module I: Introduction to Restoration Ecology (8 Hours)

Concept and Definition of Restoration Ecology; Degradation of Ecosystems; Different Restoration Approaches; Varying Scales of Restoration; Ecosystem Disturbances; Fire Disturbances; Fragmentation; Nutrient and Hydrological Cycling; Keystone Species

Module II: Succession and Assembly (8 Hours)

Theories of Succession; Successional Processes and Restoration; Management of Succession; Monitoring Succession;

Ecosystem Resistance and Stability; Regime Shift; Assembly Rules

Module III: Biodiversity and Forest Restoration (10 Hours)

Levels of Biodiversity; Threats to Biodiversity; Extinction; Rate of Extinction and Species vulnerability; Restoration of

Genetic Diversity; Restoration of Species Diversity; Ecosystem Diversity; Forest Degradation; Forest Restoration

Module IV: Landscape and Invasive species (12 Hours)

Definition and Types of Landscape; Landscape matrices; Connectivity and Metapopulation; Landscape Restoration; Process of Invasion; Effects of Invasion on Ecosystems; Methods to Control Invasion; Restoration to Constrain Invasion

Module V: Management of Restoration Plans (10 Hours)

Project Planning; Implementation; Adaptive Management Cycle; Monitoring; Selecting Monitoring Parameters and Methods; Additional Considerations in Developing a Monitoring Plan; Legal Framework and International Agreements

Module VI: Remote Sensing in Restoration Ecology (12 Hours)

Remote sensing fundamentals; Satellite Data and Sensors; Spectral, Temporal, Radiometric and Temporal Resolutions; Image Processing; Image Interpretation and Classification; Accuracy Assessment; Measuring and Monitoring Land Cover, Land Use, Change and Vegetation Characteristics; Conservation and Ecology Applications; Global Positioning System

Suggested Readings:

Greipsson, S. (2011). Restoration Ecology. United States: Jones and Bartlett Publishers.

Holl, K. (2016). Foundations of Restoration Ecology. United States: Island Press.

Holl, K. (2020). Primer of Ecological Restoration. United States: Island Press.

Aronson, J., (2012). Restoration Ecology: The New Frontier. Germany: Wiley.

Sarah, E.G., & Turner, M. (2017). Learning Landscape Ecology: A Practical Guide to Concepts and Techniques. Germany: Springer New York.

Lillesand, T. M., & Kiefer, R. W. (1994). Remote Sensing and Image Interpretation. United Kingdom: Wiley.

Mapping of COs to Syllabus:

Course Out-comes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	L				
CO2		H				
CO3			H	H	L	
CO4					H	
CO5			L	L		H

SPECIALIZATION: PLANT PATHOLOGY AND MICROBIOLOGY
BOPY0043: PLANT PATHOLOGY
(4 Credits-60 Hours) (L-T-P: 4-0-0)
Course Outcomes

At the end of this course, student will be able to:

Classify various Plant diseases and their causative organisms (Understanding)

Analyze the roles of pathogens in diseases development (Analyzing)

Identify and detect various modes of pathogen attack and defence strategies of plants (Applying)

Asses specific plant diseases caused by various microorganisms (Analyzing)

Asses and apply disease control measures and techniques (Evaluating)

Module I: Introduction (16 Hours)

Introduction to Plant pathology; The concept of disease in Plants; History of plant pathology; Types of plant diseases; Role of pathogens as causes of plant disease; Significance of plant disease; Basic procedure in diagnosis of plant diseases- Infectious diseases (caused by Parasitic higher plants, Nematodes, Fungi, bacteria, Viruses and Viroids) and non-infectious diseases; Identification of previously unknown disease: Koch's rules

Module II: Parasitism and Disease Development (8 Hours)

Parasitism and pathogenicity; Development of disease in plants: Stages in the development of disease (Disease cycle); Relationship between disease cycle and epidermis.

Module III: Pathogen attack and Plant Defense Mechanisms (10 Hours)

Mode of pathogen attack via various means (Mechanical force, Chemical, Enzymatic, Microbial toxins); Role of growth regulators in plant disease; Plant defence against pathogen: Pre-existing Structural and chemical defenses, Induce structural and biochemical defense

Module IV: Specific Plant Diseases (20 Hours)

Plant diseases caused by Fungi: Characteristics of fungal pathogen; Symptoms and Isolation of pathogen; Late blight of potato, Downy mildews/Powdery mildews, Ergot of cereals and grasses, Loose smuts of cereals; Plant diseases caused by Bacteria: Characteristics of bacterial pathogens, Identification and symptoms caused; Bacterial blight of beans, Crown gall, Citrus canker; Plant diseases by Viruses: Characteristics of Viruses; Symptoms caused by viruses and their transmission, Viroids; Plant diseases caused

by Nematodes: Characteristics of plant pathogenic nematodes; Isolation of nematodes and their symptoms; Root-knot, cyst, lesion caused by nematodes; Plant diseases caused by Protozoa: Characteristics; Phloem necrosis of Coffee, Empty root of Cassava

Module V: Disease Control Management (6 Hours)

Control methods: Exclusion of plant pathogens; Eradication or reduced pathogen inoculum; Immunizing or improving the host resistance; overview of integrated pest management

Suggested Reading:

Agrios GN. Plant pathology, 4th Edition, Academic Press London, UK.

Mehrotra RS, Aggarwal A. Plant Pathology, 2nd Edition, Tata McGraw-Hill Publishing Company Ltd.

Singh RP. Plant Pathology, 2nd Edition, Kalyani Publishers.

Mehrotra RS, Aggarwal A. Fundamentals of Plant Pathology, Tata McGraw-Hill Publishing Company Ltd.

Sambamurthy AVSS. A textbook of Plant Pathology, Dreamtech Press, Wiley.

Gour HN. Physiological and Molecular Plant Pathology, Scientific Publishers India.

Dickinson M. Molecular Plant Pathology, Garland Science

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H			L	
CO2		H			
CO3		M	H		
CO4				H	
CO5					H

BOMA0044: MICROBIAL GENETICS AND APPLIED MICROBIOLOGY

(4 Credits-60 Hours) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Tell the chemistry and functions of microbial cells and organelles (Understanding)

Apply the concepts of vector and cloning mechanisms in plant improvement (Applying)

Understand the gene regulatory mechanisms and pathways and their functions (Understanding)

Understand the roles of microbes in industries and environment (Understanding)

Detect and identify microorganisms from any samples (Evaluating)

Use microbes in agriculture, industries and environmental protection (Applying)

Module I: Microbial Cells and organelles (8 Hours)

Over view of prokaryotic cell- structure & functions, cell wall synthesis, Membrane transport in bacteria- simple, group translocation, ABC transporters, Protein export in bacteria. Membrane organelles: lysosomes, mitochondria (with small ribosomes), Golgi bodies, endoplasmic reticulum, nucleus

Module II: Microbial Genetics and Microbial vectors in genetic Engineering (18 Hours)

Structure, function and types of DNA and RNA, DNA replication in bacteria; Gene expression (concept of gene, gene structure, genetic code, transcription and translation, post transcriptional and post translational modifications); Gene regulation in prokaryotes- The operon concept (Lac and Trp operon -induction and repression); Mutations (Definition, types, molecular basis of mutations, detection of mutants); DNA repair mechanisms (Dark repair, photo-reactivation, recombination repair, SOS repair), Transposons; Plasmid

(size, copy numbers, classification, applications as vectors; Bacteriophages (types, applications as vectors); vectors for eukaryotes and other higher plants; plasmids and antimicrobial resistance, cloning (basic principle, techniques and applications)

Module III: Microbes Preservation and Fermentation technology (12 Hours)

Importance of preservation of microbes, types of preservation techniques, revival of microbes; History of fermentation, introduction to fermentation processes, Microbial culture selection for fermentation processes. Media formulation and process optimization; Design and operation of Fermenters, Basic concepts for selection of a reactor, Packed bed reactor, Fluidized bed reactor, Trickle bed reactor, Bubble column reactor, Scale up of Bioreactor; basic concept of upstream and down-stream processing

Module IV: Microorganisms in Environmental and Agriculture (15 Hours)

Microbes as tools for pollution abatement, bio-indicators, restoration of degraded ecosystem, biodegradation, bioremediation, biogenic gases; Role of microbes in relation to agriculture: nitrogen economy, plant health, biological control. Symbiotic association: concepts, types and application

Module V: Microorganisms in Food and Pharmaceutical Industries (10 Hours)

Microbes in food and dairy industries: mushroom, fermented foods, microbial spoilage of food and dairy products; Gene manipulation for production microbial toxin, types, mode of action, production of novel commercial products such as biopolymer and antibiotics; basic concepts of immunology, vaccines, immunotherapy, microbes in biological warfare

Suggested Reading:

Willey JM, Sherwood L, Woolverton CJ (2013) Prescott's Microbiology, 9 th edition, McGraw-Hill, New York.

Pelczar M.J., Chan E.C.S. and Krieg N.R. (2003) Microbiology. 5 th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Waites MJ, Morgan NL, Rockey JS, Highton G. Industrial Microbiology: An Introduction, Wiley-Blackwell

Brock T.D. and Madigan M., Biology of Microorganisms, Prentice Hall of India Pvt. Ltd.

Moat A.G. and Foster S.W., Microbial Physiology, John Wiley and Sons, New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H			
CO3		H			
CO4			H		
CO5			H		
CO6			L	H	H

SPECIALIZATION: PLANT PHYSIOLOGY AND BIOCHEMISTRY

BOPP0045: ADVANCE PLANT PHYSIOLOGY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Analyze the role of microbes in mineral acquisition (Analyzing)

Understand the process of photosynthesis and respiration and its regulatory enzymes (Understanding)
 Interpret the signal transduction and gene expression of growth hormones (Understanding)
 Assess the mechanism of plant response towards abiotic and biotic stresses and action of photoreceptors (Evaluating)

Module I: Mineral nutrition (8 Hours)

Mineral Absorption and transport, Role of microbes in nutrient acquisition by plants; Assimilation of mineral nutrients with emphasis on phosphorus and potassium assimilation

Module II: Photosynthesis (10 Hours)

Primary charge separation events in reaction centres; regulatory action of uncoupling agents of photophosphorylation; energy loss during vectorial electron transfer in light reaction; genetics of RUBISCO sub-unit assembly and organization in plants; physiological and ecological aspects of photosynthesis; efficiency of carbohydrate synthesis

Module III: Respiration (12 Hours)

Regulation of key respiratory enzymes with particular emphasis on phosphofructo kinase, glyceraldehyde-3-phosphate dehydrogenase and pyruvate dehydrogenase; mechanism of action of inhibitors of oxidative phosphorylation; arrangement and organization of protein complexes in mitochondrial electron transport chain

Module IV: Plant growth regulators (12 Hours)

Signal perception and signal transduction, hormone binding receptors, hormone induced changes in gene expression and specific functions of Auxin – cell elongation, Gibberellins – germination of dormant seeds, Cytokinins – cell division and retardation of senescence of plant parts, Abscissic acid – stomatal closure and induction of drought resistance and Ethylene
 – fruit ripening

Module V: Stress Biology and Sensory Photobiology (18 Hours)

Mechanism of plant response to water (low and high), temperature (low and high), Salt (Salinity and Alkalinity), heavy metals and biotic stresses (Pathogens and insects), Oxygen deficiency. Sensory Photobiology: Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins

Suggested Reading:

Davies P.J. Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition, Kluwer Academic Publisher, Dordrecht, The Netherlands
 Taiz L and Zeiger E. Plant Physiology, 4th Edition, Sinauer Associates Inc. Publishers, Massachusetts, USA
 Bajracharya D. (1999) Experiments in Plant Physiology- A Laboratory Manual, Narosa Publishing House, New Delhi
 Hopkins, W.G. and Huner, A. (2008) Introduction to Plant Physiology, 4th edition, John Wiley and Sons, USA

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		H	H		

CO3				H	
CO4					H

BOBM0046: PLANT BIOCHEMISTRY AND METABOLISM
(4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Understand the molecular biology of nitrogen fixation (Understanding)

Interpret the biosynthesis of secondary metabolites and their defence mechanism (Understanding)

Rephrase the structure and functions of vitamins (Understanding)

Understand the mechanism of cell signalling (Understanding)

Determine and estimate different phytochemical compounds from plant samples (Evaluating)

Module I: Nitrogen metabolism (10 Hours)

Process of biological nitrogen fixation; nodule formation-role of NOD genes and nodulins; NIF genes; molecular biology of nitrogenase complex; regulation of nitrogen fixation; nitrogen assimilation in higher plants

Module II: Secondary metabolites (12 Hours)

Biosynthesis and roles of terpenes, phenolic compounds, nitrogen containing compounds; commercial and economic importance of secondary metabolites; role of secondary metabolites in plant defence against insects, herbivores and pathogens

Module III: Vitamins (10 Hours)

Structure, and functions of Thiamine, Riboflavin, Nicotinic Acid, Pantothenic Acid, Pyridoxine, Biotin, Folic Acid, Vitamin

B12, Ascorbic Acid, Vitamin A, D, E and K

Module IV: Cell Signalling (16 Hours)

Overview, second messengers, receptors and G-proteins, phospholipid signaling, role of cyclic nucleotides, calcium-calmodulin cascade, diversity in protein kinases and phosphatases, specific signaling mechanisms and their regulation, e.g. simple and hybrid type of two-component sensor-regulator system in bacteria and plants (examples of chemotaxis, osmosensing, ethylene and cytokinin signaling), quorum sensing

Module V: Biochemical methods (12 Hours)

Determination of mineral nutrients in plant samples; Estimation of chlorophyll and carotenoids from leaf sample; Preparation of standard curve, extraction and estimation of total soluble sugars, starch, total free amino acids, total protein, fats, vitamins, antioxidative enzymes, secondary metabolites from plant samples.

Suggested Readings

Nelson DL and Cox MM. (2004) Lehninger Principles of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, USA.

Davies PJ. Plant Hormones: Biosynthesis, Signal Transduction, Action. 3rd Edition, Kluwer Academic Publisher, Dordrecht, The Netherlands

Taiz L and Zeiger E. Plant Physiology, 4th Edition, Sinauer Associates Inc. Publishers, Massachusetts, USA

Bajracharya D. (1999) Experiments in Plant Physiology- A Laboratory Manual, Narosa Publishing House, New Delhi

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H		M		
CO2	M	H			
CO3				H	
CO4			H		
CO5				H	M

SPECIALIZATION: ADVANCES IN PLANT SCIENCE

BOBB0047: BIOMASS, BIOREFINERY AND CIRCULAR BIOECONOMY (4 CREDIT, 60 Hours T-L-T:4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Identify potential biomass feedstocks including energy crops based on its biochemical composition (Analysing)

Have an understanding of the existing and emerging biomass to various technologies (Understanding)

Develop a critical thinking about sustainability and its prospect to generate circular bio-economy (Evaluating)

Determine sustainable solutions for bioresources by incorporating different technologies and assessment will be explored. (Application)

Module I: BIOMASS FEEDSTOCK, COMPOSITION AND SUPPLY LOGISTICS (10 Hours)

Biomass Feedstocks I- Harvested Feedstocks (first generation feedstock, second generation, third generation feedstocks) in context to biofuel and biorefinery. Biomass Feedstocks II- Residue Feedstocks (Agricultural waste, Forestry waste, Farm waste, Organic components of residential, commercial, institutional and industrial waste). Biochemical composition of different biomass feedstock. Conventional and Advanced logistic Systems, Feedstock barriers and strategies moving forward, Supply chain and reverse logistics

Module II: BIOMASS CONVERSION TECHNOLOGIES (12 Hours)

Biomass Conversion Technologies I- Biorefinery Concept -Understanding biorefinery concept, Bio-refineries & endproducts. Biomass Conversion Technologies II- Biochemical Conversion I-(Hydrolysis, enzyme & acid hydrolysis, Fermentation). Biochemical Conversion II- (Anaerobic digestion, Trans-esterification. Biomass). Conversion Technologies III- Thermochemical Conversion -(Combustion, Gasification, Pyrolysis. Other thermochemical conversion technologies, Scaling up emerging technologies.

Module III: LOW CARBON CIRCULAR ECONOMY and VALUE-ADDED CHEMICALS (16 Hours)

Advanced low-carbon economy from biofuel/biopolymer/value added product–Case study, Mixed alcohols (Acetone, ethanol, butanol), C3 sugars (Lactic acid, Propionic acid), C4 sugars (Malic acid), C5 sugars

(Furfural, levulinic acid, xylitol), C6 Sugars Hydroxymethylfurfural (HMF), Lignin, PHB, Bio-oil, biochar, biodiesel, bio hydrogen and other value-added organic products. carbon credit and carbon economy. Bio-economy, value creation and business development, Circular economic principles and business models Biotechnology and other bioprocesses enabling circular bioeconomy. Opportunities, framework conditions and barriers for a circular bioeconomy.

Module IV: BIOREFINERY (10 Hours)

Basic Concept and Types of Integrated biorefinery (Aquaculture and algal biorefinery, waste biorefinery). Economics and Life Cycle Analysis I- (General understanding of LCA, Cradle-to-grave, field to wheels concepts, Goal and scope determination, defining LCA boundaries). Life Cycle Analysis II. Life Cycle Inventory, Life Cycle Assessment. GIS based distribution study.

Module V: BIOSAFETY, IPR AND ENTREPRENEURSHIP (12 Hours)

History of biosafety, risk assessment, biosafety levels, personal protective equipment, laboratory facilities and safety equipment, disinfection, decontamination, sterilization, regulatory compliance, laboratory security and emergency response, administrative controls, Current trends in biosafety. Patentability search in biofuel sectors. Entrepreneurship essentials: opportunities, ideas and Innovation; feasibility an-d market research; business plan; Building a business: business models, Startup ecosystem; Technology and bio-entrepreneurship – case studies.

Suggested readings:

Ashok Pandey, R. D. Tyagi, Sunita Varjani. Biomass, Biofuels, Biochemicals: Circular Bioeconomy—Current Developments and Future Outlook. 2021, Elsevier Science Publishing Co Inc.

Wiebke Reim, Vinit Parida, David R. Sjodin. Circular Business Models for the Bio-Economy: A Review and New Directions for Future Research. Sustainability; 11, 2558.

Juan-Rodrigo Bastidas-Oyanedel, Jens Ejbye Schmidt. Biorefinery “Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels, and Fertilizers.”Springer.

Fundamentals of Entrepreneurship. 3rd Edition, Nandan H, 2007, Phi Learning, New Delhi.

Entrepreneurship and Small Business Management, 2nd Edition, Mariotti S and Glackin C, 2016, Pearson Publishers.

Ipr Biosafety And Bioethics 2013 Edition by GOEL, PEARSON

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H		M		
CO2	M	H			
CO3				H	
CO4			H		
CO5					
CO6				H	M

BOPD0048: BIOPROSPECTING OF PLANT DIVERSITY AND AUTOMATION (4 CREDIT, 60 Hours T-L-T:4-0-0)

Course Outcomes

At the end of this course, student will be able to:

Identify and explore the prospect of Plant and its molecules in industry (Understanding)

Recalling the Bio prospect of various plant molecules for commercialization (Remember)

Application of GIS and remote sensing in plant resource utilization and mapping (Analysing)
Understanding the impact climate change in soil microbiome affecting Plant diversity (Understanding)
Understanding the role of Automation in plant Science (Applications)

Module 1: Introduction to Bioprospecting: (6 Hours)

Definition, Introduction, recent trends in Bioprospecting, Pros and Cons, Omics and in silico bioprospecting, bionic bioprospecting, Bioprospecting Act and Biopiracy.

Module 2: Microbial and Marine Bioprospecting: (8 Hours)

Sources of marine planktons and their Bioprospecting, Isolation and cultivation of Marine Bioresource, Isolation of algal strain, Types of cultivations and its industrial applications, Bioactive chemicals from Seaweeds and their applications. Role of algae in Biodiesel, fertilizers and nanobiotechnology. Isolation of Microbial metabolites and their bioactivity. Endophytic microbial products as Antibiotics.

Module 3: Bioprospecting of Forestry and above ground biomass residues (8 Hours)

Cultivation and uses of Food, Fodder, paddy waste, Fibers, Oil yielding crops, wood and timber, Non-wood forest products

(NWFPS): Bamboos, Invasive Plant management and valorization, Gums, Dyes, Resins, Fruits etc, Botany, Chemistry,

Properties and uses of Medicinal, herbal and Aromatic plants, role of plants in phytoremediation of industrial waste

Module 4: Application of Remote Sensing and GIS in Bioresource management and Conservation. (10 Hours)

GIS in agro-residue bioenergy planning, Issues needing attention while using GIS, Life Cycle Assessment (LCA) in agroresidue, Spatial LCA in bioenergy and environmental planning, Satellite sensors used in Remote sensing, Predictor variables, Spectral indices, vegetation index and spatial imagery for biomass distribution

Module 5: Biotransformation and Fermentation technology (10 Hours)

Molecular farming, production of industrial enzymes, biodegradable plastics, antibodies, edible vaccines; manipulation of metabolic pathways for production of secondary metabolites, transplastomics plants, extraction of high value industrial products, growth and production kinetics of cell cultures in shake flasks; scale-up procedures in bioreactors, types of bioreactors for plant cell cultures; Manipulation in production profile by biotic and abiotic elicitation. Production of crop plants under organic and conventional farming system, Bio-fertilizers, Bio-methylation, preparation of compost / vermicomposting.

Module 6: Microbiome and Climate Change (8 Hours)

Microbiome data for applications in energy, environment, health, and agriculture, Implication of Soil microbiome, climate change and carbon storage nexus, Clean Development Mechanism, carbon offset, carbon cycle, carbon sequestration, Carbon capture, storage and uptake and Artificial photosynthesis

Module 7: Automation in Plant Science (10 Hours)

Application of IOT, digital image processing in plants (quantifying disease detection, quantification and Precision agriculture. Big Data in Plant study and conservations, Application of spectral signatures in plant distribution, taxonomy, biochemical estimation, vegetation index (NDVI, PVI, SVI), characterize by its size, shape, boundaries and internal structure ETC

Suggested Readings

C Sudhakar Reddy. (2015) Application of remote sensing in plant Sciences. An Overview. Springer India.

Charis, G., Danha, G., Muzenda, E., 2019. A review of the application of gis in biomass and solid waste supply chain optimization: gaps and opportunities for developing nations. Waste management 6; 1-11.

IoT in Agriculture Investigation on Plant Diseases and Nutrient Level Using Image Analysis Techniques

Sathiya S., Cecil, A., Ghodke. P.K., 2022. Plant disease identification using IoT and deep learning algorithms. Artificial Intelligence for Signal Processing and Wireless Communication. doi.org/10.1515/9783110734652-002.

Advanced Remote sensing and GIS. Training Manual Developed by CEGIS, USFS and BFD, 2014-15

Upadhyay S., Singh S.P. Bioprospecting of Plant Biodiversity for Industrial Molecules. Wiley. ISBN: 9781119717218

Jansson, J.K., Hofmockel, K.S. Soil microbiomes and climate change. Nat Rev Microbiol 18, 35–46 (2020). <https://doi.org/10.1038/s41579-019-0265-7>

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI	Module VII
CO1	H		M				
CO2	M	H	H				
CO3				H			
CO4						H	
CO5				L	M		H

LABORATORY COURSES**BOMP6026: MYCOLOGY AND PHYCOLOGY LAB (3 CREDITS-60 HOURS) (L-T-P: 0-0-3)****Course Outcomes**

At the end of this course, student will be able to:

Learn about the vegetative and reproductive structures of some important classes of fungi and algae (Understanding)

Acquire knowledge and importance of mycorrhizae and lichens (Understanding)

Learn the techniques of isolation of fungi and algae (Applying)

Learn the technique of producing fungal and algal bio-fertilizers (Applying)

Expt.1. Study of thallus organization, Spore producing organs, and accessory structures of Myxomycotina, Mastigomycotina, Oomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina

Expt.2. Study of morphological and anatomical features of Crustose, Foliose and Fruticose lichens

Expt.3. Isolation and characterization of fungi up to species from soil

Expt.4. Study of range of vegetative and reproductive structures of algae in Cyanophyta, Chlorophyta, Phaeophyta, Rhodophyta, Xanthophyta, Bacillariophyta, and Euglenophyta

Expt.5. Production techniques of fungal and algal based bio-fertilizers

Mapping of COs to syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5
CO1	H	L	L	H	L

CO2	L	H	L	L	L
CO3	L	L	H	L	L
CO4	L	L	L	L	H

BOBA6027: BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND ANGIOSPERMS LAB**(3 CREDITS-60 HOURS) (L-T- P: 0-0-3)****Course Outcomes**

At the end of this course, student will be able to:

Interpret the concepts of classification system and identification of few important bryophytes

(Understanding)

Infer the concepts of classification system and identification of few important pteridophytes

(Understanding)

Summarize the concepts of classification system and identification of few important gymnosperms

(Understanding)

Collect, prepare and document herbarium specimens through non-destructive field collection method so as to get acquainted with herbarium technique (Applying)

Differentiate between monocots and dicots (Understanding)

Interpret sporogenesis and gametogenesis in angiosperms (Understanding)

Part 1: Bryophytes, Pteridophytes and Gymnosperms**Expt.1.** Study of morphology and reproductive structures of the following bryophytes: Riccia, Marchantia, Anthocerus, Sphagnum, Polytrichum, Funeria, Porella.**Expt.2.** Study of morphology and reproductive structures and observe arrangement of Sori on a receptacle of the following pteridophytes: Lycopodium, Selaginella, Marsilea, Equisetum, Azolla, Salvinia, Adiantum**Expt.3.** To study the anatomy, morphology and reproductive features of the following gymnosperms: Cycas, Pinus,

Cryptomeria, Thuja, Podocarpus, Gnetum, Zamia, Ginkgo

Part 2: Angiosperms**Expt.4.** Collection, preparation and documentation of herbarium specimens through non-destructive field collection method so as to get acquainted with herbarium technique.**Expt.5.** Taxonomic study of selected families of dicots and monocots of angiospermic plants with the help of analytical drawings, botanical description and identification up to the rank of species.**Expt.6.** Study of various stages of sporogenesis and gametogenesis in selected species of angiospermic plants**Mapping of COs to Syllabus:**

Course Out-comes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6
CO1	H					
CO2		H				
CO3			H			
CO4				H		
CO5					H	
CO6						H

BOCB6028: CELL & MOLECULAR BIOLOGY, PLANT PHYSIOLOGY & BIOCHEMISTRY LAB (3 CREDITS-60 HOURS) (L-T- P: 0-0-3)
Course Outcomes

At the end of this course, student will be able to:

Get acquainted with tools and techniques of molecular biology (Remembering)

Perform isolation of genomic DNA and their quantification and understand how to calculate recombination frequencies (Understanding)

Analyze the concept of osmosis and impact of organic solvent in membrane permeability (Analyzing)

Understand the underlying principle behind respiration, transpiration and photosynthesis. (Understanding)

Analyze the functions of phytohormones and the properties of plant biomolecules (Analyzing)

Part 1: Cell & Molecular Biology

Expt.1. Acquaintance with molecular biology laboratory and instruments

Expt.2. Practical on cytoplasmic streaming in plant cell

Expt.3. Extraction of DNA from strawberry/banana by alcohol precipitation method

Expt.4. Isolation of genomic DNA from plant materials using SDS/CTAB

method **Expt.5.** Calculation of recombination frequencies of genes

Part 2: Plant Physiology

Expt.6. Determination of osmotic potential in potato tuber

Expt.7. To study the effect of different organic solvents (alcohol, formalin, benzene) on the permeability of plasma membrane of beet root

Expt.8. Determination of the effect of CO₂ concentration on the rate of photosynthesis by inverted funnel method

Expt.9. Determination of the effect of intensity of light on the rate of photosynthesis

Expt.10. To study the effect of different Phytohormones on the germination of seeds

Part 3: Plant Biochemistry

Expt.11. Estimation of protein using calibration curve following the protocol of Lowry et al., method

Expt.12. Estimation of nitrate reductase activity

Expt.13. To study the effect of NR activity in presence of light and dark period

Expt.14. Preparing the calibration curve of nitrite using azo-coupling method of Snell and Snel

Expt.15. Isolation of Plant DNA and their spectrophotometric quantification

Mapping of COs to Syllabus:

Course Out-comes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8
CO1	H	H	H	H	H			
CO2			H	H	H			
CO3						H	H	H
CO4						H	H	
CO5	H		H	H				

Course Out-comes	Expt. 9	Expt. 10	Expt. 11	Expt. 12	Expt. 13	Expt. 14	Expt. 15
CO1							H
CO2							H
CO3	H	H					

CO4			H				
CO5			H	H	H	H	H

BOPP6041: PLANT MICROBIOLOGY AND PLANT PATHOLOGY LAB (2 CREDITS-40 HOURS)(L-T-P:0-0-2)

Course Outcomes

At the end of this course, student will be able to:

Prepare different media used in microorganism isolation (Applying)

Apply various techniques for identifying different microbes (Applying)

Develop protocols and methods for characterizing microbes (Creating)

Identify chemicals agents, plants pathogens and their symptoms on diseased plant (Applying)

Expt.1. Preparation of nutrient media (solid/liquid) for culture

Expt.2. Staining techniques (Grams staining, flagella staining, capsule staining and acid fast staining of bacteria)

Expt.3. Isolation and characterization of pure cultures of microbes from soil, water and plant samples

Expt.4. Estimation of bacterial growth by spectrophotometric method

Expt.5. Culturing and isolation techniques of viruses (through seminar/virus lab visit)

Expt.6. In vitro and in vivo evaluation of chemicals against plant pathogens

Expt.7. Detailed study of symptoms of representative diseases of plantation crops, Collection and dry preservation of diseased specimens of important crops

Mapping of COs to syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7
CO1	H	H	M	L	L		
CO2	M	H	H	L	M		
CO3	M	M	H	M	M		
CO4					L	H	H

BOER6033: ENVIRONMENTAL MANAGEMENT, RESEARCH METHODOLOGY AND BIO-STATISTICS & BIOCHEMICAL LAB (2 Credits-40 Hours) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

Apply ideas gained for experimental surveys and writing sound scientific papers (Applying)

Apply the concepts of statistics for interpreting scientific data (Applying)

Develop ideas for small scale start-ups (Creating)

Expt.1. Practical on design of vermicompost/mushroom unit

Expt.2. Survey of environment risk prone areas

Expt.3. Scientific search engine tour for e-resources, research article, review article, scientific problems

Expt.4. Calculation of mean, median, mode, standard deviation, quartile deviation and coefficient of variation from a given dataset

Expt.5. Calculation of chi square statistic (goodness of fit & independence of attributes)

Expt.6. Calculation of student's t-test

Expt.7. Calculation of analysis of variance (ANOVA)

Expt.8. Designing CRD for an experimental layout

Expt.9. Designing RBD for an experimental layout

Expt.10. Determination of coefficients of partial and multiple correlation

Expt.11. Determination of the regression coefficient

Mapping of COs to Syllabus:

Course Outcomes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10	Expt. 11
CO1			H								
CO2				H	H	H	H	H	H	H	H
CO3	H	H									

BOCT6040: CYTOGENETICS AND MOLECULAR TECHNIQUES LAB (3 CREDITS-60 HOURS) (L-T-P: 0- 0-3)

Course Outcomes

At the end of this course, student will be able to:

Interpret mitosis, meiosis and chromosomal aberration (Understanding)

Solve problems based on gene interactions (Applying)

Show hybridization in self- and cross-pollinated crops (Applying)

Utilize various chromatographic techniques to separate amino acids and plant pigments (Applying)

Isolate biomolecules and learn to use a thermal cycler (Applying)

Design primers using various software and use BLAST to identify sequences of similarity (Applying)

Part 1: Cytogenetics

Expt.1. Identification of mitosis from suitable plant material (Onion and garlic root tips)

Expt.2. Identification of meiosis from suitable plant material (Onion floral buds)

Expt.3. Study of chromosomal aberrations in plant (Rhoeo)

Expt.4. Study of numerical problems involving gene interactions

Expt.5. Practice of hybridization technique in self- and cross-pollinated plants species

Part 2: Molecular Techniques & Bioinformatics

Expt.6. Separation of amino acids and plant pigments by paper chromatography and thin layer chromatography (TLC)

Expt.7. Isolation of plasmid/genomic DNA

Expt.8. Isolation of total RNA from plant sample using Trizol method

Expt.9. Understanding the functioning of a thermal cycler/ Amplification of a gene using PCR

Expt.10. Designing of primers and identifying regions of similarity in biological sequences using BLAST

Mapping of COs to Syllabus:

COs	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9	Expt. 10
CO1	H	H	H							
CO2				H						
CO3					H					
CO4						M	H	H	H	

CO5						L				H
CO6									L	H

BOPE6042: PLANT ECOLOGY AND PHYTOGEOGRAPHY LAB (2 CREDITS-40 HOURS) (L-T-P: 0-0-2)

Course Outcomes

At the end of this course, student will be able to:

Gain knowledge about the population and communities characteristics in a given field

Gain knowledge about the concepts of analyzing edaphic characteristics

Gain knowledge about the analysis of physicochemical properties of water bodies

Expt.1. To determine the minimum size of the quadrat by species area-curve method.

Expt.2. To determine abundance, density, frequency, basal covers of plant communities by quadrat method.

Expt.3. To determine minimum number of quadrats required for reliable estimate of biomass in grasslands.

Expt.4. To compare protected and unprotected grassland stands using community coefficients (similarity indices).

Expt.5. Estimation of Importance Value Index (IVI) of the species in a grassland/woodland using quadrat method.

Expt.6. To estimate the above ground and below ground biomass from unit area.

Expt.7. To analyze the edaphic characteristics- Soil profile, Texture, Soil moisture, Water holding capacity, Porosity, pH, Organic matter content, and quantitative estimation of N, P, K.

Expt.8. To study the physicochemical characteristics from polluted and unpolluted water bodies: DO, COD, BOD, pH, Hardness, Alkalinity, Conductivity, Free CO₂, Chloride, Nitrate and Phosphate.

Expt.9. Field Study

Mapping of COs to Syllabus:

Course Out-comes	Expt. 1	Expt. 2	Expt. 3	Expt. 4	Expt. 5	Expt. 6	Expt. 7	Expt. 8	Expt. 9
CO1	H	H	H	H	H	H			H
CO2				L	L	L	H		M
CO3								H	M

BODI6032: DISSERTATION PHASE I (4 CREDITS-80 HOURS)

Description

Review of literature related to the research problem assigned to the students.

Practicing research ethics and methodology

Writing review articles related to the research problem.

Publishing these review articles in peer-reviewed journals.

Initial setting up of experiments to resolve the research problem

Writing and presenting the synopsis of the research problem.

BODI6034: DISSERTATION PHASE II (10 Credits-200Hours)**Description**

Conducting experiments to resolve the research problem
 Writing research articles and reviewing papers related to the research problem
 Publishing these research and review papers in peer-reviewed journals
 Presenting, explaining and defending the dissertation
 Writing the dissertation

VALUE ADDED COURSES**BOBF6035: BIO-FERTILIZER TECHNOLOGY (NON-CREDIT COURSE - 30 HOURS)****Course Outcomes:**

At the end of this course, student will be able to:

Gain the basic knowledge about Bio-fertilizer and Organic farming and its field application (understanding).
 Able to prepare bio-compost/organic compost/vermicomposting (Applying)

Module I: (3 Hours)

Bio-fertilizer concepts, types and applications; microorganisms used as bio-fertilizers

Module II: (12 Hours)

Rhizobium, *Azospirillum*, *Azotobacter*: classification, isolation, characterization and mass multiplication – carrier-based inoculant, associative effect of different microorganisms, Cyanobacteria as fertilizer, *Azolla-Anabaena* association and their role in agriculture, Mycorrhizal association, types, applications in crop fields

Module III: (15 Hours)

Organic farming concept; Green manure and organic fertilizers; bio-composts, vermicomposting– field applications Preparation of organic compost/bio-compost/bio-fertilizer; setting up of vermicomposting unit

Suggested Readings:

John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay -Publication, New Delhi.
 Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
 Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
 Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming Akta Prakashan, Nadiad 55

Mapping of COs to syllabus:

Course Outcomes	Module I	Module II	Module III
CO1	H	H	H
CO2	L	H	H

BOBC6038: BIOMASS CONVERSION, BIOREFINERY & CIRCULAR BIOECONOMY (NON-CREDIT COURSE - 30 HOURS)**Course Outcomes:**

At the end of this course, student will be able to:

Identify potential biomass feedstocks including energy crops based on its biochemical composition (Analysing)
 Have an understanding of the existing and emerging biomass to various technologies (Understanding)

Have an understanding of Biorefinery, LCA and applications. (Understanding)

Develop a critical thinking about sustainability and its prospect to generate circular bio-economy (Evaluating)

Determine sustainable solutions for bioresources by incorporating different technologies and assessment will be explored. (Application)

Module I: INTRODUCTION TO DIFFERENT BIOMASS TYPES AND COMPOSITION (4 hours)

Biomass Feedstocks I- Harvested Feedstocks (first generation feedstock, second generation, third generation feedstocks) in context to biofuel and biorefinery. Biomass Feedstocks II- Residue Feedstocks (Agricultural waste, Forestry waste, Farm waste, Organic components of residential, commercial, institutional and industrial waste). Biochemical composition of different biomass feedstock

Module II: BIOMASS CONVERSION TECHNOLOGIES (8 hours)

Biomass Conversion Technologies I- Biorefinery Concept -Understanding biorefinery concept, Bio-refineries & end products. Biomass Conversion Technologies II- Biochemical Conversion I-(Hydrolysis, enzyme & acid hydrolysis, Fermentation). Biochemical Conversion II- (Anaerobic digestion, Trans-esterification. Biomass). Conversion Technologies III- Thermochemical Conversion -(Combustion, Gasification, Pyrolysis. Other thermochemical conversion technologies, Scaling up emerging technologies.

Module III: LOW CARBON CIRCULAR ECONOMY VALUE ADDED PLATFORM CHEMICALS (10 hours)

Advanced low-carbon economy from biofuel/biopolymer/value added product—Case study, Mixed alcohols (Acetone, ethanol, butanol), C3 sugars (Lactic acid, Propionic acid), C4 sugars (Malic acid), C5 sugars (Furfural, levulinic acid, xylitol), C6 Sugars Hydroxymethylfurfural (HMF), Lignin, PHB, Bio-oil, biochar, biodiesel, bio hydrogen and other value-added organic products. Low carbon credit and carbon economy. Bioeconomy, value creation and business development, Circular economic principles and business models. Biotechnology and other bioprocesses enabling circular bioeconomy. Opportunities, framework conditions and barriers for a circular bioeconomy.

Module IV: BIOREFINERY (8 hours)

Basic Concept and Types of Integrated biorefinery (Aquaculture and algal biorefinery, waste biorefinery). Economics and Life Cycle Analysis I- (General understanding of LCA, Cradle-to-grave, field to wheels concepts, Goal and scope determination, defining LCA boundaries). Life Cycle Analysis II. Life Cycle Inventory, Life Cycle Assessment. GIS in agroresidue bioenergy planning, Biomass Supply and Logistics management.

Suggested readings:

Ashok Pandey, R. D. Tyagi, Sunita Varjani. Biomass, Biofuels, Biochemicals: Circular Bioeconomy—Current Developments and Future Outlook. 2021, Elsevier Science Publishing Co Inc.

Wiebke Reim, Vinit Parida, David R. Sjodin. Circular Business Models for the Bio-Economy: A Review and New Directions for Future Research. Sustainability; 11, 2558.

Juan-Rodrigo Bastidas-Oyanedel, Jens Ejbye Schmidt. Biorefinery “Integrated Sustainable Processes for Biomass Conversion to Biomaterials, Biofuels, and Fertilizers.”Springer.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	3		2	
CO2	2	3		
CO3			1	1
CO4			3	
CO5				3

BOHM6036: HERBAL MEDICINES (NON-CREDIT COURSE - 30 HOURS)**Course Outcomes:**

At the end of this course, student will be able to:

Acquire the concepts of herbal medicines (Understanding)

Utilize knowledge about conservation strategies and IPR principles (Applying)

Develop formulations of herbal medicines (Creating)

Module I: Module I: Introduction to Herbal Medicines (6 Hours)

Medicinal plant research scenario in India; Commercial cultivation of medicinal plants

Module II: Module II: Herbal Medicines in Medical Science (14 Hours)

Diagnostic features, bioactive molecules and therapeutic value of some common medicinal plants. Standardization of herbal drugs; Nutraceutical and medicinal food

Module III: Module III: IPR and Conservation Strategies (10 Hours)

Conservation of medicinal plants; Bioprospecting, biopiracy and protection of traditional medicinal knowledge (IPR)

Suggested Readings:

Alamgir ANM. Therapeutic Use of Medicinal plants and Their Extracts. Volume I.

Panda H. Handbook of Medicinal Plants with Uses. Publisher: Centre for Information Technology.

Singh KP. Conservation, Cultivation and Sustainable Utilization of Medicinal and herbal Plants. SR

Scientific Publication Rastogi RP. A Compendium of Indian Medicinal Plants. Publisher: Publications and Information Directorate.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III
CO1	H	H	M
CO2	L	M	H
CO3	H	H	H

BOFI6037: FOREST INVENTORY AND MENSURATION (NON-CREDIT COURSE - 30 HOURS)**Course Outcomes:**

At the end of this course, student will be able to:

Exhibit forest inventorying and mensuration skills for data collection, analysis, and interpretation (Applying)

Interpret a wide range of scientific and popular literature related to forest inventories (Analyzing)

Prepare, analyses and present both written and verbal technical reports on forest inventories (Applying)

Module I: Introduction to Forest Inventory and Sampling Design (15 Hours)

Introduction; Types of forest inventory; Choosing a sampling design: Simple random sampling, Stratified random sampling, Systematic sampling, Cluster sampling, Choosing sampling intensity, Locating sampling units: compass and measuring distance, GPS device; Sampling approaches: Fixed-area methods, Line intercept method, Distance-based sampling, Selecting an appropriate sampling unit

Module II: Forest Mensuration (15 Hours)

Measuring individual trees: Age, Stem diameter, Height, Canopy cover; Characterizing stand structure: Age and size structure, Height and vertical structure, Leaf area, Stand volume, Stand density; Spatial

structure of tree populations; Species richness and diversity: Species richness, Species diversity, Beta diversity and similarity; Analysis of floristic composition: Cluster analysis, Ordination, Importance values

Suggested Readings:

Avery, T. E. and Burkhardt, H. E. (2002). Forest measurements, 5th edition. McGraw-Hill, NY

Newton, A.C. (2007). Forest Ecology and Conservation - A Handbook of Techniques. Oxford University Press Inc., New York 3. Sutherland, W. (ed.) (1996). Ecological census techniques, a handbook. Cambridge University Press, Cambridge

Underwood, A. J. (1997). Experiments in ecology: Their logical design and interpretation using analysis of variance. Cambridge University Press, Cambridge

West, P. W. (2004). Tree and forest measurement. Springer-Verlag, Berlin

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II
CO1	H	H
CO2	M	M
CO3	M	M

SERVICE-LEARNING

COURSE

BOSL0100: SERVICE LEARNING ON ETHNOBOTANICAL PRACTICES (NON-CREDIT COURSE - 30 HOURS)

Course Outcomes:

Ability to think critically and analyze what they have learned in the classroom and how to apply their theoretical knowledge in the real world for the betterment of the society (Applying)

Development of social accountability and greater participation in community services. (Applying)

Development of communication skill, personality skill, decision making ability and other career related skill. (Evaluating)

Awareness about the cultural diversity and their relationship with traditional plants (Understanding)

Better understand the basic concepts of ethno-botany and their conservation practices (Understanding)

Recognize the ethno-botanically important plants species (Remembering)

Module 1: Introduction to Service Learning (10 Hours)

Definitions; Aims and Objectives of Service Learning; Types of Service Learning; Principles of Service Learning; Important tools of Service Learning; Scopes of Service Learning; Benefits of Service Learning ; Community based

Service Learning and Volunteering Service Learning

Module 2: Introduction to Ethno-botany (10 Hours)

Concepts of Ethno-botany: Definitions, Interdisciplinary; Aims and Objectives of Ethno-botany; Scope of Ethno-botany: Documentation, Preservation, Conservation; Application of Ethno- botany; Concept on Rare Endangered and Threatened (RET) Taxa; Basic concept on the Conservation and Management of native plants; Basic concept on Intellectual Property Right (IPR)

Module 3: Orientation Programme (10 Hours)

Lectures from experts; Discussion on various issues related to health and wellness, environment, waste management, education; Videos on community services

Module 4: Service Learning on Ethno-botanical practices (180 Hours)

Implement of an interaction programme with the local ethnic group to understand their relationships with the native plants; Awareness programme on the conservation and management of rare and medicinal plants; Awareness campaign on the reconstruction of forest in the local community; Fundraise for cultivation of medicinal plants in the community; Creation of medicinal plant garden for recreation and to earn income for livelihood and to help those who are in need; Combat of invasive plants to restore ecosystems in preserve areas for public use.

Mapping of COs to Syllabus:

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H		L	H
CO2	H		L	H
CO3	H		M	H
CO4		H		M
CO5		H		M
CO6		H		M

DEPARTMENT OF ZOOLOGY DETAILED SYLLABUS

VISION:

To develop the Department as an interdisciplinary centre for learning, research, and innovation
To develop the Department into a hub of biodiversity research while making the surrounding a natural laboratory

MISSION:

To provide a better understanding of Zoological Sciences through interaction with the natural environment and sensitizing the students about their social responsibilities
To expose the learners to recent advances in Zoology and to provide high quality education with an emphasis on learning and research.

PROGRAMME: BSC ZOOLOGY (HONOURS)

PROGRAM OUTCOMES (PO) - BSC PROGRAMME

- PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspective.
- PO 2: **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media, and make meaning of the world by connecting people, ideas, books, media and technology.
- PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO 4: **Effective Citizenship:** Demonstrate empathetic social concern and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO 5: **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO 6: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
- PO 7: **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PROGRAMME SPECIFIC OUTCOMES (PSOs)- BSc (Honours) Zoology

- PSO 1: **Knowledge and Concept:** Acquire detailed knowledge on the extensive diversity of organisms inhabiting varied ecological niches of the earth as well as understand the complexity of the various life-systems operating in these organisms.
- PSO 2: **Applying knowledge for self-sustenance:** Build foundations for novel thinking through application-based studies such as sericulture and aquarium fish keeping, thus ensuring better opportunities for self-sustenance in future.
- PSO 3: **Skills in handling scientific instruments:** Develop interest as well as proficiency in handling scientific instruments introduced as part of practical courses, thereby warranting all-around growth.
- PSO 4: **Conservation strategies:** Recognize the importance of conservation and encourage designing of effective strategies to address present conservation issues with preference to sustainable development.

COURSES OFFERED IN BSC (HONOURS) ZOOLOGY

Sl. No	COURSE NAME
1.1	Environmental Studies
1.2	English Communication
1.3	Foundations of Service Learning
1.4	Non-chordates I: Protista to Pseudocoelomates
1.5	Perspectives in Ecology
1.6	Non-Chordates II: Coelomates
1.7	Cell Biology
1.8	Animal Diversity
1.9	Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons
2.0	Environment and Public Health
2.1	Diversity of Chordates
2.2	Animal Physiology: Controlling and Coordinating Systems
2.3	Fundamentals of Biochemistry
2.4	Research Methodology
2.5	Comparative Anatomy of Vertebrates
2.6	Animal Physiology: Life-Sustaining Systems
2.7	Biochemistry of Metabolic Processes
2.8	Sericulture
2.9	Aquarium Fish Keeping
3.0	Environmental Biotechnology
3.1	Economic Botany and Plant Biotechnology
3.2	Chemical Energetics, Equilibria and Functional Organic Chemistry - I
3.3	Molecular Biology
3.4	Principles of Genetics
3.5	Wildlife Conservation and Management
3.6	Animal Behaviour and Chronobiology
3.7	Computational Biology
3.8	Animal Biotechnology
3.9	Developmental Biology
4.0	Evolutionary Biology
4.1	Immunology
4.2	Parasitology
4.3	Fish and Fisheries
4.4	Biology of Insecta
4.5	Non-chordates I: Protista to Pseudocoelomates Lab
4.6	Perspectives in Ecology Lab
4.7	Non-Chordates II: Coelomates Lab
4.8	Cell Biology Lab
4.9	Animal Diversity Lab
5.0	Atomic Structure, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons Lab
5.1	Environment and Public Health Lab

5.2	Diversity of Chordates Lab
5.3	Animal Physiology: Controlling and Coordinating Systems Lab
5.4	Fundamentals of Biochemistry Lab
5.5	Comparative Anatomy of Vertebrates Lab
5.6	Animal Physiology: Life-Sustaining Systems Lab
5.7	Biochemistry of Metabolic Processes Lab
5.8	Environmental Biotechnology Lab
5.9	Chemical Energetics, Equilibria and Functional Organic Chemistry – I Lab
6.0	Economic Botany and Plant Biotechnology Lab
6.1	Molecular Biology Lab
6.2	Principles of Genetics Lab
6.3	Wildlife Conservation and Management Lab
6.4	Animal Behaviour and Chronobiology Lab
6.5	Computational Biology Lab
6.6	Animal Biotechnology Lab
6.7	Developmental Biology Lab
6.8	Evolutionary Biology Lab
6.9	Immunology Lab
7.0	Parasitology Lab
7.1	Fish and Fisheries Lab
7.2	Biology of Insecta Lab

BSC (HONOURS) ZOOLOGY MAPPING OF COURSES TO PO/PSO

SI. NO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
1.1						H					H
1.2					M	M		M	M		H

1.3	H				M	M		H	M	M	
1.4	H					M		H	H		
1.5		H	H	H					M		
1.6	H							H	M		
1.7	H							H	M		
1.8	M							H	M	H	
1.9	H							M	H	H	
2.0						H					H
2.1	H							H	M		
2.2	H						H	H			
2.3								H	M	H	
2.4						H		H	H		M
2.5	H							H	H		
2.6	M							H	H	H	
2.7						H		H			M
2.8	M							M			
2.9	H							H	H		
3.0								H	M	H	
3.1	M							M			

3.2	H							H	H	H	
3.3	H		M		H					H	
3.4								H	M		
3.5								H	H		
3.6	M							H	H		
3.7	M							H	H	H	
3.8								H	H	H	
3.9	H							H	H	H	
4.0								H	H	H	
4.1	H							H	H		
4.2	H							H	H		
4.3	H							H	H	H	
4.4	H				M			H	H	M	
4.5	M							H			H
4.6	M				M			H	M	M	H
4.7	H							H			
4.8	H				M			H	H	H	
4.9	H							H	H		
5.0	H							H	H	M	
5.1	H				H			H	H		
5.2	H				H			H	H	H	
5.3	H							H	M		
5.4	M							M	M		
5.5	M				M			H	H	H	
5.6								H	M	M	
5.7	H							H	H		M
5.8	H				H			H	H	H	
5.9	M							H	H		
6.0	M				M			H	H	M	H
6.1	M							H	H		
6.2					M			H	H	H	
6.3	M							H	H		
6.4	M				M			H	M	H	
6.5	H				M			M	H	M	M
6.6	M				M			H	M	M	
6.7	H				M			M	H	H	
6.8	M				M			H	M	M	M
6.9	M				M			H	M	M	
7.0	H				M			M	H	M	
7.1	H				H			M	M	M	
7.2	M				H			M	M	M	M

PROGRAMME: MSC ZOOLOGY**PROGRAM OUTCOMES (PO)- MSC ZOOLOGY**

- PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational and personal) from different perspective.
- PO 2: **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media, and make meaning of the world by connecting people, ideas, books, media and technology.
- PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO 4: **Effective Citizenship:** Demonstrate empathetic social concern and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO 5: **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO 6: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
- PO 7: **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.
- PO 8: **Skill Development:** Acquire and develop skills in handling scientific instruments, planning and executing biological research for employability and social service.
- PO 9: **Entrepreneurship:** Inculcate a holistic approach towards amalgamating and applying the acquired knowledge, ideas and views towards formulating a model that would not only encourage financial stability of the person concerned but also generate employability and strengthen the socio-economic aspect of a region or locality as a whole.
- PO 10: **Creative Thinking:** Promote creative thinking and innovative ideas for the welfare of the society.

PROGRAMME SPECIFIC OUTCOMES (PSOs)- MSc ZOOLOGY

- PSO 1: **Knowledge and concept:** To acquire in-depth knowledge about the complexity of life systems at the molecular level.
- PSO 2: **Research-inclined mindset:** To apply and analyze the various research techniques through minor dissertation projects, thus inculcating the fundamentals for future scientific studies.
- PSO 3: **Applied Zoology and Entrepreneurship:** To apply the acquired knowledge to invigorate the existing areas of application- based zoological studies for creating productive models for self-sustenance.
- PSO 4: **Conservation Models:** To specifically recognize the existing conservation issues with regards to both animal and environment and develop strategies to address these issues through ecologically sustainable methods.

COURSES OFFERED IN MSC ZOOLOGY

Sl. No	Course Name
1.1	Research Methodology and Biostatistics
1.2	Developmental Biology
1.3	Insects: Structure and Function
1.4	Insect Physiology
1.5	Cell and Molecular Biology I
1.6	Immunology I
1.7	Taxonomy and Functional Anatomy

1.8	Aquaculture and Fish Genetics
1.9	Animal Ecology and Biogeography
2.0	Wildlife Conservation and Management
2.1	Insect Ecology
2.2	Principles of Pest Management
2.3	Cell and Molecular Biology II
2.4	Immunology II
2.5	Capture Fishery and Post-Harvest Technology
2.6	Limnology, Fisher Economics, Ornamental Fishery and Fish Pathology
2.7	Wildlife Resource Management, Laws and Techniques In Population Study
2.8	Techniques in Wildlife Study, Wildlife Health, Forensics, and Conflict
2.9	Biosystematics and Evolution
3.0	Cell Biology and Immunology – Theory and Applications
3.1	Molecular Biology and Genetics
3.2	Animal Physiology
3.3	Ecology and Environmental Biology
3.4	Endocrinology and Biochemistry
3.5	Applied Zoology
3.6	Ethology and Population Genetics
3.7	Service Learning in Zoology
3.8	Project Management, Reporting, and Documentation
3.9	Dissertation Phase I
4.0	Introduction to Journalism and Photography
4.1	Dissertation Phase II
4.2	Teaching Methodology and Classroom Management
4.3	Specialization Lab I-Entomology
4.4	Specialization Lab I-Cell and Molecular Biology
4.5	Specialization Lab I-Fishery Science
4.6	Specialization Lab I-Animal Ecology and Wildlife Biology
4.7	Specialization Lab II-Entomology
4.8	Specialization Lab II- Cell and Molecular Biology
4.9	Specialization Lab II- Fishery Science
5.0	Specialization Lab II- Animal Ecology and Wildlife Biology
5.1	Biosystematics and Environmental Biology Lab
5.2	Cell Biology, Genetics and Basic Bioinformatics Lab
5.3	Developmental Biology and Biochemistry Lab
5.4	Ethology and Population Genetics Lab

Mapping of Courses to PO/PSO

Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3	PSO4
1.1	M	H			H			H		H		H	M	M
1.2	H				M						H	M		
1.3											H			
1.4	M										H			
1.5	M										H	M		

1.6											H	M		
1.7	M										H			
1.8							M				H	M		M
1.9											H			
2.0	M			M	H	H	H				H	M		H
2.1											H			H
2.2							H	M			H		M	
2.3											H			
2.4											H			
2.5							H				H	M	M	
2.6											H		H	H
2.7							H	H			H	M		H
2.8					M	H	H	H			H	M		H
2.9	H										H			
3.0	M						H				H	M		
3.1	H				M						H			
3.2											M			
3.3						H					M			H
3.4											H	M		
3.5	M				M		H	H	H	H			H	
3.6	H				H						H	M		M
3.7			H		H		H			H	H	M	M	H
3.8		H	M	M			H	H		H			M	
3.9		M	M		M									
4.0		H			H		H	H				M	M	
4.1		H	M		H									
4.2								H					M	
4.3		M					M							
4.4		M					M							
4.5		M					M							
4.6		M				H	H							
4.7		M					H							
4.8		M					H							
4.9		M					H							
5.0		M												
5.1		M				H	H							
5.2		M					H							
5.3		M					H							
5.4		M					H							M

**DETAILED SYLLABUS THEORY
COURSES**

BTRM0003: RESEARCH METHODOLOGY AND BIOSTATISTICS (4 CREDITS – 60 HOURS) [L-T-P: 4-0-0]

Course Outcomes

At the end of the course students will be able to:

Identify the complex issues inherent in selecting a research problem, selecting an appropriate research design and implementing a research project (Applying)

Define various kinds of research, objectives of doing research, research process, research designs and sampling. (Remembering)

Analyze the application of statistics in educational research. (Application)

Identify the ethical issues of research. (Applying)

Design and develop synopsis and thesis writing. (Creation)

Module I: Introduction to Scientific Research (15 hours)

Definition, basic and applied research, interdisciplinary research,

Discriminative reading, reading and reviewing scientific literature – consulting source material, primary and secondary literature, biological abstract, current content, review, monograph, peer-reviewed journals, e-resources; research and review articles

Introduction on scientific problems, your scientific problem, methods and techniques, research conditions, data types, techniques, repeatability, reproducibility and reliability, validity, effect measure and choice of statistical test, experimental protocol, experimental routine

Scientific communication - scientific paper, scientific posters

Module II: Ethics and Scientific Conduct (5 hours)

Brief introduction to ethics, scientific conduct and misconduct-plagiarism, authorship issues, investigation and punishment of scientific misconduct, ethics of animal and human research

Module III: (15 hours)

Introduction to Biostatistics: definition and applications of biostatistics;

Data-types and presentation: types of biological data, accuracy and significant figures;

Populations and samples: populations, samples from populations, random sampling, variables and attributes, statistical errors, Frequency distributions

Graphical representation of data: line diagram, bar diagram, pie chart, histogram

Measures of central tendency: the arithmetic mean, median and mode

Measures of dispersion: range, mean deviation, variance, standard deviation, standard error of mean, standard score

Module IV: (6 hours)

Permutations and combinations, sets

Probability: introduction, counting possible outcomes, probability of an event, adding and multiplying probabilities

Probability distributions: Binomial, Poisson and Normal distribution

Module V: (19 hours)

Testing of hypothesis and goodness of fit: Null hypothesis, level of significance, errors of influence,

Student's t-test, paired t-test, Fischer's test, Chi-square test, linear correlation and linear regression

Analysis of variance: variances of samples and their means, F-distribution, partitioning of the total sum of squares and degrees of freedom, models and types of ANOVA

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	L	L	H	M
CO 2	L	H			
CO 3	M	M	H	H	H

ZGDB0005: DEVELOPMENTAL BIOLOGY (4 CREDITS–60 HOURS) (L-T-P: 4-0-0)

Objective: The objective of this course on Developmental Biology is to enable the students to understand the process of development in animals and the phenomena associated with it. It will enable the students to understand the environmental influences on development and factors responsible for age so as to imbibe the current knowledge pertaining to the development of animal embryos of diverse taxonomic groups through experimental analyses based on modern biological tools.

Course Outcomes

Develop the concepts of mechanisms of embryonic development. (Applying)

Categorize different mechanisms of embryological development through experimental techniques. (Analyzing)

Assess the effects of various teratogenic agents and environmental estrogens on development. (Evaluating)

Appraise the interactions of maternal effect of gene, gap gene, pair-rule gene, and hox- gene in development with respect to *Drosophila*. (Evaluating)

Discuss the various methods of assisted reproductive technology. (Creating).

Module I (14 hours)

Fertilization-pre and post fertilization events: activation of eggs, gamete fusion and concept of prevention of polyspermy

General concept of embryonic Induction in animals (experimental evidence); Imaginal disc of insects

Experimental evidence of hybridization experiments in animals, nuclear transplantation experiments.

Module II (10 hours)

Principles of experimental embryology: the developmental dynamics of cell specification, stem cells and developmental commitment, totipotency and pluripotency.

Morphogenesis and cell adhesion- the thermodynamic model of cell interactions, concept of morphogen gradient and morphogenetic field, cell adhesion molecules.

Module III (10 hours)

Role of maternal contribution in early embryonic development in *Drosophila*: maternal effect genes, gap genes, pair rule genes and hox genes in development

Module IV (10 hours)

Organogenesis: Vulva formation in *Caenorhabditis elegans*; Regeneration of Salamander limbs; Lens regeneration in amphibia; Bone and neural regeneration-Medical Advances in regeneration.

Module V (16 hours)

a) Medical implications of Developmental Biology - Genetic error of human development; Environmental assault on human development, Teratogenic agents (Retinoic acid, pathogens, alcohol, drugs and chemicals, heavy metals); b) Infertility- In vitro fertilization and embryo transfer. Cloning experiments- Amphibians and Mammals.

c) Sex determination- Temperature-dependent sex determination in animals, Endocrine disruptors and sex determination problems

Suggested Readings

Balinsky, B.I. An Introduction to Embryology. W.B Saunders Co., Philadelphia.
 Gilbert, S.F. Developmental Biology. Sinauer Associates Inc. Sunderland, Massachusetts, U.S.A.
 John E. Hall: Textbook of Medical Physiology. Guyton & Hall 4. Kalthoff: Analysis of biological development. McGraw-Hill, 1996.
 Karp, G. and Berrill, N.J. Development. McGraw Hill, New York.
 Nagabhushanam, R. and Sarojini, R. Invertebrate Embryology. Oxford and IBA Publishing Co.
 Oppenheimer, S.B. Introduction to Embryonic Development. Allyn and Bacon, Inc.
 Saunders, J.W. Developmental Biology. MacMillan Co., London.
 Tyagi and Shukla, Development of Fishes. Jaya Publishing House, New Delhi.
 Wolpert: Principles of development. Oxford.
 N. Arumugan, A textbook on Embryology, Saras Publication.
 Gurbachan S. Miglani, Developmental Genetics, I.K. International Publishing House Pvt. Ltd.
 Verma P.S. and Agarwal V.K, Chordate Embryology, S. Chand Publishing.
 Chordate Embryology by Verma P.S. and Agarwal V.K., S. Chand Publishing.
 Saidapur.S.K. Reproductive cycles of Indian vertebrates. (Allied Publishers Ltd. New Delhi)
 Sarkar. H.B.D Principles of Vertebrate reproductive Biology
 Chester-Jones I: Fundamentals of Comparative vertebrate Endocrinology (Pleum Press: NY)

Mapping COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	L					
CO2		H				
CO3				H		
CO4						H
CO5			H		H	

SPECIALISATION I: ENTOMOLOGY

ZGIF0008: INSECTS- STRUCTURE AND FUNCTION (4 CREDITS-60 HOURS; L-T-P: 4-0-0)

Course/Learning Outcomes (CO)

At the end of this course students will be able to:

Recall the basics of insect classification of different insect orders up to family level. (Remembering)

Identify details of insects' morphology, origin and locomotion and the different receptor organs.
 (Applying)

Discuss the basic concepts of insect-plant interactions. (Creating)

Module I (20 hours)

Origin and evolution of insects

Segmentation of insect: head, thorax and abdomen: body tagmata, sclerites and segmentation, Type of mouthparts, antennae, legs, their modifications and functional significance; model Genitalia and their modifications; Embryonic and post-embryonic development; Types of metamorphosis in insects.

Wings: wing structure, venation and wing coupling; Insect flight taking *Drosophila* as a model.

Module II (20 hours)

Basic concept of surveillance and sampling of insect.

Classification of insect up to family with example : a) Coleoptera, Diptera, Hymenoptera; b) Lepidoptera, Odonata; c) Orthoptera, Hemiptera and; Insect molecular taxonomy-DNA as a new tool for insect identification

Module III (8 hours)

Insect integument: Structure, chemical composition, bio-composition of chitin, function of integument

Module IV (12 hours)

Receptor organ in insects (Chemoreceptors, mechano receptors and photoreceptors);
Sound and Light producing organs in insects;
Locomotion in insects,
Insect Muscle,
Insect eye.

Suggested Readings

R.F. Chapman, The Insect Structure and Functions, Cambridge University Press
D.B. Tembhare, Modern Entomology, Himalaya Publishing House
K.P. Srivastava, Textbook of Applied Entomology Vol- I & Vol- II, Kalyani Publishers
Abhishek Shukla and Sushil Kumar Saxena, Introduction to General and Applied Entomology, Astral International (P) Ltd.
H. Maxwel-Lefroy & F.M. Howlett, Indian Insect Pests, Astral International (P) Ltd.
Abhishek Shukla, A Handbook on Economic Entomology, Astral International (P) Ltd.
T.V. Sathe & Jyoti M. Oulkar, Insect Pest Management: Ecological Concepts, Astral International (P) Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H		L
CO 2	H	H	H	H
CO 3	L	H		
CO 4	H	M	M	M
CO5	H			

ZGIP0009: INSECT PHYSIOLOGY (4 CREDITS-60 HOURS; L-T-P: 4-0-0)

Course/Learning Outcomes

- 1: Develop knowledge on detailed different systems of physiology of insects. (Applying)
- 2: To analyze the different reproductive system of insects in relation to recent literature (Analyzing)
- 3: Improve the knowledge that neural and hormonal controls have within each system. (Creating)
- 4: Develop a sense of how physiology can be infused in major research topics in entomology. (Applying)

Module I (25 hours)

Digestive System: Different types of alimentary canal, salivary glands, physiology of digestion and absorption.

Respiratory System: General organization of respiratory system, classification of respiratory system, respiration in terrestrial insects-different types of spiracles and their structure, opening and closing mechanism of spiracle, trachea and tracheoles, air sac, ventilation of tracheal system, mechanism of gaseous exchange, respiration in aquatic insects, physiology of gill and plastron respiration, respiration in parasitic insects.

Circulatory system: Diaphragm and sinuses, dorsal vessels, accessory pulsatory organs, blood circulation, chemical composition of haemolymph, different types of haemocytes and their functions.

Module II (18 hours)

Nervous system: Structure and types of neurons, central nervous system basic plan, gross anatomy and microanatomy of brain and ganglion, sympathetic nervous system, nerve impulse transmission.

Excretory System: Basic and cryptonephridial system, malpighian tubules-anatomy and histology, Accessory organs of excretion, metabolic pathways of formation of uric acid and ammonia, elimination of Uric acid by malpighian tubules;

Diapause: Hormonal control of embryonic, larva, pupal and reproductive diapause

Module III (17 hours)

Reproductive System: male and female reproductive system, spermatogenesis, oogenesis; Hormonal control of reproduction in male and female insects;

Neuroendocrine System: Neuroendocrine organs, hormones produced by neurosecretory cells, corpus allatum, corpus cardiacum and prothoracic gland, their chemical nature and functions; Insect immunity; Growth and metamorphosis of insects; Insect Pheromones.

Suggested Readings

The Insect Structure and Functions, R.F. Chapman, Cambridge University Press

Modern Entomology, D.B. Tembhare Himalaya Publishing House

Text Book of Applied Entomology Vol- I & Vol- II, K.P. Srivastava, Kalyani Publishers

Introduction to General and Applied Entomology, Abhishek Shukla and Sushil kumar Saxena, Astral International (P) Ltd.

Indian Insect Pests, H. Maxwell-Lefroy & F.M. Howlett, Astral International (P) Ltd.

A Handbook on Economic Entomology, Abhishek Shukla, Astral International (P) Ltd.

Insect Pest Management: Ecological Concepts, T.V.Sathe & Jyoti M. Oulkar, Astral International (P) Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H

SPECIALIZATION II: CELL AND MOLECULAR BIOLOGY SPECIALIZATION**ZGCB0010: CELL AND MOLECULAR BIOLOGY-I (4 CREDITS; 60 HRS; 4-0-0)****Course Outcomes**

Analyze the structure and working of various components of the cell such as bio membrane structure and organization; genes and gene regulation and protein hierarchical structure. (Analyzing).

Evaluate the various types of protein in the cell organization. (Interpreting)

Classify the positive and negative control of gene expression and also the molecular structure of chromosomes. (Analyzing)

Recommend the use, Ramachandran plot for the prediction of secondary structure of protein. (Evaluating)

Module I (10 hrs)

Transport across cell membrane: Mechanism of diffusion, Facilitated diffusion; Osmosis and water channels, movement, Flick's law, Donnan equilibrium; Uniporter-catalyzed transport, difference between uniporter-catalyzed transport and passive diffusion, GLUT- 1 transport & its kinetics; Intracellular ion environment and membrane electric potential; Active transport - P-class ion pumps, F-class and V-class ion pumps and ABC superfamily, Plasma Membrane Ca^{++} ATPase pump, Muscle Ca^{++} ATPase pump and $\text{Na}^{+}/\text{K}^{+}$ ATPase pump; Cotransport by symporters and antiporters; Transport across epithelia, Receptor mediated endocytosis.

Module II (15 hrs)

Cytoskeleton: Microfilaments: Actin cytoskeleton, G-actin and F-actin; structural and functional polarity. Cortical actin network, erythrocyte and platelet cytoskeleton; Actin bundle support projecting fingers of membrane; Dynamics of actin assembly, actin polymerization; Toxins effect on actin monomer - polymer equilibrium, stabilization of actin filaments by actin capping proteins; Movement with actin polymerization (a) Intracellular bacterial and viral movements (b) Actin polymerization at the leading edge of moving cells; Myosin: (a) Structure and mechanism of movement with actin (b) Conformational changes in myosin during movement.

Microtubules: Microtubules structure and microtubule assembly from organizing centers, Microtubule dynamics, Microtubule associated proteins (MAP's) and crosslinking of microtubules.

Microtubules and mitosis (a) Centrosome duplication (b) Kinetochore and force for poleward chromosome movement (c) Organization of spindle pole and orientation of assembly (d) Formation of poles and capture of chromosomes (e) Kinetochore and force of poleward chromosome movement (f) Astral microtubule and cytokinesis (g) Microtubules and plant cell formation.

Module III (20 hrs)

Molecular structure of genes and chromosomes: Definition of gene; Chromosomal organization of genes- coding and non-coding DNA; Functional re-arrangements in chromosomal DNA; Organizing cellular DNA into chromosomes; Morphological and functional elements of eukaryotic chromosomes.

Regulation of Gene expression: Operon concept; Positive and Negative regulation; Inducers and corepressors; Regulation by attenuation-his and trp operons.

Module IV (15 hrs)

Protein structure and function: Structure and chemistry of amino acids; Hierarchical structure of proteins- Secondary structure: α -helix, β -pleated sheets and bends; Prediction of secondary structure, Ramachandran plot; Tertiary structure, forces stabilizing tertiary structure; Domains and Motifs; Quarternary structure of proteins

DNA binding proteins and gene regulation: DNA binding domain; Homeodomain proteins; Zinc finger proteins; Winged-helix (Forked head) proteins; Leucine-Zipper proteins; Helix Loop helix proteins.

Suggested Readings

Cooper, G. M., Cell (A Molecular Approach)

DeRobertis&DeRobertis: Cell and Molecular Biology

Lodish et al: Molecular Cell Biology

Karp: Cell and Molecular Biology

Becker et al: World of Cell

T.A. Brown: Genome

Griffith et al: Modern Genetic Analysis

Hartl& Jones: Essential Genetics: A Genome Perspective

Ram Mahabal, Fundamental of Cytogenetics and Genetics

Lewin, Genes VIII

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	L			
CO2		M		
CO3			H	
CO4				H

ZGIY0011: IMMUNOLOGY-I (CREDIT 4; 60 HRS; 4-0-0)

Course Outcomes

- Demonstrate the basic concepts of the immune system and its components. (Understanding)
- Apply the concept of antigenic determinant, antigen specificity and hybridoma technology to construct monoclonal antibodies. (Applying)
- Examine how the antigen processing and presentation of both exogenous and endogenous antigen works. (Analyzing)
- Compare various agents responsible for different types of hypersensitivity reactions. (Evaluating)
- Elaborate the network of various components and complexes of the immune system and make a checklist of organ specific and systemic autoimmune diseases. (Creating)

Module I (15 hrs)

Cells and organs of immune system: Hematopoiesis- B-Lymphocytes, T-lymphocytes and Null cells; Mononuclear cells (antimicrobial and cytotoxic activities, secretion of factors); Granulocytic cells (Neutrophils, Eosinophils and Basophils); Mast cells; Dendritic cells and Langerhans cells; Organs of immune system: Primary lymphoid organs (Thymus and bone marrow), Secondary lymphoid organs (Lymph nodes, spleen, mucosal associated lymphoid tissue and cutaneous associated lymphoid tissue, tonsils and Peyer's patches; Lymphatic system.

Molecular Immunology: Components of immunity; Innate (nonspecific) immunity- Anatomic barriers, Chemical barriers, Phagocytic barriers, Inflammatory barriers; Adaptive (specific) immunity-Humoral and cell-mediated immunity (CMI):(a) Recognition of antigen by B-and T-lymphocytes and antigen presenting cell (APC)(b) Clonal selection of lymphocytes; Cellular interactions required for generation of immune responses(a) Activation and proliferation of B and T cells (b) Generation of humoral immune responses (c) Generation of Cell mediated immune responses.

Module II (15 hrs)

Antigens: Immunogenicity versus antigenicity; Factors that influence immunogenicity, Contribution of the immunogens (foreignness, molecular size, chemical composition and heterogeneity, susceptibility to antigen processing and presentation); Haptens and epitopes; Immunogen dosage and route of administration and adjuvants.

Immunoglobulins structure and function: Molecular structure of Ig; Immunoglobulin classes (IgG, IgM, IgE and IgD and their biological activities; Immunoglobulin - mediated effector functions (Opsonization, activation of complement, antibody dependent cell- mediated cytotoxicity , neutralization); Antigenic determinants on immunoglobulin (isotype, allotype and idiotype); Monoclonal antibodies: Formation and selection of hybrid cells, Production of monoclonal antibodies, Clinical uses of monoclonal antibodies, Catalytic monoclonal antibodies (abzymes).

Antigen - Antibody Interaction: Antibody affinity and activity; Cross reactivity; Agglutination reactions; Precipitation reaction.

Module III (20 hrs)

Major Histocompatibility complex: General organization and inheritance of MHC; Location and function of MHC; MHC haplotypes; MHC molecules and gene: Structure of class I molecules; Structure of class II molecules; Organization of class I and II genes; Peptide binding by MHC molecules; Class III molecules; Regulation of MHC expression; MHC and immune responsiveness; MHC and disease susceptibility.

Antigen processing and presentation: Role of antigen presenting cell, Early evidence for the necessity of antigen processing; Cells that function in antigen presentation; Evidence for two processing and presentation pathways; Endogenous antigens (The cytosolic pathway): (a) Peptide generation by proteasomes (b)

Peptide transport from the cytosol to rER (c) Assembly of peptide with class I MHC molecules; Exogenous antigens (The endocytic pathway)(a) Peptide generation in endocytic vesicles(b) Transport of class II MHC molecules to endocytic vesicles.(c) Assembly of peptide with class II MHC molecules.

Module IV (10 hrs)

Hypersensitivity: Type I, II, III and IV; *In vivo* and *in vitro*

Autoimmunity: Organ specific autoimmune disease; Systemic autoimmune disease.

Suggested Readings

Kuby et al.: Kuby Immunology

Abbas A.K., Lichtman A.K. and Pober J.S. Cellular and Molecular Immunology

Roitt et al, Essential Immunology

Price C.P., Newman D.J., Principles and Practices of Immunology

Kindt T.J., Osborne B.A., Goldsby R., Immunology

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
1	L			
2		H		
3			M	
4				M

SPECIALIZATION III: FISHERY SCIENCE

ZGTF0012: TAXONOMY AND FUNCTIONAL ANATOMY (4 CREDITS- 60 HOURS/L-T-P: 4-0-0)

Course Outcomes

Analyze the non-piscine fishery resources and their importance in fisheries. (Analyzing).

Apply the knowledge of fish biology and its importance in fishery practices for the development of future entrepreneurship. (Applying).

Develop fundamental skill to identify and classify various groups of fishes, their relationship with morpho-anatomical and molecular techniques. (Creating)

Module I (10 hours)

Fin fish taxonomy: General characters and classification, major fish groups (extant & extinct), phylogeny of fishes;

Gross external anatomy of fishes: skin and its derivatives, scales and their significance; Significance of fish osteology in taxonomy.

Fish barcoding.

Module II (30 hours)

Fin fish functional biology: Food and feeding habits: Food– Kinds and varieties, abundance of food and its availability, structural adaptation, search for food, classification based on food and feeding habits;

Respiratory organs in fishes – Modification of gills and Tracheae in relation to habit – Structural adaptations of air breathing fishes;

Age and growth: Growth, length weight relationships, condition factors, morphometric indices and bioenergetics index, variation in growth rate, age determination;

Fin fish reproductive biology: Modes of reproduction, reproductive cycle, gonad maturity stages, Hormonal regulation of gonadal development, activity of Gonadotropin-releasing hormone, modes of spawning; Environmental factors controlling reproduction and factors affecting development.

Module III (20 hours)**Shellfish taxonomy:**

General characters and classification of major groups of crustacean and molluscs.

Food and feeding biology of Shellfish:

Food, feeding habits and adaptations of cultured prawn and shrimps. □ Food, feeding habits and adaptations of cultured Molluscs.

Shellfish reproductive biology:

Reproductive patterns in prawn and shrimp, reproductive organs, gonad maturity, spawning and fertilization. Endocrine organs in crustaceans and their role in reproduction.

Reproductive patterns in Molluscs, reproductive organs, gonad maturity, spawning and fertilization.

Suggested Readings

Barrington, F.J.W. Invertebrates: Structure and Functions. EIBS.

Carl, B.E. Biology of Fishes. Saunders,

Fretter, V. & A. Graham. The functional anatomy of vertebrates. Academic Press Inc. (Lon.) Ltd.

Kaestner, A. Invertebrate Zoology. Vol. I – III, John Wiley & Sons 5. Kurian, C.V. & V.O. Sabastian. Prawns and Prawn Fisheries of India.

Lagler, K.E. et. Al. Ichthyology. John Wiley,

Low, M.S. & G.M. Cailliet (eds.). Readings in Ichthyology. Prentice Hall,

Moyle Peterb, Fishes: An Introduction to Ichthyology. Prentice Hall.

Nikolsky, G.V. Ecology of Fishes. Academic Press, NY. Howar, W.S. & D.J. Randal. Fish Physiology, Vols.1–4, Academic Press, NY

Norman, J.R. & P.H. Greenwood. A History of Fishes, Ernest Benn Ltd.

Jayaram K. C. The fresh water fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka.

Jhingran V. G. Fish and Fisheries of India.

Lagler, K.F. Ichthyology. John Wiley Publication 14. Norman, J.R. & P.H. Green Wood. A history of fishes.

Bond, E. Carl. Biology of fishes.

Kumar S and Thembre M Anatomy and Physiology of Fishes (Vikas Publishing House)

Srivastava, C.B.L. Textbook of Fishery Science and Indian Fisheries. KutubMahal

Khanna S. S. and H. R. Singh. A textbook of Fish Biology and Fisheries, Narendra Publishing House

Beaven C R. Handbook of the freshwater fishes of India (Narendra Publishing House)

Biswas K P A Text Book of Fish, Fisheries and Technology, (Narendra Publishing House)

Brown E and Margaret 1957 Physiology of Fishes Vol I & II (Academic Press, Inc. Publishers)

Daniels R J R Freshwater fishes of Peninsular India (Universities press)

Lagler, K.F. Ichthyology. John Wiley Publication

Love, M.S. & Cailliet, G.M. Readings in Ichthyology. Prentice Hall Publications, 1979.

Norman, J.R. & P.H. Green Wood. A history of fishes.

Pandey. Fish and Fisheries. Rastogi Publications

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1			H
CO 2		H	
CO 3	H		

ZGAF0013: AQUACULTURE AND FISH GENETICS (4 CREDITS-60 HOURS/ L-T-P: 4-0-0)

Course Outcomes

Identify various freshwater fish culture methodologies and their significance. (Applying).

Utilize the knowledge on the process of fishery and aquaculture management for development of future entrepreneurship. (Applying).

Determine the nutritional requirements in fishery and development of skill on fish feed formulation for a profitable fish farming system. (Creating).

Apply the knowledge of the application of modern biotechnological tools and their role in the development of fishery. (Applying)

Module I (15 hours)

Fishery Management: Construction of fish farm and reclamation of swamps; Selection of species for culture – Biological principles, Preparation and management of nursery ponds, rearing ponds and stocking ponds along with control of weeds, pests and predators, Construction of hatcheries and their management.

Aquaculture Management: Feed, health and water quality management.

Module II (15 hours)

Freshwater fish culture: Indian Major carps and exotic carps - Composite Fish Culture; Air breathing fishes; Integrated Fish Farming – Paddy cum Fish Culture and Fish cum Livestock Culture, Monoculture, Monosex culture; Sewage fed fisheries, Catfish culture, Trout culture, Freshwater prawn culture; shrimps and Crab culture; cage culture and pen culture, Lobster culture, Mussel culture; Pearl oyster culture; Edible oyster culture

Module III (15 hours)

Fish nutrition: Nutritional requirements, formulation and preparation of fish feeds Food & Feeding habits of commercially important fishes. Larval nutrition — Importance of live feed and artificial feed, Different types of feed available for larvae.

Fish seed resources: Procurement and transportation of seed from natural resources.

Module IV (15 hours)

Fishery Genetics and Biotechnology: Inheritance in fishes, sex determination, hybridization

Cytogenetics and molecular techniques in fisheries: Comet Assay, Micronuclei Test, Fish cell lines and cell culture. Application of biotechnological tools: Recombinant DNA, Transgenesis, Gynogenesis and Androgenesis, Jellyfish Green Fluorescent Proteins and their applications; Cryopreservation.

Suggested Readings

Arumugam, N. Aquaculture & Fisheries, Saras Publication

Bardach, J.E., Ryther, J.H. and McLarney, W.O. Aquaculture. John Wiley & Sons Inc., USA.

Beaven C R Handbook of the freshwater fishes of India (Narendra Publishing House)

Boris, Gomelsky. Fish Genetics. VDMVerlag

C.I.F.R.I., Prawn Fisheries Bulletin

Chakroff, M., Freshwater Fish Pond Culture and Management, Scientific Publishers

Christenson, K. Aquaculture: Introduction to Aquaculture for Small Farmers. Createspace Independent Publishing Platform

Daniels R J R Freshwater fishes of Peninsular India (Universities press)

Dholakia, A.D. Identification of Prawns/Shrimps of India and Their Culture. Daya Publishing House

Elizabeth Gosling. Bivalve Molluscs: Biology, Ecology and Culture Wiley-Blackwell

Ghosh, S., Palanisamy, K. and Pathak, S.C. Shrimp and Freshwater Hatchery Public Relations Division, National Bank for Agriculture and Rural Development, Bombay.

- Gray, Camillo W. Guide to Shrimp and Prawn Culture in Bangladesh. University of Stirling Institute of Aquaculture
- Gupta S.K., Gupta P.C. General & Applied Ichthyology. S Chand & Company
- Hall, C. B., Ponds and Fish Culture, Agro Botanical Publishers
- Harvey, B. J. and Hoar, W. S. Theory and practice of induced breeding in fishes.
- Hora, S. L. and Pillay, T.V. R. Handbook on Fish Culture in the Indo-Pacific Region, Fisheries Division, Biology Branch, FAO,
- Huet, M., Textbook of Fish Culture, Breeding and Cultivation of Fish, Fishing News (Books) Ltd..
- CAR. Handbook of Fisheries and Aquaculture Reddy,
- M.S. A Text Book of Aquaculture, Discovery Publishing Pvt. Ltd
- Jhingran V. G. Fish and Fisheries of India.
- Kolappan Nisha. Identification of Genetic Relation Between Fish Species Using Sds-Page. Lambert Academic Publishing 23.
- Kurian, C.V. and Sebastian, V.O. Prawns and prawn Fishery of India. Hindustan Publishing Corporation (India), New Delhi.
- Lakra W. S., Abidi SAH, Mukherjee SC and Ayyappan S. 2004. Fisheries Biotechnology.
- Lucas, J.S. Aquaculture: Farming aquatic animals and plants (Fishing News Books)
- MacKenzie, Simon A. Genomics in Aquaculture Academic Press
- Michael Bernard New (Editor), Wagner Cotton iValenti(Editor), James H. Tidwell(Editor). Freshwater Prawns: Biology and Farming Wiley-Blackwell
- Mikhalev, Viktor. Genetics and Fish Breeding. Arcler
- Nigel Preston (Editor), Dean R. Jerry (Editor) Biology and Culture of Farmed Marine Shrimps. CRC Press
- Pandian, T.J. (Editor), C.A. Strüssmann (Editor), M.P. Marian (Editor). Fish Genetics and Aquaculture Biotechnology. CRC Press
- Pandian, T.J. Genetic Sex Differentiation in Fish. CRC Press
- Pillay, T. V. R. 1993. Aquaculture – Principles and Practices. Fishing News Book.
- Pillay, T.V.R. and M.N. Kutty, Aquaculture: Principles and Practices. Wiley India Pvt Ltd; Second edition
- Rao, K. L. 1975. India's water wealth.
- Rath, R.K. Freshwater Aquaculture Scientific Publishers Journals Dept
- Ravishankar Piska, 1999. Fisheries and Aquaculture. Lahari Publications, Hyderabad.
- Santhanam R. Fisheries Science, Daya Publishing House, 1990.
- Selvamani B.R & Mahadevan R.K 2008 Freshwater fish farming (Campus Books International)
- Singh, B. & A. Dey. Fish and Fisheries. Invincible Publishers
- Singh, N.P. & B. Santosh. Handbook of freshwater aquaculture. New India Publishing Agency
- Turner, Bruce. Evolutionary Genetics of Fishes (Monographs in Evolutionary Biology). Springer

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1		H		
CO 2	H			
CO 3			H	
CO 4				H

SPECIALIZATION IV: ANIMAL ECOLOGY AND WILDLIFE BIOLOGY

ZGEB0014: ANIMAL ECOLOGY AND BIOGEOGRAPHY (4 CREDITS: 60 HOURS, L-T-P: 4-0-0)

Course Outcomes (CO)

Identify various freshwater fish culture methodologies and their significance. (Applying).

Utilize the knowledge on the process of fishery and aquaculture management for development of future entrepreneurship. (Applying).

Determine the nutritional requirements in fishery and development of skill on fish feed formulation for a profitable fish farming system. (Creating).

Apply the knowledge of the application of modern biotechnological tools and their role in the development of fishery.

(Applying)

Module I: Basic Ecological concept (15 hours)

Habitat & Niche, Ecological Versatility & Niche dimension.

Competitive displacement: Gause's principle of Competitive Exclusion, Predator-Prey relation: Lotka Volterra Model of Interspecific Competition, Ecological equivalents.

Species diversity, Species richness, Global patterns in species richness, Theories of species richness, Invasive species and its effect on species richness.

Ecosystem model

Module II: Habitat and landscape ecology (25 hours)

Introduction to Habitat Ecology: Ecology of major habitats- Grasslands, Wetlands, Forests, Physical and anthropogenic factors influencing habitats.

Introduction to Landscape Ecology: Edge, ecotones, Edge effect interspersation and juxtaposition. Habitat fragmentation and its effect on the resident community.

Metapopulation concept and its application in designing Nature reserve; Theory of Island Biogeography.

Measuring Wildlife habitat: Inventory, evaluation and monitoring of wildlife habitat - availability, quality, palatability of graze and browse. Inventory of unique habitats, their distribution and need for conservation, Animals signs as indicators of habitat use.

Module III: Principles of Biogeography (10 hours)

History of biogeography. Ecology of dispersal and faunal exchange, barriers, mode of dispersal, origins and radiation; island biogeography: endemism, refugia. Continental drift; dispersal and vicariance biogeography; dispersal mechanisms and dispersal barriers.

Module IV: Indian biogeography (10 hours)

India's biogeographic classification. Case studies of Indian fauna explaining Biogeographic Theories. Biogeographic affinities of the fauna and flora of the Indian sub-continent.

Suggested Readings

Smith TM and Smith RL (2012). Element of Ecology (9th edition). Pearson Publication

Begon M, Townsend CR and Harper JL (2006). Ecology From individuals to Ecosystems (4th edition). Blackwell Publishing

Ricklefs RE and Miller GL (1999). Ecology (4th edition). WH Freeman Publication

Mani MS (1974). Ecology and Biogeography in India. Springer Netherlands

Cox CB, Moore PD and Ladle R (2010). Biogeography: An Ecological and Evolutionary Approach (9th Edition). WileyBlackwell.

Huggett RJ (2004). Fundamentals of Biogeography (2nd edition). Routledge London and New York

Ladle R and Whittaker RJ (2011). Conservation Biogeography. Wiley Blackwell

MacArthur RH (1984). Geographical Ecology: Patterns in the Distribution of Species. Princeton University Press.

MacArthur RH and Wilson EO (2001). The Theory of Island Biogeography. Princeton University Press.

Mayr E (1969). Principles of Systematic Zoology. Tata McGraw Hill Publ. Co.

Mayr E and Ashlock PD (1991). Principles of Systematic Zoology. McGraw Hill International Edition.

Simpson GG (1961). Principles of Animal Taxonomy. Columbia University Press.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	M	M
CO2		H	L	
CO3		M	L	
CO4			H	H

ZGWM0015: WILDLIFE CONSERVATION AND MANAGEMENT (4 CREDITS: 60 HOURS, L-T-P: 4-0-0)

Course outcome (CO)

Relate different principles and practices of wildlife management and make use the concepts of conservation (Understanding, applying)

Explain the concepts of wildlife management and applying theories on habitat management (Understanding, Applying)

Explain about different plant diversity, Phyto resource utilization and their importance, threatened plants of India with respect to Northeast India. (Understanding)

Test the efficacy of conservation efforts of an eco-sensitive zone in (Northeast) India and develop a framework for its management. (Creating)

Module I: Conservation Biology (20 hours)

Introduction to conservation biology: Values of biodiversity and conservation ethics, Patterns and process of biodiversity, losses and threats to biodiversity. Geological and present extinctions, changes in species composition and problem of climate change.

Strategies for conservation –

In situ conservation: International efforts and Indian initiatives; protected areas in India – sanctuaries, national parks, biosphere reserves, sacred groove and Community Reserve. Ecological restoration and its significance

Ex situ conservation: Principles and practices; botanical gardens, fields gene banks, seed banks, cryobanks; nonformal conservation efforts.

Module II: Wildlife Management (25 hours)

Principles and practices of wildlife management; Management of special habitats: riparian zones, Grasslands, wetlands.

Species conservation projects: Tiger, Lion, Rhino, Crocodile, Turtle, Adjutant stork.

Management plan for Protected Areas: Principles of planning, objectives, resource surveys, analysis of surrounding region, management zones, theme plans, communications, staff and visitor amenities, monitoring. Financing protected areas; Need for wildlife management planning

Module III: Plant diversity and Phytoresources (15 hours)

Plant Biodiversity: Concept, status in India, utilization and concerns.

Forest products: Important timber yielding planting. Timber types,

Non-Timber Forest products

Plants used as avenue trees for shade, pollution control and aesthetics. e) Threatened plants of India with special reference to NE India

Suggested Readings

Hillis DM (1996) (ed). Molecular Systematics. Sinauer Publ Inc. Dash, M. Fundamentals of Ecology, Tata McGraw Hill

Gopal, R. Wildlife Management, Allied International

Saharia, V. Wildlife conservation

Primack- Essentials of Conservation Biology
 Dyke- Conservation Biology- Foundation, Concepts, Applications
 Primack- A primer of Conservation Biology
 Singh- Textbook of Wildlife Management
 Bailey- Principles of Wildlife Management
 Krausman and Cain- Wildlife Management and Conservation
 B.B. Dutta- A handbook of Plant Resource Utilization and Conservation
 Kibue- Wildlife Conservation and Utilization
 Trivedi and Sharma- Plant Resource Utilization and Conservation

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO1	H	M	L
CO2	M	H	
CO3			H

SPECIALISATION I: ENTOMOLOGY

ZGIG0017: INSECT ECOLOGY (4 CREDITS-60 HOURS, L-T-P: 4-0-0)

Course Outcomes

Apply the basics of insect ecology to the development of their research (Applying)
 Acquire knowledge on behavioural ecology, insect association, interactions and population ecology (Applying)
 Outline and interpret the concepts of ecology, basic principles of distribution and abundance of organisms and their causes and the impact of climate change on insect diversity (Understanding)
 Explain the life history of some insects (Understanding)
 Estimate the diversity of insects using different diversity indices (Creating)

Module I (15 hours)

Dynamics of insect life system-determinants of insect abundance, population change, birth rate, Death rate, movements; ; Law of minimum, law of tolerance
 Population growth models, Exponential and logistic model, discrete and continuous growth model, concept of carrying capacity, life tables and their application to insect biology, survivorship curves, case study of insect life tables,

Module II (9 hours)

Regulation of insect populations, Population dynamics- Factors affecting abundance- Environmental factors, dispersal and migration, Seasonality in insects. Diapause (Quiescence) -aestivation, hibernation. Dominance of insect-cause of success; Adaptation of insect- aquatic, terrestrial, soil, boring wood

Module III (18 hours)

Calculation of some diversity indices: Shannon, Simpson Problem solving in ecology
 Insect biodiversity, threats to insect biodiversity, impact of climate change on insect communities;
 Insect plant interaction Pollination Biology with special reference to Bees

Module IV (18 hours)

a) Insect behavior: chemotropism, thigmotropism, hydrotropism, rheotropism, anemotropism, phototropism, thermotropism, geotropism, instinct. Protective behavior: mimicry crypsis, warning coloration. Behavioral defense, chemical defense; Breeding behavior.

Suggested Readings

The Insect Structure and Functions, R.F. Chapman, Cambridge University Press

Modern Entomology, D.B. Tembhare Himalaya Publishing House

Text Book of Applied Entomology Vol- I & Vol- II, K.P. Srivastava, Kalyani Publishers

Introduction to General and Applied Entomology, Abhishek Shukla and Sushilkumar Saxena, Astral International (P) Ltd.

Indian Insect Pests, H. Maxwell-Lefroy & F.M. Howlett, Astral International (P) Ltd.

A Handbook on Economic Entomology, Abhishek Shukla, Astral International (P) Ltd.

Insect Pest Management: Ecological Concepts, T.V. Sathe & Jyoti M. Oulkar, Astral International (P) Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		L	L
CO 2	M		H	H
CO 3	H	M		
CO 4				M
CO 5	H	H	H	

ZGPM0035: APPLIED ENTOMOLOGY AND PRINCIPLES OF PEST MANAGEMENT (4 CREDITS-60 HOURS, L-T-P: 4-00)

Course Outcomes

At the end of this course students will be able to:

Illustrate the classification and life histories of the important household and agricultural and forest pests. (Understanding)

Develop the knowledge of Insect's role as a source for commercial products (honey, wax, silk, lac and medicines). (Applying)

Apply the latest knowledge of application of modern technique and principles of biological control and Chemical control of pest. (Applying)

Adapt the knowledge of use of insects in Forensic Science. (Creating)

Module I (10 hours)

Definition of Insect Pest; Classification of Insect Pest; Major pest of rice, wheat, cotton, vegetables, tea, jute, pulses, stored grain pest- life history, nature of damage and control.

Module II Pest Control (24 hours)

Primary control measures: Physical, mechanical, traditional and legislative measure.

Chemical Control Measures: Nomenclature and Classification of Insecticides; Mode of action of Insecticides; Advantage and Hazards of Insecticides; LD₅₀ and LC₅₀.

Biological control measures

Autocidal control measures

Integrated Pest Management (IPM)

Module III Industrial Entomology and Pest of Medical Importance (16 hours)

a) Apiculture, Sericulture (Muga, Eri, Mulberry and Tasar), Lac culture.

b) Insects of medical importance: Mode of Transmission; Common Vector Insects (Mosquitoes, House flies, Sand flies, Human louse and Tsetse flies)- Morphology with role in disease transmission and control

Module IV Forest Entomology and Forensic Entomology (10 hours)

Insect common to forest and their damage, defoliators, borers and sap suckers.

Insects of Forensic importance; Carcass condition and incidental attack by insects; Investigation methodology by forensic insects.

Suggested Readings

The Insect Structure and Functions, R.F. Chapman, Cambridge University Press

Modern Entomology, D.B. Tembhare Himalaya Publishing House
 Text Book of Applied Entomology Vol- I & Vol- II, K.P. Srivastava, Kalyani Publishers
 Introduction to General and Applied Entomology, Abhishek Shukla and Sushil Kumar Saxena, Astral International (P) Ltd.
 Indian Insect Pests, H. Maxwell-Lefroy & F.M. Howlett, Astral International (P) Ltd.
 A Handbook on Economic Entomology, Abhishek Shukla, Astral International (P) Ltd.
 Insect Pest Management: Ecological Concepts, T.V. Sathe & Jyoti M. Oulkar, Astral International (P) Ltd.
 Indian Pest Aphids, T.V. Sathe & B.V. Jadhav, Astral International (P) Ltd.
 Insect Pest Predators, T.V. Sathe & Y.A. Bhosale, Astral International (P) Ltd.
 Insect Predators and Pest Management, Vaishali J. Patil & T.V. Sathe, Astral International (P) Ltd.
 Insect in Vegetables, Dharmo K. Butani & M.G. Jotwani, Astral International (P) Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1	H	H	H
CO 2	H	H	L
CO 3	H	M	H

SPECIALIZATION II: CELL AND MOLECULAR BIOLOGY

ZGMB0019: CELL AND MOLECULAR BIOLOGY-II (4 CREDIT; 60 HRS; 4-0-0)

COURSE OUTCOMES

Define the cell adhesion molecules and their role in cell junctions. (Remembering)
 Demonstrating the concept of protein targeting. (Understanding)
 Make use of various theory of aging for understanding its process. (Applying)
 Analyze the genetics and physical mapping of mutation. (Analyzing)
 Estimate the effect of Cyclins and cyclin - dependent kinases in cell cycle regulation. (Evaluating)

Module I (15 hours)

Cell-Cell Signaling: Endocrine, paracrine and autocrine signaling; Receptor Proteins- Cell Surface receptors and intracellular receptors; Cell Surface receptors-G-protein coupled receptors, ion channel receptors, tyrosine kinase-linked receptors and receptors with intrinsic enzymatic Activity; Second messenger System - cAMP and IP₃, DAG; MAP kinase cascade, JAK/STAT and TGF- β / Smad signaling, NF-kB signaling; Signaling from plasma membrane to nucleus (a) CREB links cAMP signals to transcription (b) MAP kinase. Wnt pathway, Hedgehog pathway and Notch pathway

Module II (10 hours)

Protein sorting and targeting to organelles: Protein traffic through the endomembrane system; Targeting of proteins to the Rough Endoplasmic Reticulum and Golgi complex; Anterograde and retrograde transport; Signal-mediated protein transport to organelles (i) Nucleus (ii) Mitochondria (iii) Peroxisome

Module III (10 hours)

Genetic analysis in Cell Biology: Mutation: type and causes; Isolation and analysis of mutants; Physical and Genetic mapping of mutations; Molecular cloning of genes defined by mutations.

Module IV (15 hours)

Cell Cycle: Bacterial cell cycle (Helmstetier - Cooper or I+C+D model); Partition and cytokinesis; Eukaryotic cell cycle – G₁, S, G₂ and M phases; Cell cycle checkpoints; Molecular basis of cell cycle regulation(a) Cyclins and cyclin - dependent kinases(b) Regulation of CDK cyclin activity.
 Cell Death: Apoptosis and necrosis; Apoptosis-its characteristics; Genes involved in apoptosis.

Module V (10 hours)

Aging, the biology of senescence: Maximum life span and life expectancy; Causes of aging: (i) General wear and tear and genetic instability (ii) Free radicals, oxidative damage and antioxidants (iii) Telomerases and aging.

Cancer: Tumor cells and onset of cancer; Proto-oncogenesis and tumor suppressor genes; Mutation causing loss of cell cycle; Mutations affecting genuine stability.

Suggested Readings

Cooper, G.M., Cell (A Molecular Approach)

Sadava, D.E., Cell Biology

Karp, G., Cell and Molecular Approach

Kish, V.M. and Kleinsmith L.J., Cell and Molecular Biology

Gardener, Principles of Genetics

Strickberger, Genetics

Ram mahabal, Fundamental of Cytogenetics and Genetics

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
1	L				
2		M			
3			H		
4				M	
5					H

ZGIM0020: IMMUNOLOGY II (4 CREDIT; 60HRS; 4-0-0)**Course Outcomes**

Illustrate the basic organization and expression of the immunoglobulin genes. (Understanding)

Make use of non-virulent strain of microorganism for the development of vaccine. (Applying)

Examine the properties and role of various cytokines related to diseases. Compare the immune responses to various infectious diseases caused by bacterial, viral and protozoan infections. (Analyzing)

Estimate opportunistic agents and therapeutic agents to deal with immunodeficiencies. (Evaluating)

Formulate the use of various tumor suppressive drugs for preventing the graft rejection and also to develop various methods for immunization. (Creating)

Module I (20 hours)

Organization and expression of Ig genes: Multigene organization of Ig genes; Light-chain multigene family; Heavy chain multigene family; Variable region gene rearrangement, V-J rearrangements in light chain DNA, V-D-J rearrangements in heavy chain DNA, Mechanism of gene rearrangement, Allelic exclusion; Generation of antibody diversity, Multiple germline V, D and J gene segments; Combinatorial V-J and V-D-J joining; Junctional diversity; Association of heavy and light chain; Expression of Ig genes, Differential RNA processing of heavy chain primary transcripts, Expression of membrane secreted Ig, Simultaneous assembly and secretion of IgM and IgD, Synthesis, assembly and secretion of Ig; Class switching of constant regions

Module II (15 hours)

Cytokines: Properties of cytokines, General structure of cytokines, Function of cytokines, Cytokines related diseases, Bacterial septic shock, Bacterial toxic shock and similar diseases, Lymphoid and myeloid cancers, Chagas disease

Immune system in health and disease: Immune response to infectious disease; Viral infections (i) Viral neutralization by humoral antibody (ii) Cell - mediated antiviral mechanism (iii) Viral evasion of host defense mechanisms; Bacterial infections

(i) Immune responses to extracellular and intracellular bacteria (ii) Bacterial evasion of host defense mechanism; Protozoan diseases; Diseases caused by helminths.

Module III (15 hours)

Vaccines: Active and passive immunization; Designing vaccines for active immunization; Whole organism vaccine (i) Attenuated viral or bacterial vaccines (ii) Inactivated viral or bacterial vaccines; Polysaccharide vaccines; Recombinant vector vaccines; DNA vaccines; Synthetic peptide vaccines; Multivalent peptide vaccines

Immunodeficiencies: Primary and Secondary Immunodeficiencies, lymphoid and myeloid lineage; AIDS: Structure and types, genome organization, replication, opportunistic agents and therapeutic agents

Module IV (10 hours)

Tumor immunology: Tumor antigen; Tumor evasion; Immune system against tumors; Therapies.

Transplantation immunology: Acute, hyperacute and chronic rejection; Tissue matching (HLA typing); Graft Vs host (GVH) reaction; Xenotransplantation; Immunosuppressive drugs; role of monoclonal antibodies in transplantation.

Suggested Readings

Kindt, T.J., Osborne, B.A., Kuby, J., Kuby Immunology

Kasper, D.L., Fauci, A.S., Harrison's Infectious Diseases

Abbas, A.K., Lichtman, A.H.H., Pillai, S., Cellular and Molecular Immunology

Sell, S., Berkower, I., Immunology and Immunopathology and Immunity

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
1	L			
2		M		
3			H	
4				H

SPECIALIZATION III: FISHERY SCIENCE

ZGCP0021: CAPTURE FISHERY AND POST-HARVEST TECHNOLOGY (4 CREDITS-60 HOURS/ L-T-P: 4-0-0)

Course Outcomes

Identify the capture fishery resources of the country and the managerial practices for sustainable utilization of these aquatic resources. (Applying)

Develop the knowledge of cold-water fishery resources of the country and their applicability in the development of future entrepreneurs in the fishery sector of the region. (Creating)

Categorize various fishing gears and crafts used in various water bodies of the country. (Analyzing)

Develop new ideas on the development of efficient fishing tools and the skill to predict the possible fish stock in the water bodies and management for sustainable utilization of the resources. (Creating)

Develop the skill of fish preservation and processing for long term utilization. (Creating)

Module I (20 hours)

Capture fishery: Fish catch statistics of the world with special reference to India; Riverine Fisheries River Systems in India, their ecology and fisheries (Ganga & Brahmaputra); Reservoir Fisheries: Development, Exploitation and management of Reservoirs with special reference to India–Dams and their effect On fish migration; Beel fisheries of Assam: Fish resources, problems and management;

Module II (10 hours)

Cold water fisheries: Hill stream fisheries of North East India; Mahseer fisheries: prospects and problems with special reference to NE India; Major Estuaries of India and their fisheries; Brackish water Fisheries: Chilka lake. Hilsa fishery—causes of decline and efforts for revival

Module III (10 hours)

Craft and Gear used in Fisheries: Traditional and mechanized boats and nets used in catching fish; Population Dynamics: Fish populations and factors affecting the population structures; Estimation of fish yield and control of overfishing, Yield and optimum catch; Fishing crafts and gears used in Inland capture fisheries; Destructive fishing— its impact on fish diversity.

Fish oils, Fish Proteins, Fish manure, Fish glue, Fish flour, Isinglass, Fishmeal, Fish Silage, Fish guano, Bone meal; Production of fish sauce by lactic acid fermentation.

Module IV (20 hours)

Post-harvest technology and fish by-products: Preservation and processing: Methods of preservation Of both finfish and shellfish preservation(Refrigeration and freezing, Drying, Salting, Smoking, Canning, Pickling, pasting and spicing) and associated problems; Rigor mortis and post-mortem changes. Handling and packaging of fish for marketing; product stability and shelf-life. Fish by-products

Suggested Readings

1. Bal, D.V. and Veerabhadra Rao, K. Marine Fisheries. IBH Publications
2. Balakrishnan, N. N. and Thampy, D. M.A textbook of marine ecology. Beaven C R Handbook of the freshwater fishes of India (Narendra Publishing House)
- Biswas K P A Text Book of Fish, Fisheries and Technology, (Narendra Publishing House)
- Brody , Fishery by-products technology., AVI, Westport
- Chandy, M. Fishes, National Book Trust, India;
- EIRI Board.Hand Book Of Fish Farming & Fishery Products
- Gopakumar, K., Singh, B.N. and Chitranshi, V.R. Fifty Years of Fisheries Research in India, Fisheries Division Indian Council of Agricultural Research, New Delhi.
- Gupta S.K., Gupta P.C .General & Applied Ichthyology.S Chand & Company
- Jayaram K. C. The fresh water fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka.
- Jhingran V. G. Fish and Fisheries of India.
- Jobling M Environmental Biology of Fishes (Chapmen and Hall)
- Khanna S. S. and H. R. Singh. A textbook of Fish Biology and Fisheries, Narendra Publishing House
- Kreuzer, R., Fishery products., FAO, Fishing News Books Ltd., England
- Krishnaveni, G., N.Veerabhadra Rao and K.Veeranjaneyulu Recent Technologies in Fish and Fisheries, Rigi Publication
- Lagler, K.F. Ichthyology. John Wiley Publication.
- Nikolsky, G.V. Ecology of fishes. Academic Press.
- Pandey.Fish and Fisheries.Rastogi Publications
- Rao, K. L. India's water wealth.
- Ravishankar Piska. Fisheries and Aquaculture. Lahari Publications, Hyderabad.
- Ricker, W.E. 1984.Methods for assessment of fish production in freshwaters.Blackwell Publications.
- Rounsfell, G.A. and Everhart, W.H. Fishery Science: it 's Methods and Applications John Wiley & Sons,
- Sachindra, N.M. & N.S. Mahendrakar. Fish Processing Byproducts: Quality Assessment And Application Studium press
- Santhanam,R. Fisheries Science, Daya Publishing House, 1990.
- Singh, B. A. Dey. Fish and Fisheries. Invincible Publishers
- Srivastava, C.B.L. A Textbook of Fishery Science and Indian Fisheries, Kitab Mahal.
- The Wealth of India, Raw Materials Vol. IV, Fish and Fisheries, CSIR, 1962

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M		
CO 2		H		
CO 3			H	
CO 4			M	
CO 5				H

**ZGLF0022: LIMNOLOGY, FISHERY ECONOMICS, ORNAMENTAL FISHERY AND FISH PATHOLOGY
(4 CREDITS-60 HOURS/ L-T-P: 4-0-0)**
COURSE OUTCOMES (CO)

- 1: Explain the needs of physico-chemical factors in maintaining a proper productive aquatic ecosystem, an essential element in aquaculture and fishery management. (Understanding)
- 2: Utilize the understanding of fishery economics and laws of the country, various fishery training institutions and their roles and extension program in fishery development. (Applying)
- 3: Develop the skill on ornamental fish culture and aquarium preparation and maintenance. (Creating)
- 4: Apply the knowledge acquired on fish pathology and their prophylactic control measures. (Applying)

Module I (15 hours)

Limnology: Physico-chemical factors of fresh water habitat; Nutrients – Availability, Seasonal distribution and availability of phosphorus, Nitrogen and Silicon; Ecological classification of freshwater organisms; Plankton –Distribution, seasonal variation in space and time, planktonic migration, cyclomorphosis

Module II (15 hours)

Fishery economics and law: Larvivorous fishes in relation to public health; Exclusive Economic Zone(EFZ) and its strategy; Fisheries co-operatives and their role in fish production and marketing; Aquaculture and rural development in India; Fishery education, training and extension; Fishery research Institutes in India; Fishery legislation and their role in fishery development.

Module III (15 hours)

Ornamental fishery: Ornamental fish culture: Ornamental aquarium fishes, Breeding and care of Freshwater aquarium fishes; Aquarium keeping—Design and construction of tanks; species-wise tank size requirement; heating, lighting, aeration and filtration arrangements; decorations; common aquarium plants and their propagation; Maintenance of Natural Colour of fishes in Aquarium.

Module IV (15 hours)

Fish pathology: Fish and Prawn/Shrimp Diseases: Types of Diseases-viral, bacterial, fungal, protozoan and other parasitic diseases; symptoms & control measures; Diagnosis-Histopathological methods; Immunoassay; Biochemical assay; Serological techniques; Role of biopesticides; Application of Monoclonal antibodies; Vaccines and immune stimulants; Drug resistance.

Suggested Readings

Agarwal, S.C. Limnology
 Bond, E. Carl. Biology of fishes.
 Datta, J. J. Datta Munshi. Fundamentals of Limnology
 Dholakia, A.D. Ornamental Fish Culture and Aquarium Management. Daya Publishing House
 Edward, J. Noga. Fish Disease: Diagnosis & Treatment
 Gerald, A. Textbook of Limnology. The C.V. Morby Co.
 Hutchinson, G.E.A. Treatise on Limnology. Vol.1. John Wiley & Sons.
 Kumar, Arvind. Fundamentals of Limnology. APH Publishing Corporation
 Nikolsky, G.V. Ecology of fishes. Academic Press.
 Ricker, W.E. Methods for assessment of fish production in freshwaters. Blackwell Publications.

Ruttner, F. Fundamentals of Limnology. University of Toronto Press, 1968.
 Sharma Shailendra & Pawan Kumar Bharti. Limnology and Aquatic Science. Discovery publishing house
 Smith David J. Aquarium Keeping: Aquarium Keeping Essentials
 Thornton Kent W., Bruce L. Kimmel, Forrest E. Payne. Reservoir Limnology: Ecological Perspectives
 Untergasser, D. Handbook of Fish Diseases. TFH Publications
 Welch, P.S. Limnological Methods. McGraw Hill Book Company, New York.
 Wetzel, Robert G. Limnology: Lake and River Ecosystems. Elsevier Academic Press

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3			H	
CO 4				H

SPECIALIZATION IV: ANIMAL ECOLOGY AND WILDLIFE BIOLOGY

ZGRE0025: WILDLIFE RESOURCE MANAGEMENT, LAWS AND TECHNIQUES IN POPULATION STUDY (4 CREDITS: 60 HOURS, L-T-P: 4-0-0)

Course Outcome

Define wildlife disease, identify major parasitic diseases in wild animals and assess animal health conditions. (Remembering, Applying).

Apply different techniques of wildlife study. (Applying)

Discuss about wildlife forensic, various protocols for species identification and trade of wildlife products. (Creating)

Develop the prospects of ecotourism in Northeast India, its importance and consequences and recommend mitigation plans to reduce human animal conflict. (Evaluating, Creating)

Module I Species conservation (20 hours)

IUCN categories, criteria for allocation into different categories. Threatened animal species of India with special reference to NE India. Role of Iconic species designation in conservation. Concept and significance of conservation of Flagship (Target) species; overview of conservation problems and issues of fauna of Indian sub-continent.

Module II Natural resource management and conservation (15 hours)

Introduction to forestry, principles of forest management, Importance and performance of joint forest management (JFM) Role of Non-Government Organizations (NGO).

Conservation movement in India. Concept of stakeholders. International conservation bodies; IUCN, UNDP, Durrell Wildlife Conservation trust.

Project Grants for Wildlife Conservation

Module III Forest and Wildlife laws of India (5 hours)

Wildlife Protection Act, 1972; The Biological Diversity Act, 2002; The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of forest Rights) Act, 2006.

Module IV Population ecology and Sampling Techniques (20 hours)

Demographic and life history parameters, evolution of life history parameters: r & K selection, allometry, aging and sexing, life tables, age and stage structures models, methods of estimation of life history and demographic parameters

Sampling designs for population estimation, population estimation methods: Mark-Recapture for Closed Population, Collection Techniques used in wildlife study.

Suggested Readings

Caughley G (1978). Analysis Of Vertebrate Populations. John Wiley, Chichester.
 Hastings A (1997). Population Biology: Concepts And Models. Springer Verlag, New York.
 Neal D (2004). Introduction to population biology. Cambridge University Press. UK
 Ricklefs R (2010). The Economy of Nature (6 edition). W. H. Freeman
 Tokeshi M (1998). Species Coexistence: Ecological and Evolutionary Perspectives.
 W. J. Ecological Census Techniques Cambridge University Press
 Patro, L. Biodiversity Conservation and Management
 Misra, H.N. – Managing Natural Resources- Focus on Land and Water
 Anderson, Sweeney and Williams- Wildlife and Natural Resource Management
 Deal, K.H. Environmental Economics and Natural Resource Management
 Kumar, R. Environmental Laws
 Muthukrishna- Natural Resource Economics
 Field, B.C. Economics of Environment
 Began, M. & Mortimer, M.- Population Ecology
 Rockwood- Introduction to population Ecology

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M	H	
CO2		H	M	
CO3				L
CO4				H

ZGWC0026: TECHNIQUES IN WILDLIFE STUDY WILDLIFE HEALTH, FORENSICS AND CONFLICT (4 CREDITS: 60 HOURS, L-T-P: 4-0-0)

Course Outcome

Define wildlife disease, identify major parasitic diseases in wild animals and assess animal health condition. (Remembering, Applying).
 Apply different techniques of wildlife study. (Applying)
 Discuss about wildlife forensic, various protocols for species identification and trade of wildlife products. (Creating)
 Develop the prospects of ecotourism in Northeast India, its importance and consequences and recommend mitigation plans to reduce human animal conflict. (Evaluating, Creating)

Module I: Wildlife Health (20 hours)

Introduction to disease and epizootiology, Determinants of disease and disease transmission, Disease and population dynamics.

Assessment of condition, health and nutritional status in free-ranging populations. Disease control operations, Planning and management of wildlife health programmes.

Module II: Techniques for wildlife study, Capture and handling of wild animals (15 hours)

a) Techniques for wildlife study: Radio telemetry and acoustic analysis.
 b) Capture and handling of animals - purpose, restraint techniques, different capture methods and animal barriers. Drug immobilization - drug delivery equipment and accessories. Handling and transport of wild animals, designing sledge, crate and holding enclosures.

Module III: Conservation Genetics, Wildlife Forensics and Trade (15 hours)

Application of genetics for wildlife conservation; Application of Molecular markers, PCR, DNA Sequencing in wildlife forensics and conservation. Loss of genetic diversity

Wildlife Forensics- Overview, various forensic protocols for species identification.

Wildlife trade: The Convention on International trade in Endangered Species of Wild Fauna and Flora (CITES)

Module IV: Human-wildlife conflict (10 hours)

Causes and management; Impact on ecosystem, lives and livelihood of human

Ecotourism: problems and prospects with special reference to northeast India.

Suggested Readings

Fowler- Restraint and Handling of wild and Domestic Animals

Briscoe, Ballou and Frankhan- Introduction to Conservation Genetics

Leeschcke, Temivk and Jain – Conservation Genetics

Frankhan, Ballou and Briscoe- Primer of Conservation Genetics

Cooper and Cooper- Wildlife Forensic Investigations

Huffman and Wallacw- Wildlife Forensics – Methods & Applications

Sahaipal, Thakar & Goyal – Forensic Examination of Hair of Protected Indian Wildlife Species

Linacre and Tobe- Wildlife DNA analysis

Rao, G. Textbook on pathology of Wildlife Diseases

Jani, R. Basic of Wildlife Health Care Management 11. Ayadi, D.P. Human Wildlife Conflict

12. Wang, J. Human Wildlife Conflict management: Understanding the Fundamentals of Human Wildlife Conflicts in Human Dominated Landscape

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3		L	H	L
CO4				H

ZGBE0027: BIOSYSTEMATICS AND EVOLUTION (4 CREDITS -60 HOURS) (L-T-P:4-0-0)

Course Outcomes

Explain the concept of Biosystematics and Taxonomy, ICZN rules and formation of names of taxa (Understanding)

Explain the causes of evolution and natural selection. (Understanding)

Apply Taxonomy to solve the species problem and Identify species on the basis of taxonomic keys. (Applying)

Justify the role of isolating mechanisms in speciation, estimate, construction of evolutionary trees, and measurement of genetic relationship among organisms. (Evaluating)

To apply application of knowledge on science involving society and culture

Module I: Biosystematics (10 hours)

Trends in Biosystematics: Chemotaxonomy, Cytotaxonomy, Numerical and Molecular Taxonomy; Dimensions of Speciation; Species Concepts: Subspecies and other intraspecific Categories; Cladistics

Module II: Taxonomy and Nomenclature (10 hours)

Taxonomic Categories. Different Kinds, Hierarchy of Categories; Taxonomic Procedures: Taxonomic collections, Preservations, Process of identification(General Idea); Taxonomic Keys: types, merits and demerits; International Code of Zoological Nomenclature (ICZN):Operative principles, interpretation and application of important rules; Formation of names of various Taxa.

Module III: Evolution (15 hours)

Micro and Macro evolution; Natural Selection-Concept of stabilizing selection, Frequency dependent selection, Balancing selection, Disruption selection; Destabilizing factors-Mutation, Genetic drift, Migration, Meiotic drive; Emergence of Non Darwinian theory of evolution, Neutral theory of evolution (Kimura).

Module IV: Speciation and Molecular basis of evolution (15 hours)

Isolation Mechanisms-Isolation Mechanisms and their role in speciation, Models of speciation (Allopatric, sympatric, parapatric)

Molecular basis of evolution-Constructing evolutionary trees, measures of genetic relationship among organisms,

Molecular clock of evolution, Molecular phylogeny; Origin and Evolution of Primates.

Module V: Society and Science (10 hours)

Citizen Science: Significance, challenges and drawbacks

Ethnozoology: Brief introduction, importance, historical aspects and current trends

Citizen science: Case study

Suggested Readings

G. G. Simpson. Principle of animal taxonomy; Oxford IBH Publishing Company.

V.C Kapoor-Theory and practice of animal taxonomy

J.C. Avise. Molecular Markers, Natural History and Evolution, Chapman & Hall, New York.

E.O. Wilson, Biodiversity, Academic Press, Washington.

E. Mayer & P. Ashlock. Principles of systematic Taxonomy

E.O. Wilson. The Diversity of Life (The College Edition), W.W. Norton & Co.

Dalela and Sharma. Animal taxonomy and Museology, Jai Prashnath & company.

Bugs, Butterflies, Spider, snakes (1998). Kern Preston-Mafham, Nigel Marven & Robturvey.

Dobzhansky, Th., F.J. Ayala, G.L. Stebbins and J.M. Valentine. Evolution. Surject Publication, Delhi. 10.

Futuyma, D.J. Evolutionary Biology, Sinauer Associates, INC Publishers, Dunderland. 11. Jha,

A.P- Genes and Evolution. John Publication, New Delhi.

Ashok Verma, Principles of Animal Taxonomy, Alpha Science International Ltd, Delhi.

Ramesh Chandra Tripathi, Biosystematics and Taxonomy, University Book House, Jaipur.

Avers, C.J. Evolution Process and Pattern in Evolution Oxford University, Press, New York, Oxford.

Ayala, F. J. and Valentine J. W. Evolving the theory and Process of Organic Evolution,

Brookfield, A. P. Modern aspects of Evolution. Hutchinson London, Melbourne.

Gallow, P. Evolutionary principles.

Chapman and Hall. Freeman, S. and Herron, Jon C. Evolutionary analysis Pearson Prentice Hall, New Jersey.

Futuyma, D. J. Evolutionary Biology, Sinauer Assoc. Inc. Pub. USA.

Meglitsch, P. A. Invertebrate Zoology (3rd edition), Oxford University Press.

Minkoff, E. C. Evolutionary Biology, Addison Wesley Pub. Co., London. 22. Wen-Hsiung Li, Molecular Evolution, Sinauer associates Inc. Pub. USA.

23. Burton S. Guttman: Evolution a beginner's guide, One world Publications.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			
CO 2		M	H		
CO 3		H			
CO 4				L	H
CO 5			L	H	H
CO 6			L	L	H

ZGCI0028: CELL BIOLOGY AND IMMUNOLOGY- THEORY AND APPLICATIONS (4 CREDITS-60 HOURS) (L-T-P:4-0-0)

COURSE OUTCOMES (CO)

Illustrate the operative mechanism of the cell. (Understanding)
Examine and analyze the different Cell signaling pathways (Analyzing)
Compare the different types of Immunological systems (Evaluating)
Demonstrate molecular techniques to understand underlying cellular composition. (Analyzing)
Discuss and implement the different analytical techniques in cell biology and immunological process (Creating).

Module I: Cell Organisation (10 hours)

Biomembranes-Molecular composition and functional feature of membrane lipid, protein and carbohydrate.
Cytoskeletons -Structure and Organisation of Microfilament, Microtubule and Intermediate filament.
Cell Motility- Intercellular transport, kinesin-dynein, cilia and flagella.

Module II: Cell adhesion molecule, Cell signaling, Cell cycle (15 hours)

Extracellular Matrix and Cell Interaction-Cell walls, Adhesion junctions, Tight junctions, Gap junctions, Plasmodesmata; Cell- Cell Adhesion - Ca⁺⁺-dependent and Ca⁺⁺ independent Homophilic Cell-Cell Adhesion.
Cell division and cell cycle regulation and control of cell cycle; Cyclins and Cyclin Dependent Kinases(CDK), Regulation of CDK- Cyclin activity, Molecular basis of Cellular Checkpoints
Cell-Cell Signalling-Cell Signalling, Cell surface receptors, G-Protein coupled receptors and Second messenger

Module III: Immunology (15 hours)

Immune system-innate and adaptive immunity; components and characteristic features, humoral and cell-mediated immunity;
Cells and organs of immune system; T cells and B cells-maturation, activation and differentiation;
Antigens-immunological properties of antigens, factors influencing antigenicity; Immunoglobulin-structure and function, classes of Ig molecules, Antigen-antibody interactions.

Module IV: Analytical techniques (20 hours)

Review of principles of light microscopy; principles and applications of phase contrast and fluorescence microscopy
Principles and applications of Transmission and Scanning Electron microscopy
Spectroscopy: basic principles and types
Theories of Tissue fixation and staining techniques
Basic principles of colorimetry
Principles and applications of centrifugation techniques: types of centrifugation; Introduction to hydrodynamics Molecular modeling ELISA, RIA, Immunodiffusion

Suggested Readings

Cooper, G. M., Cell (A Molecular Approach)
Sadava D. E., Cell Biology
Kish V. M. and Kleinsmith L. J., Cell and Molecular Biology
DeRobertis & DeRobertis: Cell and Molecular Biology (Lee & Febiger, 1987)
Karp: Cell and Molecular Biology
Lodish et al: Molecular Cell Biology
Pollard & Earnshaw: Cell Biology
Verma P. S. and Agarwal V.K, Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Company Ltd.

Verma P.S. and Agarwal V.K, Cell Biology (Cytology, biomolecules and Molecular Biology), S. Chand & Company Ltd.

Kuby et al. : Kuby Immunology

H.H. Willard, L.L. Merritt Jr. and others, Instrumental Methods of Analysis, 6th Edition, 1986, CBS Publishers and Distributors.

Chatwal G and Anand, S., Instrumental Methods of Chemical Analysis, 1989, Himalaya Publishing House, Mumbai.

Williams, B.L. and Wilson, K., A Biologist's Guide to Principles and Techniques of Practical Biochemistry, 1975. B.B. Straughan and S. Walker Eds., Spectroscopy, Volume 1, Chapman and Hall Ltd.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H		
CO 3	M	H	M	
CO 4			H	L
CO 5	L	L	L	H
CO 6		H		

ZGBG0029: MOLECULAR BIOLOGY AND GENETICS (4 Credits-60 hours) (L-T-P:4-0-0)

Course Outcomes

Understand the basic concepts of Genetics and Molecular Biology techniques. (Understanding)

Analyze the differences in molecular biology and genetic techniques. (Analyzing)

Compare and interpret the various patterns of genetic inheritance. (Evaluating)

Interpret and discuss different cytogenetics and molecular biology tools (Creating)

Module I: Nucleic Acids (16 hours)

Nucleic acids - Molecular Structures of DNA and RNA.

DNA Replication- Replication in Prokaryotes and Eukaryotes, Semi conservative nature of DNA replication, Messelson-Stahl experiment, Enzymes and proteins associated with replication, DNA polymerases, Regulation of eukaryotic genome replication.

DNA Damage and Repair Mechanism- Different types of DNA Damage, Direct repair system, Excision repair system, Mismatch repair system, DNA break repair.

Module II: Transcription and Translation (12 hours)

Transcription- Basic concept of Prokaryotic and Eukaryotic transcription, Promoters (Pribnow Box, TATA-box, CpG island), Transcription factors, Initiation, elongation and termination of transcription in Eukaryotes. Post Transcriptional Modification

Translation- Genetic Code, Mechanism of Initiation, Elongation and Termination.

Module III: (10 hours)

a) Organisation of genetic material- Nucleosome, Molecular anatomy of eukaryotic chromosome; Genome size and Complexity- C value paradox, Unique and repetitive DNA, Euchromatin and Heterochromatin
Sex Chromosomes - Sex determination, Role of Y chromosome, Dosage Compensation in Drosophila and Human Being, X- Chromosome inactivation, Sex chromosome anomalies

Human Genetics- Normal Human Karyotyping, Autosomal chromosome abnormalities, Principle and Methods of Pedigree Analysis

Genomic Imprinting- Imprinting of genes, Epigenetic, Epigenetic regulation by DNA methylation; Somatic Cell Genetics
Cell fusion technology, Chromosome mapping, Application of Somatic Cell Genetics.

Module IV: Genetic Inheritance (10 hours)

Concept of gene: Allele, multiple alleles, pseudoallele, complementation tests; Extensions of Mendelian principles: Codominance, incomplete dominance, gene interactions, pleiotropy, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters
Extra Chromosomal Inheritance: Inheritance of Mitochondrial and chloroplast genes, maternal inheritance.

Module V: Bioinformatics (5 hours)

Gene Prediction-Finding genes in prokaryotic and eukaryotic genomes, Regulatory sequence analysis; Genome maps and markers, Genome variation.
Human genome project; Concept and Software used in Gene expression analysis and Microarray.
Structural biology-Protein structure prediction and classification.

Module VI: Electrophoretic Techniques (7 hours)

Basic principles of Electrophoresis, Agarose gel, native and SDS-PAGE
Isoelectric focusing, 2D-PAGE and their uses in protein research
Blotting Techniques

Suggested Readings

Gardner, Principles of Genetics

Strickberger, Genetics

Ram Mahabal, Fundamentals of Cytogenetics and Genetics

Brooker: Genetics: Analysis and Principles

Griffith et al: Modern Genetic Analysis

6.Hartl & Jones: Essential Genetics: A Genomic Perspective

Boyer: Modern Experimental Biochemistry and Molecular biology

DeRobertis & DeRobertis: Cell and Molecular Biology

Hanes, Gel Electrophoresis of Proteins - A Practical Approach

Sedgewick R and Wayne K. Introduction Computer Science, Princeton University [available online].

Blum R and LeBlanc Dee-Ann. Linux for Dummies, WILEY [available online].

Kanetkar YP. Let Us C [available online].

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H			
CO 4				H		
CO 5					H	
CO 6						H

ZGAP0030: ANIMAL PHYSIOLOGY (4 CREDITS-60 HOURS) (L-T-P:4-0-0)**Course Outcomes**

Outline the physiology and mechanism of digestion, absorption by summarizing the role of the different glands and their secretions involved. (Understanding)

Build a clear concept of mammalian blood chemistry, clotting mechanism, musculature in vertebrates, molecular mechanism and regulation of muscle contraction. (Applying)

Explore the physiology of respiration and analyze the oxygen dissociation curve and regulation of respiration. (Analyzing)

Explain the urine formation physiology and compare the osmoregulation in terrestrial and aquatic animals. (Evaluating)

Elaborate the dynamics of neural impulse conduction along the axonal axis, at electrical and chemical

synapse. (Creating)

Module I Physiology of digestion (10 hours)

Glands and secretion of digestive enzymes,
Mechanism of digestion, Gastrointestinal hormones
Absorption of Carbohydrates, lipids and proteins.

Module II Physiology of Respiration (10 hours)

Alveolar ventilation, alveolar-capillary gas exchange, Transport of O₂ and CO₂
Oxygen dissociation curve and the factors influencing it,
Regulation of respiration.

Module III Mammalian blood chemistry (10 hours)

Mammalian blood chemistry and blood groups.
Blood clotting mechanism
Cardiac cycle and its regulation in mammals.

Module IV Musculature in vertebrates (10 hours)

Musculature in vertebrates: Types of muscles, Ultrastructure and chemical composition of skeletal muscles, Molecular mechanism and regulation of muscle contraction, muscle fatigue and rigor mortis.

Module V Physiology of Excretion (10 hours)

Ultrastructure of nephron, mechanism of urine formation, excretion of dilute solutes and mechanism of excretion of excess solutes, counter current mechanism
Osmoregulation in different animal groups (aquatic and terrestrial)

Module VI Nerve physiology (10 hours)

Neuron: Ultrastructure, types and function,
Membrane potential: Resting membrane potential, action potential, Nernst Equation, Chronaxie, Rheobase, utilization time.
Neural impulse induction through an axon, neurotransmitters and synaptic transmission-mode of information transfer across electrical and chemical synapses

Suggested Readings

Brooks and Marshall: Essentials of Endocrinology, Blackwell Science.
Ganong: Review of Medical Physiology, Lang Medical Publications
Guyton and Hall: TextBook of Medical Physiology, W.B. Saunders
Hadley: Endocrinology, Prentice hall. International Edition.
Keel et al: Samson Wright 's Applied Physiology, Oxford Press,
Larson: Williams TextBook of Endocrinology, 10th edition. W.B. Saunders Company, Philadelphia.
Murray et al: Harper 's Illustrated Biochemistry, Appleton & Lange
Norris: Vertebrate Endocrinology. Lea & Febiger.
Turner and Bagnara: General Endocrinology, W. B. Saunders Company Philadelphia.
West: Best and Taylor 's Physiological Basis of Medical Practice, Williams and Wilkins,
N Arumugam and A Mariakuttikan, Animal Physiology, Saras Publication.
N Arumugam, Animal Physiology & Biochemistry, Saras Publication.
Dharmalingam, Textbook Of Endocrinology, Jaypee Brothers Medical Publisher
Verma P.S, Agarwal V.K and Tyagi B. S, Animal Physiology, S. Chand Publishing.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO 1	H					
CO 2		H				
CO 3			H	H	H	

CO 4	H					
CO 5	M	M	M	M	M	M

ZGEE0031: ECOLOGY AND ENVIRONMENTAL BIOLOGY (4 CREDITS - 60 HOURS) (L-T-P:4-0-0)**Course Outcomes**

Outline the foundations of Ecology. (Understanding)

Identify the effects of abiotic environment on plants and animals to understand the distribution and abundance of life on earth (Applying)

Develop solutions to pressing environmental problems that threaten ecological systems at every level (Creating)

Analyze the importance of biodiversity and threats to biodiversity. (Analyzing)

Design steps to protect and conserve biodiversity. (Creating)

Module I (12 hours)

Types of ecosystems–Salient features of aquatic and terrestrial ecosystems and their biotic communities.

Ecological energetic and energy flow; Measuring ecosystem productivity

Population Ecology-Population density, Growth rate, Natality, mortality, survivorship curves and life tables, Biotic potential

Module II (12 hours)

Community Ecology-Types of biotic communities, organization, carrying capacity, r and k-selection.

Community Development–Types of community changes, ecological succession-its causes and examples, climax community.

Species interactions, Competition theory, Niche, Habitat,

Ecological Equivalents, Character displacement; Liebig law of minimum, Shelford's law of tolerance, Significance of limiting factors, Ecotone and Edge effect.

Thermoregulation: Heat balance in animals, Adaptations to temperature extremes, Aestivation, hibernation and Diapause, acclimatization, avoidance and tolerance

Module III (12 hours)

Eutrophication in the aquatic ecosystem, Remediation of eutrophication.

Acidification in aquatic and terrestrial environment, Consequences and control strategies.

Environmental monitoring, Environmental impact assessment and environmental management plan.

Biogeochemical cycles–carbon, nitrogen, sulphur cycles, impact of human activity on nutrient cycles.

Module IV (12 hours)

Biodegradation and Bioremediation: concept, environmental limitation for bioremediation, bioremediation of ecosystem (Air/water/soil)

Wastes in Ecosystem and management: Agricultural wastes and Management, Biomedical wastes and Management, Domestic waste, effects and management for purification and recirculation.

Environmental toxicology: Diversity and classification of environmental toxins, Air, Water and soil pollutants, Food additives and contaminants, Pesticides, Metals and Solvents, Radioactive pollution.

Module V Biodiversity (12 hours)

Components of Biodiversity (Genetic, Organismal and Ecological), Value of Biodiversity, threats to biodiversity, biodiversity conservation, Mega biodiversity countries, hotspots and heritage sites,

IUCN Red list categories. Habitat diversity of Indian wildlife, endemic and Threatened species of northeast-India Ethnozoology with special reference to Northeast India

Suggested Readings

Asthana, D.K. and Asthana, M. Environmental Problems and Solutions S. Chand and Co., New Delhi.

Odum : Basic Ecology (Saunders)

Odum : Fundamentals of Ecology (Saunders)
 Odum. E.P. Fundamentals of Ecology. Nataraj Publishers, DehraDun.
 Raven, Berg, Johnson : Environment (Saunders College Publishing)
 Sharma :Ecology and Environment (Rastogi Publication)
 Smith, R.L. Elements of Ecology. Harper and Row Publishers, New York.
 Trivedi, P.R. and Gurdeepraj, K. Environmental Biology. Akashdeep Publishing House New Delhi
 Turk and Turk : Environmental Science
 VermaP.S. and Agarwal V.K, Environmental Biology(Principles of Ecology)by.,S.Chand Publishing.
 GuptaS.R.andSinghS.P.,EcologyEnvironmentalScienceandConservation,S.ChandPublishing
 Manju Yadav, Ecology, Discovery Publishing House
 Rana S.V.S. ,Essentials of Ecology and Environmental Science, S.V.S. Rana. Publisher, Prentice-Hall of India
 Anderwartha, H.G.and Birch,L.C.,The distribution and abundance of animals, University of Chicago Press, Chicago London.
 Beeby, A., Applying Ecology Chapman and Hall Madras.
 Begon, M.,HarperJ.L.andTownsend,C.R,Ecology–Individuals, populations and communities, Blackwell Science, Cambridge UK.
 Brewer, R., The science of Ecology, Saunders College of Publishing, New York.
 Chapman,J.L.andResis,M.J.,Ecology-Principles And Applications,CambridgeUniversityPress, Cambridge UK.
 Kaeighs, S. C., Ecology with special references to animals and Man, PrenticeHall Inc.
 Putmann, R. J. and Wratten, S. D., Principles of Ecology,
 Crown Helm, London. Salanki,J.,Jeffery E. and Hughes G.M., Biological Monitoring of the Environment (A manual of Methods) CAB International, Wallingford UK. Singh M C: Environment Protection and the Law (Ashish Publishing House)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H			
CO 2			H	H	
CO 3			M	H	H
CO 4					H
CO 5			L	L	H

ZGEB0032: ENDOCRINOLOGY AND BIOCHEMISTRY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)

Course Outcomes

Define the various metabolic pathways and the role of hormone. (Remembering)
 Explain the basic principles of modern analytical techniques. (Understanding)
 Analyze the energy production and utilization. (Analyzing)
 Explain the enzyme kinetics. (Evaluating)

Module I: Basic concepts: Hormone, action and Feedback Mechanism (5 hours)

Hormone: Classification and Chemical nature of hormones Homeostasis: Concept and Feedback system
 Hormone receptor and target organ concept, Mechanism of hormone action. Hypothalamo- hypophyseal axis

Module II: Endocrine glands-Structure, Hormones, Functions, Axis, Abnormalities (15 hours) a) Structure of the pituitary gland; pituitary hormones and their functions

Structure of thyroid glands, thyroid hormones–biosynthesis and metabolic functions. Role of thyroid

hormone in amphibian metamorphosis

Structure of adrenal gland; Synthesis of adreno-cortical and medullary hormones and their functions.

Structure of endocrine pancreas and Hormones of Islets of Langerhans.

Module III: Reproductive Endocrinology (10 hours)

Testis and ovary –endocrine structure and their functions

Reproductive cycle- Oestrous cycle and Menstrual cycle, Role of Hormones in Implantation, Parturition and Lactation Neuroendocrine regulators in insects and mammals

Module IV: Metabolism (13 hours)

Carbohydrate metabolism-Glycolysis, Glycogenolysis, Gluconeogenesis, TCA cycle, Cori cycle, Phosphogluconate pathway.

Lipid Metabolism-Oxidation of fatty acid, Cholesterol biosynthesis and metabolism, Prostaglandins.

Protein metabolism- Amino acid Classification, Amino acid degradation, Decarboxylation, Deamination, Ornithine Cycle.

Module V: Bioenergetics And Enzymes (10 hours)

Bioenergetics-Energy producing and utilizing system, Electron transfer system and Oxidative Phosphorylation.

Enzymes-Classification of enzymes, General properties of enzymes, Mechanism of enzyme action, Enzyme kinetics, Michaelis- Menten and Lineweaver-Burk Equations; Enzyme inhibition.

Module VI: Basic concepts of biochemistry (10 Hours)

Review of concepts of acids and bases, Principle and working of pH meter, Buffer preparation

Principle of Laminar-air flow chamber.

Principles, types and applications of Chromatography

Gas Chromatography, GC-MS, LC – MS / MS, MALDI TOF mass spectrometer

Ion Exchange Chromatography, gel permeation, Affinity and reverse phase chromatography

HPLC and FPLC

Suggested Readings

Brooks and Marshall: Essentials of Endocrinology, Blackwell Science.

Ganong: Review of Medical Physiology, Lang Medical Publications

Guyton and Hall: Text Book of Medical Physiology ,W.B. Saunders

Hadley: Endocrinology, Prentice hall. International Edition.

Keel et al: Samson Wright 's Applied Physiology, Oxford Press,

Williams TextBook of Endocrinology, 10th edition. W.B. Saunders Company, Philadelphia. 7. Murray et al:

Harper 's Illustrated Biochemistry, Appleton & Lange

Norris: Vertebrate Endocrinology. Lea & Febriger.

Turner and Bagnara: General Endocrinology, W. B. Saunders Company Philadelphia.

Berg et al.: Biochemistry, Freeman

Boyer: Modern Experimental Biochemistry and Molecular biology

DeRobertis & DeRobertis: Cell and Molecular Biology

Freifelder: Physical Biochemistry

Holme and Peck: Analytical Biochemistry, Tata McGraw Hill

Switzer and Garritty: Experimental Biochemistry

Biochemistry, Tata-McGraw Hill

Mapping COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	L	L	L			
CO2						L

CO3			M	H	H	
CO4						H

ZGAZ0033: APPLIED ZOOLOGY (4 CREDITS-60 HOURS) (L-T-P: 4-0-0)**Course Outcomes**

Identify methods of silkworm cultivation, maintenance of the farm, seed technology, silkworm rearing and silk reeling. (Applying)

Assess the basic life cycle of the honeybee and about beekeeping tools and equipment for honey production and pollination. (Evaluating)

Apply the latest knowledge in poultry management. (Applying)

Develop an overall idea of fish farming, the scientific management of different species in aquaculture, aquarium keeping and fish diseases. (Applying)

Identify the different types of parasites, their life cycles and the diseases caused by them. (Applying)

Develop the concepts in Zoology with the core principles of Sustainable Development. (Applying)

Module I (15 hours)

Sericulture: Types of Silk Worm (Muga and Eri), their host plants, silkworm rearing and management practices. Diseases and Pest of Silk Worm and their management, Biodiversity conservation project through sericulture (Case study- 7Weaves Model)

Apiculture: Different species of honey bees, bee plants, pollen calendar, bee keeping and management practices, bee products, Bee enemies and diseases.

Vermiculture: species of worms, condition for efficient vermiculture (domestic and commercial level), Economics of Vermiculture

Module II (10 hours)

Aquaculture: Aquarium fish keeping: Ornamental Fishes of India special reference to North East India, common aquarium fishes; Aquarium Maintenance, Fisheries management: Composite fish culture, induced breeding and hybridization; Prawn and Pearl Culture, Exotic and Indigenous food Fishes of NE India, Fish and shellfish diseases and their control measures. Fish genetic resource conservation; Aquaponics—prospect and future.

Module III: Poultry management (8 hours)

Poultry Rearing / Farming: Housing and equipment; Nutritional Requirements; Poultry diseases; Poultry products: Broilers, meat processing and meat products, Poultry by products

Module IV: Parasitology (10 hours)

Introduction to Parasitology: Types of parasites, Types of Host, Zoonosis, Host-parasite Relationship, Sources of Infection, Mode of infection, Pathogenesis.

Vibrio cholera and *Clostridium tetani*- Life Cycle, mode of transmission, infection and treatment.

Dengue and Bird flu - Life cycle, mode of transmission, infection and treatment.

Module V: Insect pest management, Public Health and Forensic Entomology (12 hours)

a) Concept of Pest, concept of integrated pest management (IPM)

b) Mosquito (*Aedes*, *Culex*, *Anopheles*)-Taxonomy, Biology, Behavior and their control. Life cycle of *Calliphora* and *Scrophaga*, determination of death and causes of death.

Module VI: Sustainable Development Goals and Zoology (5 hours)

Concept of Sustainable Development, Background of SDGs, role of a zoologist, SDGs and Zoology (SDGs 1,3,5,6,8,11,12,13,14 and 15), SDG(s)-based projects/dissertations

Suggested Readings

Venkitaraman: Economic Zoology, Sudarsana Publishers

Srivastava : A Text Book of Applied Entomology, Vol. II & II.I Kalyani Publishers
 Shukla And Upadhyaya :Economic Zoology. Rastogi Publishers.
 Ananthakrishnan,T.N.andK.G.Sivaramakrishnan.Ecological Entomology: Insect life in an odd environment. Scientific Pub.: India
 David, B. V and T.N. Ananthakrishnan. General and Applied Entomology. 2ndEdition. Tata McGraw-Hill Publ. Co. Ltd.: New Delhi
 Fenemore P G and Prakash Applied Entomology (New Age Publishers: New Delhi)
 Packer, B. Aquaponics System: A Practical Guide to Building and Maintaining Your Own Backyard Aquaponics
 Jayashree, K.V., C.S. Tharadevi& N. Aurumugam. Apiculture. Saras Publication
 Chandra Girish. Apiculture & the heHoneyBee (Know About The Species Of Honey Bees, beekeeping, pollination, beehives, entomology, beekeepers, honey making
 Arumugam,N.,T.murugan,R.RamPrabhu,J.JohnsonRajeshwar. Applied Zoology.Saras publication
 Ganga & Chetty. Comprehensive Sericulture 2nd Edition Paperback. Oxford & IBH publication
 Narasaiah, M.L. Problems and Prospects of Sericulture. Discovery Publishing Pvt. Ltd
 Sharma,A.K.,K.Jaiswal &R.N. Pandey. Research and Development in Indian Sericulture. Alfa Publications
 Singh, R.N. & C.M. Bajpeyi. Muga Culture. APH Publishing Corporation
 Bernstein, S.Aquaponic Gardening: A Step-By-Step Guide to Raising Vegetables and Fish Together
 New Society Publishers
 Jadhav and Siddiqui. Handbook of Poultry Production and Management. Jaypee Publications
 Krishnamurthy. An Advanced Textbook On Biodiversity: Principles and Practice. Oxford & IBH Publishing
 Johns, J. Worm Farming - Creating Compost at Home With Vermiculture. Creates pace Independent Pub
 NPCS Board of Consultants & Engineers The Complete Technology Book on Vermiculture and Vermicompost
 ICAR. Handbook of Integrated Pest Management (IPM) Pub: ICAR, Govt. of India
 Metcalf, RW.H.Luckmann. IntroductionTo Insect Pest Management. Wiley India Pvt Ltd.
<https://bloncampus.thehindubusinessline.com/case-studies/figure-out-how-7weaves-can-scale-up-and-go-global/article25933346.ece>
<https://bloncampus.thehindubusinessline.com/case-studies/7weaves-a-promising-model-for-ethical-slow-fashion/article26388043.ece>
<https://bloncampus.thehindubusinessline.com/case-studies/strong-business-model-can-creat-value-for-all/article26388095.ece>
<https://bloncampus.thehindubusinessline.com/case-studies/focussing-on-organic-growth-and-sustainability/article26389036.ece>

Mapping COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H					
CO2		H				
CO3			H			
CO4				H		
CO5					H	
CO6						H

ZGEP0034: ETHOLOGY AND POPULATION GENETICS (4 CREDITS- 60 HOURS) (L-T-P: 4-0-0)

Course Outcomes(Co)

Define states and events of behaviour. (Remembering)

Illustrate the concept of ethology and its significance. (Understanding)

Elaborate fitness in terms of evolution (Creating)
 Apply Hardy Weinberg law for studying population genetics (Applying)
 Identify sociobiology, social hierarchy, dominance in group living animals. (Applying)
 Construct behavioral catalog for studying animal behavior. (Creating)

Module I: Basic Concepts of Ethology

(10 hours) a) Concepts of Ethology,

Genes and behaviour: Selfish gene concept, Fisher's Runaway theory

Evolution and development of behaviour

Deception, Mimicry, and Camouflage: Deimatic behaviour, Aposematic behaviour

Module II: Sociobiology (20 hours)

Social Behaviour: Properties And Advantages Social Grouping, social group of monkeys;

Fitness: Darwinian fitness, individual fitness, kin selection, group, cooperation, reciprocation, altruism, reciprocal altruism, Proximate and Ultimate causations;

Parental care in animals (amphibians)

Module III: Learning and Communication (10 hours)

Communication in animals-vocal, and aggression tactile, visual and chemical; Territoriality

Learning: Introduction and definition, Types-Habituation, trial and error, conditioning, cognition and imprinting; Short and long term memory, neural mechanism of learning

Module IV: Population Genetics (20 hours)

Gene frequencies in population - The Hardy-Weinberg principle and analysis of gene frequencies in natural population.

Major factors influencing gene frequencies (migration, inbreeding), Effects of selection and mutation on gene frequencies. Gene flow between subpopulations

Suggested Readings

Drickamer & Vessey: Animal Behaviour –Concepts, Processes and Methods, Wadsworth

Goodenough et al : Perspectives on Animal Behaviour, Wiley,

Grier : Biology of Animal Behaviour, Mosby,

John Alcock: Animal Behaviour, Sinauer associates

John Krebs, Baron Krebs: An introduction to behavioural ecology, Blackwell scientifics

Aubrey Manning: An introduction to animal Behaviour, Cambridge University press

Mapping COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	L	L	L	
CO2	L			
CO3		H		
CO4				H
CO5		H		
CO6			H	

ZGBB0036: BASIC BIOINFORMATICS THEORY

(1 CREDIT: 15 Hours) (L-T-P: 1-0-0)

Objective(s): To gather knowledge on fundamental concepts and methodologies in Bioinformatics, focusing on practical applications and data analysis and equip with the skills to analyze biological data and explore how computational approaches are applied to biological research questions.

COURSE OUTCOMES:

CO1: Explain the key concepts and applications of Bioinformatics in Modern biology. Apply Bioinformatics tools to retrieve and analyze biological data from various databases. (**Understand & apply**)

CO2: Analyze sequence data using alignment techniques to identify similarities and differences. Utilize different bioinformatics tools and software in decoding nucleic acid and protein sequence, their structure and interactions, and correlate these data amongst different species. (**Analyse & apply**).

CO3: Evaluate phylogenetic relationships using tree construction methods and interpret the results. Analyze the evolutionary interrelationship amongst different organisms using sequence alignment tools. (**Evaluate**).

CO4: Exercise the Homology modeling, Molecular Docking. (**Apply & determine**).

CO5: Develop critical thinking skills and ethical awareness for Bioinformatics research. Create a bioinformatics workflow to address a specific biological question, integrating multiple tools and datasets. (**Create**).

Module I: Introduction to Bioinformatics (1 Hours)

Concept and scope of Computational Biology and Bioinformatics. Applications and Importance of Bioinformatics. Key concepts and terminology.

Module II: Biological Databases (3 Hours)

Introduction to Literature Database and Biological Databases; Primary, Secondary and Composite databases; Navigation and data retrieval from Nucleic acid databases (GenBank, DDBJ, EMBL and NDB); Protein databases (PIR, SWISS-PROT, TrEMBL, PDB); Metabolic pathway database (KEGG, EcoCyc, and MetaCyc); Small molecule databases (PubChem, Drug Bank, ZINC, CSD). Genome visualization- UCSC.

Module III: Data Generation and Data Retrieval (3 Hours)

Generation of data (Gene sequencing, Protein sequencing), Sequence submission tools (BankIt, Sequin, Webin). Data retrieval systems (SRS, Entrez). Sequence analysis (Introduction to GTF, GFF file Formats, FASTA/FLAT file Genbank file analysis, BED files). Gene and Protein data retrieval system and processes.

Module IV: Sequence Alignment and Evolutionary Bioinformatics (3 Hours)

Sequence alignment and its application: Local and Global Alignment, Scoring Matrices (PAM, BLOSUM), Methods of Alignment (Dot matrix, Dynamic Programming), Alignment algorithms (Needleman-Wunsch, Smith-Waterman), Pair wise and multiple sequence alignments (MSA); Introduction to Tools: BLAST, FASTA, CLUSTAL, and various software and servers; Phylogenetic Analysis using academic software.

Module V: Structural Bioinformatics and Molecular Docking (4 Hours)

Basics of protein structure and function, Homology modeling and structure prediction, structure validation. Tools for structural analysis (SWISS-MODEL, PyMol). Introduction to Molecular Docking, Principles of ligand-receptor interactions, Introduction to Docking software (AutoDock, Swiss Dock).

Module VI: Ethics in Bioinformatics (1 Hour)

Ethical Considerations (Data Privacy and Confidentiality, Handling and Protection of Genetic Data), Ethical Implications of Genome Editing Technologies (CRISPR-Cas9), Ethical Dimensions of artificial Intelligence (AI) and Machine Learning (ML) applications in Bioinformatics.

Suggested Readings

Ghosh Z and Mallick B. (2008). Bioinformatics: Principles and Applications, Oxford University Press.

Pevsner J. (2009). Bioinformatics and Functional Genomics, II Edition, Wiley Blackwell.

Zvelebil, Marketa and Baum O. Jeremy (2008). Understanding Bioinformatics, Garland Science, Taylor and Francis Group, USA.

S. Jayanitha, T. Kartheeswaran (2019). Ethical, Legal and Social Issues in Bioinformatics Applications.

(Proceedings of the Vavuniya Campus International Research Symposium).

Andreas Dress, Michal Linial, Olga Troyanskaya, Martin Vingron. Computational Biology

(Print ISSN -1568-2684) by International Society for Computational Biology (Springer).

Zhumur Ghosh, Bibekanand Mallick (2008). Bioinformatics: Principles and Applications. Oxford University Press (ISBN: 9780195692303).

Jin Xiong (2006). Essential Bioinformatics. Cambridge University Press (ISBN: 9781139450621).

Mapping to the CO of the Syllabus

	Module I	Module II	Module III	Module IV	Module V	Module VI
CO1	H	H				
CO2		H				
CO3			H	H		
CO4				H	H	
CO5					H	H

ZGSL0200: SERVICE LEARNING IN ZOOLOGY

Course Outcomes

Develop an understanding about the importance of service to community. (Understanding)

Identify the needs of a community. (Applying)

Apply skills acquired in Zoology to render service to community. (Creating)

Examine what can be learned from the community. (Analyzing)

Module I (5 hours)

Service learning: Definitions; Principles of Service Learning; Awareness of Community; Involvement with Community; Commitment to service

Module II (10 hours)

Aquaculture: Aquarium management - Aquarium fish keeping and breeding using local resources

Sericulture: Eri and their host plants **plantations**; indoor rearing and management practices; marketing and management of produce

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	L
CO 2	L	M
CO 3	L	H
CO 4	M	H

LABORATORY COURSES

ZGPR6004: PROJECT MANAGEMENT, REPORTING AND DOCUMENTATION (30 HOURS) (P/NP)

Course Outcomes

Identify qualities of a successful entrepreneur and develop competencies. (Applying)

Construct economically and socially sound business ideas. (Creating)

Analyze the potentials of a social catalyst and examine case studies. (Analyzing)

Assess plans for effective preparation of Detailed Project Report (DPR) and financials of a DPR. (Analyzing)

Develop skills for project implementation and management. (Applying)

Define concept of market. (Remembering)

Distinguish different methods of Bookkeeping and Accountancy. (Analyzing)

Adapt effective plans for preparing accurate project report and practicing positive documentation. (Creating)

Objective: Help the student to understand Entrepreneurship, identification of qualities of a successful entrepreneur & how to develop it

Module I: Entrepreneurship : Concept and

Functions Who is an entrepreneur?

Entrepreneurial competencies (Initiative, Creativity and Innovation, Risk Taking and Risk Management, Problem Solving, Leadership, Persistence, Quality Performance, Information Seeking, Systematic Planning, Persuasion and Influencing Others, Enterprise Launching Competencies, Enterprise Management Competencies)
Functions of an entrepreneur (Promotional functions: Innovation, Risk-taking, Organisation Building, Discovery of an idea, Detailed Investigation, Assembling the Requirements, Financing the Proposition.

Managerial functions: Planning, Organizing,

Staffing, Leadership, Supervision, Communication, Motivation, Controlling.

Commercial Functions : Production, Finance, Marketing, Accounting)

Types of entrepreneur (Innovative Entrepreneur, Imitative Entrepreneur, Fabian

Entrepreneurs, Drone Entrepreneurs)

Entrepreneurship: meaning and definition; types of entrepreneurship; entrepreneur and entrepreneurship

Difference between entrepreneur and employee

Objective: Help the students to generate various business ideas and link the best one with them

Module II: Generation of business ideas and linking

EDP: Meaning, Need, Importance of EDP

Necessity of generating ideas

Ways to generate ideas, Area Assessment Survey – Modes (Desk Research, Field

Work, Market Need Based Opportunities, Ideas from Existing Entrepreneurs)

Linking business ideas with the entrepreneur

Methodology of Opportunity Identification & Profiling Business Ideas (Preparation of Personal Profile, Development of OS (decision making) Framework, Snap Investigation of ideas generated, Evaluation in terms of OS (decision making) Framework and Short-listing of Ideas, Pre-feasibility Studies, Errors in Selection, Final Opportunity Selection)

Preparation of business project plan and business project plan execution (Summary of the Project/Project at a Glance, General Information, Details of the Proposed Project, Market Potential, Manufacturing Process, Production Programme/Sales Revenue, Cost of Manufacturing and Profitability Projections)

Objective: To impart knowledge on social entrepreneurship

Module III: Social entrepreneurship

Who is a social entrepreneur (definition and case study)

Difference between entrepreneurship and social entrepreneurship

Characteristics of social entrepreneur (Social Catalysts, Socially aware, Opportunity- seeking, Innovative, Resourceful, Accountable)

Examples and case study

Objective: To impart knowledge on preparation of DPR

Module IV: Preparation of Detailed Project Report (DPR) and financials

of a DPR Business plan : key questions

Technical arrangement & Production process (Manufacturing process, Sources of technical know how, plant & machinery, Supplier identification & supplier selection, Raw materials, packaging, land requirement, utilities and manpower, financial viability) and Location selection (Layout, built up area etc).

Product and Market (Product description, Capacity, Market study and market demand, Product mix, Branding, Channels of distribution, Advertising and Promotion etc.)

Project cost and means of finance (Land, site development, building and civil works, plant and machinery cost, other fixed assets, technical knowhow fees, preliminary and preoperative expenses, working capital margin, contingency and escalation)

Income analysis (Capital utilisation and income estimate, Expenditure estimate, Profit estimate, income tax estimate, profitability ratios : TC ratio, cash flow estimate, risk analysis, sensitivity analysis etc.)

Objective: Impart knowledge on implementing, managing and monitoring the progress of the selected project

Module V: Project implementation and management

Understanding Total Quality Management (Acceptable Quality Level, Benchmarking, Deming Wheel, ISO 9000, Pareto Analysis, Quality Circles, Measures of Central Tendency and Dispersion, Geometric Moving Average, Statistical Process Control etc.)

Goal Oriented Project Planning (Project Planning Matrix and Product Matrix)

Project Activity Planning and Implementation (Gantt Charts, the Programme Evaluation and Review Technique (PERT) and Critical Path Method (CPM) of project scheduling)

Soft skills for launching and managing a project (Creativity and Problem Solving, Interpersonal Communication, Persuasion and

Use of Influence Strategy, Negotiation and Networking, Delegation of Authority and Work Effort, Efficiency Orientation As a Trait, Leadership, Concept of risk and risk taking, Legal Requirements, Types of business organisation) Managing Business Crisis – Starting and Liquidity Crisis

Objective: To impart the Knowledge of different component of Market

Module VI: Concept of market

Traditional market

Emerging market : E commerce

Analysing the market environment 4

Researching the market and market survey

Marketing mix

Product mix

Promotion mix

Price mix, method of pricing

Objective: To impart knowledge on Book Keeping

Module VII: Bookkeeping and Accountancy

Basic concept of Accounting (Management and financial accounting)

Basic books of accounts (Journal, Purchase book, Purchase return book, Sales book, Sales return book, ledger book, Cash book etc.)

Financial statement: Meaning, Importance

Profit and loss account

Balance sheet

Depreciation and adjustment etc.

Interpretation of financial Statement (Liquidity, Current ratio, Profitability ratio, Inventory turnover ratio, Debtors turnover ratio, ROI etc) Fund flow Analysis

Objective: To impart knowledge on Documentation and Reporting

Module VIII: Documentation and Reporting

Why to Document

What is a Documentation Report

When and How to prepare the Documentation Report

Typical format of a Documentation report

Layout of the Report

Writing a Report

Mapping COs to syllabus

Course Outcomes	Module1	Module2	Module3	Module4	Module5	Module6	Module7	Module8
CO1	H							
CO2		H						
CO3			H					
CO4				H				
CO5					H			
CO6						L		
CO7							H	
CO8								H

ZGDI6006: DISSERTATION PHASE I (4 CREDITS)

Course Outcomes

At the end of Dissertation phase I students will be able to:

Review and analyse scientific papers (Analyzing)

Design and perform experiments and prepare work plan (Applying)

Formulate hypotheses and choose appropriate methodologies to achieve the desired objectives (Creating)

The dissertation phase I is the preliminary stage where a student selects a research topic on interest in consultation with the assigned supervisor. In this phase the student is learns to identify research gap, formulate objectives and hypothesis, design work plan and experiments and fixes his/her methodologies to achieve the desired objectives.

ZGWP6011: INTRODUCTION TO WILDLIFE PHOTOGRAPHY (30 HOURS, L-T-P: 2-0-0) (P/NP)

Course Outcomes

Discuss the history of Photography, moving images and Stock photography Creating)

Demonstrate a brief understanding of ethics of journalism, photo journalism and sources (Understanding)

Assess the importance of digital technology in photography (Evaluating)

To define camera basics and different genres of photography (Remembering)

Learning Objective

Through theory and practical assignments, this class provides the students with hands on experiences in photography. Lectures, field studies, guest instructors, student presentation and group work will help you develop the analytical basis and insight to reflect upon and assess the impact of photographs on our ideas of the world.

By the end of this course, Students will: Be able to start their career in photography. Will be able to create picture story

/Photo Essays and understand the conventions and challenges of telling stories through images

Gain personal leadership through challenging, intercultural assignments

Objective: This module will help to understand the students about photography basics

Module I: Introduction to photography

Camera Basics, Types of Camera, Operating a Camera, Exposure, Aperture & Shutter Speeds Light Meter, Depth of Field, Choosing Lenses, Types of lens, Lighting, Flash Photography, Filters, Steady Shooting, Composition in wildlife Photography.

Objective: This module will help to understand the students about different types of photography in details

Module II: Different genres of photography

Mobile Photography, **Microscopic photography, Macro photography, Drone photography, Wildlife Photography**

Objective: Post production is an important part of photography student will learn post-production in this module

Module III: Post Processing

Enhancing Photographs, Organizing the Picture, Quality Control, Intermediate/advanced use of post-production software like Adobe Photoshop, Lightroom etc

Objective: How to earn the livelihood from selling your images internationally

Module IV: Stock Photography

Introduction to Stock Photography, How to contribute to various stock photo agencies. Causes of rejections, Submitting
Guidelines, Meta Data

Objective: This module focuses on photojournalism.

Module V: Ethics in Wildlife Photography

How to prepare for a photo tour (Dress code in wildlife photography, permissions, water bottle, notebook and other accessories) How to remain safe during shooting (How close is too close, keeping antivenom & antiallergen; leach guard, safety of gears used) Ethics in wildlife photography (knowing Schedules of animals in Wildlife (Protection) Act, 1972, not using any bait, not taking any animal out of its habitat without permission, non use of flash, not altering the habitat)

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	H	L	H	
CO 2		M			H
CO 3	H	H	H	L	M
CO 4	H	M	H	M	M

ZGDS6009: DISSERTATION PHASE II (8 CREDITS)

Course Outcomes

At the end of Dissertation phase II students will be able to:

Conduct experiments/ field studies using different materials and methods (Analyzing)

Collect various types of data and use those data for testing hypotheses (Analyzing, Evaluating)

Make use of several statistical tools for data analysis (Analyzing)

Create a scientific report based on the study (Creating)

During the dissertation phase II, a student learns how to perform experiment/field study and collect necessary data for data analysis. He/She also learns to use several statistical tools to analyze data and create a dissertation thesis based on original work done during the end semester examination.

ZGTM6010: TEACHING METHODOLOGY AND CLASSROOM MANAGEMENT (30 HOURS: P/NP)

Course Outcome (CO):

Define different concepts of teaching skills (Remembering)

Create effective teaching instruction (Creating)

Evaluate assessments (Evaluate)

Make use of ICT (Analyzing)

Module I: Introduction to Core teaching Skills. Micro- teaching.

Introduction to Methods, Maxims, Devices and techniques of teaching. Practice teaching on Core teaching Skills in Microteaching mode.

Approaches and methods of teaching Science - (i) Lecture, demonstration, explanation, Observation. (ii) Ensuring Problem solving, laboratory, Project, Heuristic, Discussion for teaching science. (iii) Learning by discovery, group work and team teaching.

(iv) Collaborative strategies, provision in heterogeneous classroom.

Module II: Planning and designing for effective instruction in science.

Design of unit and lesson planning approaches to lesson planning, format of lesson plans

Teaching aids and laboratories in science, their necessity and importance.

Museum, field trips and excursion, their relevance to science. Preparation of simple aids of Science teaching.

Module III: Evaluation of Learners Progress.

Concept and importance of assessment & evaluation.

Techniques of evaluation (Theory & Practical)

Construction of Unit test: Design and blueprint, Item construction, Question wise analysis, Construction of Science question paper including marking scheme.

Module IV: Information and Communication Technology (ICT) Integration in

Science teaching. a) Introduction to ICT

Importance of ICT in Science teaching.

Exploring various ICT tools for Science teaching.

Open Education Resources (OER) and its uses in Science teaching.

ICT Integration in Science teaching.

Exploring FOSS in Science teaching

Mapping of COs to Syllabus

Course Outcomes	1	2	3	4
CO1	H	M	M	M
CO2		H		
CO3			H	
CO4				H

ZGEE6011: SPECIALIZATION LAB I – ENTOMOLOGY (2 CREDITS)**Course Outcomes**

Explain and Identify insects of different insect orders
 Develop the skill required to properly collect and preserve insects (Creating)
 Compare the different types of legs, antennae and mouthparts of insects (Analysing)
 Develop a sound knowledge on basic aspects of anatomy of different systems, physiology of internal systems like digestive system, circulatory system, reproductive system and nervous system. (Creating)
 To Estimate haemolymph, chitin and uric acid in insects (Creating)

Syllabus

Insect collection and preservation
 Different types of mouth parts
 Different types of antenna
 Different types of legs
 Preparation of arolium, empodium and pollen basket
 Preparation and identification of haemocytes, quantitative count of haemocytes.
 Detection of chitin in insect cuticle
 Detection of Uric acid in insects
 Estimation of haemolymph proteins in insects.
 Histological study of foregut, midgut and hindgut of insect.
 Reproductive system of cockroach
 Prothoracic gland of cockroach
 Biosensing activity in Butterflies, Honeybees and beetles
 Identification Of insects of forensic importance and forest defoliator

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14
CO1	H													
CO2	M	H												
CO3		H	H	H	H									
CO4									H	H	H	H	H	H
CO5						H	H	H						

ZGCM6012: SPECIALIZATION LAB I- CELL AND MOLECULAR BIOLOGY (2 CREDIT; 30 HRS, 0-0-2)**Course Outcome**

To demonstrate the method to study cell morphology. (applying)
 Demonstrating the method of preparation of histological slides. (applying)
 Show the method of preparation to study various chromosome. And also demonstrating the pk value of buffer. (analysing)
 To demonstrate various method of detecting concentration of an unknown sample. (applying)
 Demonstrating the enzyme end point techniques. (analyzing)
 Illustrating various immunological techniques. (analysing)

Creating a report on the techniques observed in advanced lab. (creating)

Syllabus

Use of oculometer-standardization and measurements of cell height, nuclear diameters and tabular diameters

Histology of biological tissues and sectioning by microtome

Preparation of salivary gland chromosomes from *Drosophila* /Chironomous larva and stain with acetocarmine/aceto-orcein/fuelgen

Preparation of mammalian chromosomes from bone marrow or testis and stain with Giemsa stain

Determination of pK value of buffer

Determination of relationship between absorption and various concentration of a solution using a colorimeter, spectrophotometer/spectrophotometer.

Preparation of standard curve for total cholesterol

Quantization of enzymes: End point techniques (alkaline phosphatase), enzyme kinetics.

Permanent Slides: Types of cells (squamous, cuboidal, columnar epithelial cells, blood cells, nerve cells, muscle cells), connective tissues of various types, adipose tissue, mitotic & meiotic chromosomes and their different phases.

Preparation of emulsions- syringe method and hubbed needle method

Immunization routes: Intradermal, Subcutaneous, Intramuscular, Intraperitoneal, Intravenous

Bleeding Schedules and collection of blood: cardiac puncture, external jugular vein. Separation and preservation of serum: Liquid Storage using preservative and by sterilization

Report submission- Visit to advanced lab.

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12	E13	E14
CO1	H													
CO2		H							H					
CO3			H	H	H									
CO4						H	H							
CO5								H						
CO6										H	H	H	H	
CO7														H

ZGFS6013: SPECIALIZATION LAB I- FISHERY SCIENCE (2 CREDITS: 30 HOURS/ L-T-P: 0-0-2)

COURSE OUTCOMES (CO)

Identify commercially important fish species of Northeast India. (Applying)

Prepare fish bones using various techniques. (Analyzing)

Analyze various biological parameters of fish. (Analyzing)

Determine various indices of fish. (Evaluating)

Create reports on visits to fish landing centres and fish farms. (Creating)

Syllabus

Identification of commercially important fish species of north east India representing all fish groups

Fish osteology —preparation of fish skeleton (using KOH and Trypsin).

Biological Analysis of fish samples for gut contents, maturity stages and fecundity

Dissecting out the pituitary gland and preparing the extract, Weberian Ossicle.

Determination of length-weight analysis in fishes.

Determination of gonado somatic index (GSI), hepatosomatic index(HSI),condition factor(CF), and fecundity.

External characters, types of scales, fins, types of teeth, structure of alimentary canal, gill rakers.

Visit to fish landing centre and fish farms and make Reports of visit

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8
CO 1	H							
CO 2		H						
CO 3				H				
CO 4			H		H	H	H	
CO 5								H

ZGAW6014: SPECIALIZATION LAB I- ANIMAL ECOLOGY AND WILDLIFE BIOLOGY [2 CREDITS: 30 HOURS, L-T-P: 0-0- 2]

Course Outcome

Identify different flora and fauna (Applying).

Applying ecological sampling techniques (Applying)

Create and Analyse animal behavior (Analyzing, Creating)

Identify different successional stages (Applying)

Evaluate species diversity and similarity between communities (Analyzing)

Create field reports by studying different protected areas (Creating)

Syllabus:

Identification of species of butterfly, fishes, amphibia, reptilia, aves and mammalia from collection/model/photographs etc.

Identification of fish, amphibian and reptiles (local fauna) using Morphometric landmarks.

Ecological Sampling techniques: a) point transect, b) line transects, c) belt transect,

Behavioural study through Ethogram preparation

Time and Activity budgeting using Focal/Scan sampling.

Systematic study of common plants: Field and Herbarium techniques.

Study of successional stages of various forest communities.

Measuring diversity using Diversity:

Diversity Indices: Shannon Weiner Index, Brillouin's index, Simpson index.

Similarity Indices: Morisita's index, Sorenson's coefficient, Sorenson's and Dice index, Jaccard index

Dissimilarity indices: Bray-Curtis, Ochiai index

Report Submission: Study of nearby protected areas (forests and grasslands) under various management regimes and make a report

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9
CO1	H	H				H			
CO2			H						
CO3				H	H				
CO4							H		
CO5								H	
CO6									H

ZGEE6015: SPECIALIZATION LAB II – ENTOMOLOGY AND ENVIRONMENTAL BIOLOGY (2 CREDITS, L-T-P: 0-0-2)

Course Outcomes

To categorize aquatic, terrestrial and boring insects (Analysing)

To Identify different pests of insects, insects of forest importance and forest defoliator (Analysing)

To identify major vector species of insects (Analysing)
 Demonstrate phylogenetic tree (Understanding)
 Develop a sound knowledge on basic aspects of physiology of different systems (Applying)

Syllabus:

Alimentary canal of house fly with crop
 Bacterial chamber of termite
 Pharyngeal, labial and thoracic salivary gland of honey bee
 Sting apparatus of honey bee
 Identification of aquatic, terrestrial and boring insects with specific adaptive characteristics.
 Visit to agricultural field/tea garden and forest for on spot study of pest and damage caused by them
 Preparation of Phylogenetic tree of Insect species
 Study of Life Cycle of Mosquito, Housefly, Drosophila
 Collection and identification of economically important insects and various stages of their life history (using unique representatives)
 Identification Of Pests (Tea , Jute, Paddy stored grain)
 Identification and anatomical studies of major vector species of Anopheles, Culex and Aedes

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
CO1					H	H					
CO2						M			H	H	
CO3						M		L			H
CO4							H				
CO5	H	H	H	H							

ZGCM6016: SPECIALIZATION LAB II- CELL AND MOLECULAR BIOLOGY (2 CREDIT; 30 HRS; 0-0-2)

Course outcomes:

Demonstrating the method of separation of various cell organelles.(Understanding)
 Illustrating the separation of nucleic acid, proteins, and amino acids. (Applying)
 Qualitative analysis of carbohydrate, protein, lipid, nucleic acid by various methods. (Analysis).
 Demonstration the method of lymphocyte count. (Applying)

Syllabus

Tissue homogenization and fractionation by differential centrifugation for isolation of mitochondria, nuclei and cytosol
 Separation of DNA by agarose gel electrophoresis
 Separation of proteins on Sodium dodecyl sulphate - polyacrylamide gel electrophoresis
 Separation of amino acids by Thin Layer Chromatography.
 Detection of Carbohydrate (a) PAS method/(b) Alcian blue method
 Detection of Proteins (a) Mercury bromophenol blue method/(b) Ninhydrin method
 Detection of Lipids (a) Phosphomolybic acid method/(b) Copper phthalocyanine method
 Detection of DNA by Feulgen method and differential detection of DNA and RNA in a cell by Methyl green- Pyronin method.
 Isolation and vital staining of lymphocytes obtained from spleen and lymph nodes of sensitized animals

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9
CO 1	M								
CO 2		H	H	H					
CO 3					H	H	H	H	

CO 4									H

ZGFS6017: SPECIALIZATION LAB II- FISHERY SCIENCE (2 CREDITS: 30 HOURS/ L-T-P: 0-0-2)**Course Outcomes**

Evaluate the physicochemical parameters of water samples. (Evaluating)

Estimate and determine productivity of water bodies and its biotic components. (Evaluating)

Analyze important fish parasites. (Analyzing)

Develop efficient fishing tools for sustainable utilization of the resources. (Creating)

Create reports on the study of freshwater bodies and fish processing centre. (Creating)

Syllabus

Analysis of water samples for various physicochemical parameters—pH, freeCO₂, dissolved oxygen, alkalinity, chloride, hardness, nitrates, phosphates, BOD, COD

Estimation of primary productivity by light and dark method.

Composition and biomass of phytoplankton, Collection, enumeration and biomass of Zooplankton

Identification of important fish parasites (external and internal).

Identification of fishing gears and fish by products.

Fieldwork: Visit to fresh water bodies, study of physico-chemical and biological status and make a report

Visit fish processing centers and make a report.

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7
CO 1	H						
CO 2		H	H				
CO 3				H			
CO 4					H		
CO 5						H	H

ZGAW6018: SPECIALIZATION LAB II- ANIMAL ECOLOGY AND WILDLIFE BIOLOGY [2 CREDITS: 30 HOURS, L-T-P: 00- 2]**Course Outcome:**

Apply ecological techniques (Applying)

Analyze animal sign (Analyzing)

Make use of GPS to create habitat maps (Applying)

Make use of wildlife equipment (Applying)

Make use of software for sound analysis and species abundance data (Analyzing)

Explain and Perform DNA isolation (Understanding, Applying)

Create report on conservation practices (Creating)

Syllabus:

Ecological census techniques: a) mark recapture b) quadrat sampling c) plotless sampling d) pellet group count

Animal sign & marks analysis: Pug mark analysis; Scat/ Dung analysis: (parasite identification)

Mapping distribution of endangered animal fauna of Northeast India

Demonstration and use of equipment- camera traps, remote drug delivery equipments, tags, collars, radio tracking equipment

Analysis of Abundance Data

Extraction of DNA from biological sample, PCR amplification 7. Preparation of an area map using on field-GPS data.

Acoustic analysis of birds /amphibians

Report Submission: Preparation of conservation statements-through review of literature or via field visit.

Mapping of COs to Syllabus

Course Outcomes	E1	E2	E3	E4	E5	E6	E7	E8	E9
CO1	H								
CO2		H							
CO3			H				H		
CO4				H					
CO5					H			H	
CO6						H			
CO7									H

ZGBE6019: BIOSYSTEMATICS AND ENVIRONMENTAL BIOLOGY LAB (2 CREDITS) (L-T-P:0-0-2)

Course Outcomes

Explain taxonomic procedures and identify various fauna. (Understanding)

Apply biodiversity indices. (Applying)

Determine parameters of the Environment. (Evaluating)

Application of biostatistical tools. (Applying)

Make use of bioinformatics softwares for genetic analysis. (Applying)

Demonstrate survey techniques. (Applying)

Syllabus

Collection, preservation, curation and identification of non-chordata and chordate species (only pest and cultured species)

Identification with only diagnostic features (specimen or model/diagnostic photograph) of different phyla

Survey and application of biodiversity indices on animal species (any one group)

Calculation of Pearson correlation coefficient, T-test (One sample t-test, Two sample t- test, Paired t-test);

Chi square test, ANOVA, Mann-Whitney test on supplied data.

Preparation of Taxonomic key, study of evolution through models/charts.

Estimation of CO₂, DO, Nitrites, total alkalinity and hardness of water sample.

Study of zooplanktons and its role in a pond ecosystem.

Analysis of physical parameters of soil.

Study of different types of survey techniques

Mapping of COs to Syllabus

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11	E12
CO 1	H	H			H							
CO 2			H									
CO 3				H					H		H	
CO 4						H	H	H				
CO 5												
CO 6										H		H

ZGCI6020: CELL BIOLOGY, GENETICS AND BASIC BIOINFORMATICS LAB (2 CREDITS) (L-T-P:0-0-2)

Course Outcomes

Demonstrate laboratory safety protocols. (Understanding)

Identify laboratory equipment and their uses. (Remember)

Interpret cell division and the stages. (Understanding)

Analyze macromolecules using electrophoretic techniques. (Analyzing)

Apply bioinformatics tools to archive, retrieve, and analyze biological data. (Analyzing)

Syllabus

Use and care and maintenance of common lab equipment (microscope, colorimeter/ spectrophotometer, balance, pH meter, oven, incubator, microtome, electrophoretic apparatus, centrifuge, water bath etc.)

and glass wares.

Identification of various stages of mitosis and meiosis from prepared slides.

Temporary squash preparation of onion root-tip/tadpole tail-tip cells to study stages of mitosis and

Grasshopper/ Gryllotalpa testis to study meiotic stage of cell division.

Comparison of RBC and WBC in different groups of Vertebrate.

Isolation of DNA from any animal source.

Agarose Gel electrophoresis of isolated genomic DNA.

Detection of Barr body from epithelial cells

Pedigree analysis of some human inherited trait

Preparation of metaphase chromosome and chromosome banding studies

Mapping of COs to Syllabus

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10
CO 1	H									
CO 2		H								
CO 3			H	H						
CO 4					H	H				
CO 5							H	H	H	H

ZGDB6021: DEVELOPMENTAL BIOLOGY AND BIOCHEMISTRY LAB (2 CREDITS: 30 HOURS) (L-T-P: 2-0-0)

Course Outcomes

Develop the concepts of mechanisms of embryonic development. (Applying)

Categorize different mechanisms of embryological development through experimental techniques. (Analyzing)

Assess the effects of various teratogenic agents and environmental estrogens on development. (Evaluating)

Appraise the interactions of maternal effect of gene, gap gene, pair-rule gene, and hox- gene in development with respect to Drosophila. (Evaluating)

Discuss the various methods of assisted reproductive technology. (Creating).

Syllabus

In vivo/in vitro culture and study of chick embryo

Study of blastula, gastrula, tail bud and gill stages of frog embryo.

Study of developmental stages of Chick embryo from permanent slides.

Study of different stages of estrous cycle in mice (photographic).

Mini Project: Study of different types of eggs of invertebrates and vertebrates

(Field visit or visit to an institution for study) and preparation of project report.

Preparation buffers of different pH using Henderson-Hasselbalch Equation And Its Verification using pH meter.

Quantitative estimation of amino acid using ninhydrin reagent.

Quantitative estimation of total soluble protein by Lowry method.

Estimation of glucose in serum by glucose oxidase peroxidase method/tissue by Anthrone reagent

Determination of in vitro antioxidant property (of plants extracts).

Mapping COs to syllabus

	E1	E2	E3	E4	E5	E6	E7	E8	E9
CO1	H	H							
CO2			H						
CO3				H					
CO4						H	H	H	H
CO5					H				

ZGEP6022: ETHOLOGY AND POPULATION GENETICS LAB (2 CREDITS: 30 HOURS) (L-T-P: 0-0-2)

Course Outcomes

Compare different types of behavior and analyze the methods of behavior sampling. (Evaluating)

Identify characteristic features of social organization in primates and analyze inclusive fitness. (Applying)

Construct gene frequencies using Hardy Weinberg Law. (Creating)

Determine food preferences in fish or insects. (Evaluating)

Distinguish behavioral changes in zooplanktons in relation to temperature and chemicals. (Analyzing)

Syllabus

Identification of different behavioral types (States and Events) in any group of animals.

Preparation of behavioral catalog (Ethogram)

Behavioral sampling Techniques: Scan animal Sampling, Focal animal sampling

Time and activity budgeting

Social organisation in primates

Analysis of gene frequencies using Hardy Weinberg Law using case studies.

Thermotactic behaviour in Zooplanktons/ Earthworm 8. Chemotactic behaviour in Zooplanktons/ Earthworm

Food preference in Tribolium / fish.

Study of Deimatic behaviour/ Aposematic behaviour in any group of animals.

Analysis of inclusive fitness.

Mapping COs to syllabus

	E1	E2	E3	E4	E5	E6	E7	E8	E9	E10	E11
CO1	H	H	H	H						H	H
CO2					H						
CO3						H					
CO4									H		
CO5							H	H			

ZGBB6023: BASIC BIOINFORMATICS LAB

(1 CREDIT: 15 Hours) (L-T-P: 0-0-1)

Objective(s): To acquire practical skills in bioinformatics and computational biology techniques and develop critical thinking abilities and ethical reasoning skills necessary for conducting research in the field.

COURSE OUTCOMES:

CO1: Identify different databases and utilise for sequence/structure retrieval. Data visualization of various 3D models and determine molecular structures and their functions.

CO2: Distinguish sequence alignment techniques and comparison and analysis of biological sequences.

CO3: Building 3D protein structures and explore protein structure-function relationships. Solve questions for interactions between proteins and ligands through molecular docking.

CO4: Analyze phylogenetic relationships to investigate evolutionary patterns and understand biological diversity and evolutionary history.

CO5: Develop critical thinking skills through case study evaluation to analyze and evaluate the ethical implications of computational techniques in biology research.

List of Practicals

Retrieval of Nucleotide sequences / Protein structure from the databases.

To visualize three-dimensional (3D) structure of protein in various models

To perform Pair-wise Sequence Alignment using NCBI BLAST (BLASTN) and interpret the output.

To perform Sequence Alignment using NCBI Protein BLAST (BLASTP) and interpret the output.

To perform Multiple Sequence Alignment (MSA) using Clustal Omega and interpret the output.

To build 3D structure of a target protein through Homology Modelling.

To perform Phylogenetic Analysis using academic software.

To investigate the interactions between protein and ligands through Molecular docking.

Ethical Analysis by Case Study Evaluation - To evaluate the ethical implications and assess their impact on societal values, individual rights, and scientific integrity. – *Assignment*.

Suggested Readings

Ghosh Z and Mallick B. (2008). Bioinformatics: Principles and Applications, Oxford University Press.

Pevsner J. (2009). Bioinformatics and Functional Genomics, II Edition, Wiley Blackwell.

Zvelebil, Marketa and Baum O. Jeremy (2008). Understanding Bioinformatics, Garland Science, Taylor and Francis Group, USA.

S. Jayanitha, T. Kartheeswaran (2019). Ethical, Legal and Social Issues in Bioinformatics Applications. (Proceedings of the Vavuniya Campus International Research Symposium).

Andreas Dress, Michal Linial, Olga Troyanskaya, Martin Vingron. Computational Biology

(Print ISSN -1568-2684) by International Society for Computational Biology (Springer).

Zhumur Ghosh, Bibekanand Mallick (2008). Bioinformatics: Principles and Applications. Oxford University Press (ISBN: 9780195692303).

Jin Xiong (2006). Essential Bioinformatics. Cambridge University Press (ISBN: 9781139450621).

Mapping to the CO of the Syllabus

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9
CO1	H	H							
CO2			H	H	H				
CO3		H				H		H	
CO4							H		
CO5									H

SERVICE LEARNING IN ZOOLOGY PRACTICAL**Course Outcomes**

Demonstrate aquaculture practices and techniques. (Applying)

Demonstrate techniques in Sericulture. (Applying)

Examine what can be learned from the community. (Analyzing)

Syllabus

Identification of local potential aquarium fishes

Aquarium making and management

Preparation and setting up of aquarium

Rearing of Eri silkworm

Identification of silkworm pests

Mapping of COs to Syllabus

	E1	E2	E3	E4	E5
CO 1	H	H			
CO 2			H	H	
CO 3	M	M	L	H	M

FOUNDATIONS OF SERVICE LEARNING PRACTICAL (2 CREDITS)(L-T-P: 0-0-2)**Course Outcomes**

Demonstrate waste management practices. (Applying)

Demonstrate proper health and hygiene practices. (Applying)

Examine what can be learned from the community. (Analyzing)

Syllabus

Identification and segregation of waste in designated bins

Composting of biodegradable waste

Visit to nearby school and demonstration of personal hygiene habits

Awareness Programme on breeding grounds of vectors and their control.

Mapping of COs to Syllabus

Course Outcomes	1	2	3	4
CO 1	H	H		
CO 2			H	H
CO 3	L	M	L	L

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS MASTER OF ARTS IN ECONOMICS

Course Structure of MA Programme

SEMESTER I						
TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE NO
Theory	Core Course	ENML0046	Microeconomic Analysis	4-0-0	4	2061
Theory	Core Course	ENMY0047	Macroeconomic Analysis	4-0-0	4	2062
Theory	Core Course	ENFE0067	Financial Economics	4-0-0	4	2087
Theory	Core Course	ENMM0048	Mathematical Methods in Economics	4-0-0	4	2063
Theory	Department Elective (DE)	ENMB0050	Money and Banking	3-0-0	3	2065
Theory	School Elective (SE)	ENIP0051	Indian Economic Development	3-0-0	3	2067
Theory	Service Learning	ENSL0200	Service Learning	2-0-0	2	
Total Credits					22	
SEMESTER II						
TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE NO
Theory	Core Course	ENSM0052	Statistical Methods in Economics	4-0-0	4	2068
Theory	Core Course	ENEO0049	Economics of Development			2064
Theory	Core Course	ENPS0054	Public Economics	4-0-0	4	2070
Theory	Core Course	ENDV0055	Indian Economic Development and Policy	4-0-0	4	2071
Theory	School Elective (SE)	ENPB0056	Public Finance	3-0-0	3	2073
Total Credits					23	
SEMESTER III						
TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE NO
Theory	Core Course	ENRM0057	Research Methodology in Economics	4-0-0	4	2074
Theory	Core Course	ENES0058	Environmental Economics and Sustainability	4-0-0	4	2075

Theory	Core Course	ENDI6003	Dissertation Phase I	2-0-0	2	2091
Theory	Discipline Specific Elective (DSE) (Any one)	ENEG0059	Agriculture Economics - Issues and Management	4-0-0	4	2077
Theory		ENBE0070	Behavioural Economics			2089
Theory	Discipline Specific Elective (DSE) (Any one)	ENHE0061	Health Economics	4-0-0	4	2079
Theory		ENOR0065	Operations Research			2084
Total Credits					18	
SEMESTER IV						
TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE NO
Theory	Core Course	ENIN0063	International Economics	4-0-0	4	2081
Theory	Core Course	ENPE0064	Population Economics	4-0-0	4	2083
Theory	Core Course	ENDI6004	Dissertation Phase II	4-0-0	4	2092
Theory	Discipline Specific Elective (DSE) (Any one)	ENNE0071	Economy of North East Region	4-0-0	4	2090
Theory		ENLE0069	Labour Economics			2088
Theory		ENEI0062	Economics of Industry			2080
Theory	Discipline Specific Elective (DSE) (Any one)	ENEM0053	Econometric Methods			2069
Theory		ENGE0066	Gender Economics			2085
Theory		ENED0060	Economics of Education			2078
Total Credits					20	
Total Programme Credits in MA Economics					83	

MA Economics - LIST of VALUE ADDED COURSES

SEMESTER II						
TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE NO
Practical	Value-added Course	ENDA6005	Data Analysis with SPSS/STATA	0-0-2	2	

DEPARTMENT OF EDUCATION MASTER OF ARTS IN EDUCATION

Course Structure of MA Programme

SEMESTER I					
Type of Course	Category	Course Code	Course Title	Credits	Page No.
Theory	DC	EDFE0035	Philosophical Foundations of Education	4(4-0-0)	2117
	DC	EDEP0036	Fundamentals of Educational Psychology	4(4-0-0)	2118
	DC	EDTE0013	Emerging Trends in Education	3(3-0-0)	2096
	DC	EDDE0014	History and Development of Education in India	3(3-0-0)	2098
	Elective Group I				
	DE	EDET0015	Educational Technology	3(3-0-0)	2099
	Elective Group II				
	DE	EDLR0007	Leadership and Social Responsibility	3(3-0-0)	2095
Practicum	DC	EDJG6002	Journaling – A Technique for Personal and Academic Growth	3(3-0-0)	2124
Total Credits				23	
SEMESTER II					
Theory	DC	EDSF0038	Sociological Foundations of Education	4(4-0-0)	2121
	DC	EDRM0034	Research Methodology in Education	4(4-0-0)	2116
	Specialisation Courses: One area of Concentration to be opted (Educational Leadership/Educational Psychology)				
	DC	EDEL0019	Developing Educational Leadership	3(3-0-0)	2100
	DC	EDDL0020	Human Development and Learning	3(3-0-0)	2102
	Elective Group I				
	-	-	-	3(3-0-0)	
	Elective Group II				
	DE	EDPC0037	Peace Education and Conflict Management	3(3-0-0)	2120
Practicum	DC	EDES6003	Educational Seminar I	2	2125
	SE	SWCA6010	Computer Applications for Social Sciences (Lab)	2	2131
	DC	EDEP6016	Experiments in Educational Psychology	2	2130
Total Credits				23	
SEMESTER III					

Theory	DC	EDCI0039	Curriculum Development and In- struction	3	2123
	DC	EDTP0022	Principles and Techniques of Teach- ing and Pedagogy	3	2103
	DC	EDTE0023	Teacher Education	3	2105
	DC	EDME0024	Measurement and Evaluation in Edu- cation	3	2106
	SPECIALIZATION COURSES				
	Educational Leadership				
	DC	EDOC0029	Organisational Communication	3	2111
	DC	EDFM0026	Financial Management and Account- ing	3	2107
	Educational Psychology				
	DC	EDLE0027	Life Span Development and Educa- tion	3	2108
Practicum	DC	EDLI0028	Learning and Individual Differences	3	2109
	DC	EDDI6005	Dissertation Phase I	2	2126
	DC	EDES6009	Educational Seminar II	2	2128
	DC	EDTP6010	Teaching Practice	2	2129
		Total Credits		24	
SEMESTER IV					
Theory	SPECIALIZATION COURSES				
	Educational Leadership				
	DC	EDEA0030	Educational Administration	3	2112
	DC	EDSR0031	Ethics and Social Responsibility in Education	3	2113
	Educational Psychology				
	DC	EDSP0032	Counselling Skills for Educational Psychologists	3	2114
	DC	EDCA0033	Child and Adolescent Mental Health	3	2115
Practicum	DC	EDDI6007	Dissertation Phase II	4	2126
	DC	EDIN6008	Internship	3	2127
	Total Credits			13	
	TOTAL PROGRAMME CREDITS			83	

		LIST OF VALUE ADDED COURSES				
Course Type	Category	Course Code	Name of Paper	L-T-P	Credits	Page No.

Theory & Practicum	Value Added	EDES6011	Education for Sustainable Development	1-0-1	2	2134
		EDTT6012	Teacher and Teaching Skills	1-0-1	2	2135
		EDHW6013	Education for Health and Wellness	1-0-1	2	2135
		EDWE6014	Women Empowerment	1-0-1	2	2137
		EDFL6015	Family Life Education	1-0-1	2	2136
		EDAD6017	Adult Education	1-0-1	2	2138

DEPARTMENT OF ENGLISH

MASTER OF ARTS IN ENGLISH

Course Structure of MA Programme

SEMESTER I					
TYPE	COURSE CODE	COURSE TITLE	CATEGORY	CREDITS	PAGE NO
Theory	EGEP0001	Chaucer to Elizabethan Period – Poetry, Drama and Romance	DC	4	2142
	EGLS0002	Literary and Social History of England - Chaucer to Elizabethan Period	DC	3	2143
	EGSD0029	Shakespearean Drama	DC	4	2158
	EGWL0033	World Literature Since 20th Century		2	2162
	Elective I One course to be chosen				
	EGAA0034	Arts and Aesthetics	DE	3	2163
	EGCS0035	Cultural Studies	DE		2164
	EGFS0036	Film Studies			2165
	Elective II One course to be chosen				
	MCML0027	Media Literacy	SE	3	2181
	EDLR0007	Leadership and Social Responsibility	DE		2095
	SWGS0039	Gender studies	SE		2294
	EGET0007	English Language Teaching	SE		2144
Orientation	EGSL0200	Service Learning-Language Communication			2170
Total Credits				19	
SEMESTER II					
Theory	EGRR0008	Restoration to Romantic Period – Poetry and Drama	DC	4	2145

	EGLC0028	Literary Criticism – Plato to F.R. Leavis and Select Twentieth Century Perspectives	DC	4	2158
	EGIL0030	Introduction to Linguistics	DC	4	2159
	EGAL0011	Approaches to Language and Lit-erary Research	DC	3	2147
	Elective I One course to be chosen				
	EGTR0012	Classics in Translation	DE	3	2148
	EGNE0037	North-East Indian Literature in English	DE		2148
	Elective II One course to be chosen				
	SWEM0038	Environment studies and Disas-ter Management	SE	3	2293
	EDPC0037	Peace Education and Conflict Management	SE		2120
	PCSP0006	Introduction to Social Psychology	SE		2216
	EGWR0038	Women’s Writings	DE		2167
Seminar	EGSP6006	Seminar and Presentation	DC	2	2173
Theory	EGSL0200	Service Learning-Language Communication			2170
				23	
SEMESTER III					
Theory	EGVP0015	Victorian to Post-Modern Period – Poetry, Drama & Fiction	DC	4	2149
	EGPL0016	Post-Colonial Literature – Poetry, Drama & Fiction	DC	3	2150
	EGAL0017	American literature – Poetry, Drama & Fiction	DC	3	2151
	EGLT0018	Literary and Critical Theory	DC	4	2152
	EGGN0019	Gender and Literature	DC	2	2153
	Specialisation Course: Language and Linguistics				
	EGLS0020	Linguistics and Stylistics I	DC	3	2154
	Specialization Paper: Euro-pean Literature				
	EGIM0031	Modern European Literature I	DC	3	2160
	Specialization Paper: African Literature				
	EGAL0039	Colonial and Post- Colonial Afri-can Literature I	DC	3	2168
Project	EGPP6003	Project Phase I	DC	3	2171
Practical	EGSL0200	Service Learning-Language Communication(Community En-gagement)			2170

Total Credits				21	
SEMESTER IV					
Theory	EGIW0023	Indian Writing in English – Poetry, Drama & Fiction	DC	4	2155
	EGSA0024	South-Asian Literature	DC	4	2156
	Specialization Paper: Language and Linguistics				
	EGLS0025	Linguistics and Stylistics II	DC	3	2157
	Specialization Paper: European Literature				
	EGEL0032	Modern European Literature II	DC	3	2161
	Specialization Paper: African Literature				
	EGPC0040	Colonial and Post- Colonial African Literature II	DC	3	2169
Project	EGPP6004	Project Phase II- Dissertation	DC	8	2172
Practical	EGSL0200	Service Learning-Language Communication(Community Engagement)			2170
Total Credits				19	
Total Programme Credits				82	

VALUE ADDED COURSES						
Course-Type	Category	Course Code	Name of Paper	L-T-P	Credits	PageNo
Theory & Practical	Value Added	EGES0138	Effective Communication Skills	1-0-1	2	2173
		EGML0028	Myths in Literature	2-0-0	2	2174
		EGLA6005	Lyrical Analysis	1-0-1	2	2175

DEPARTMENT OF MASS COMMUNICATION

MASTER OF ARTS IN MASS COMMUNICATION

Course Structure of MA Programme

SEMESTER – I					
Type	Category	Course Code	Name	Credits	Page No.
Theory	DC	MCHD0028	History and Development of Communication Media	3	2182
	DC	MCPC0029	Philosophy of Communication	3	2183
	DC	MCTC0030	Theoretical Perspectives of Communication	4	2183
	DC	MCPJ0031	Principles and Practices of Journalism	4	2184
Elective 1: One Course to Be Opted					
Theory	SE	PCEC0013	Eastern Approaches to Psychology and Counseling	3	2217
	SE	EDET0015	Education Technology	3	2099
	SE	SWEM0038	Environment and Disaster Management	3	2293
Elective 2: One Course to Be Opted					
Theory	DE	MCML0027	Media Literacy	3	2181
	SE	EDLR0007	Leadership and Social Responsibility	3	2095
	SE	SWGS0039	Gender Studies	3	2294
	SE	EGET0007	English Language Teaching	3	2144
Practicum	DC	MCTP6015	Techniques of Photography and Image Editing	2	2204
Practicum	DC	MCJG6016	Journaling	1	2205
Theory	Service Learning	MCLS0100	Community Media	2	2211
Total Credits				26	
SEMESTER – II					
Theory	DC	MCID0032	Investigative and Data Driven Journalism	3	2185
Theory	DC	MCTS0033	Theories of Development Communication and Social Change	4	2186
Theory	DC	MCRM0034	Media and Communication Research Methodology	4	2188
Theory	DC	MCDM0052	Digital Media	3	2202
Elective 1: One Course to Be Opted					
Theory	SE	SWDS0044	Introduction to Disability Studies	3	2301
Theory	SE	PCPD0007	Personality Development		
Theory	DE	MCRC0026	Rural Communication		2179
Elective 2: One Course to Be Opted					
	SE	PCSP0006	Introduction to Social Psychology		2216

Theory					
Theory	SE	EDPC0037	Peace Education and Conflict Management	3	2120
Theory	SE	SWEM0038	Environment Studies and Disaster Management		2293
Theory	SE	LSNE0020	North-East Indian Literature in English		2148
Practi-cum	DC	MCDI6017	Dissertation Phase - I	2	2205
Practi-cum	DC	MCAV6018	Audio-Video Production	2	2206
Total Credits				21	
SEMESTER- III					
Theory	DC	MCML0037	Media Laws, Ethics and Social Responsibility	3	2189
Theory	DC	MCAM0038	Advertising, Marketing and Public Relations	3	2190
Practi-cum	DC	MCDP6019	Dissertation Phase - II	2	2206
	Specialization: Electronic Media				
Theory	DC	MCAV0039	Audio-Video Editing	3	2191
Theory	DC	MCTV0040	Television and Video Production	4	2192
Theory	DC	MCSM0041	Sound for Media	4	2193
	Specialization: Print Media				
Theory	DC	MCPC0042	Political Communication	3	2194
Theory	DC	MCNR043	News Reporting and Editing	4	2195
Theory	DC	MCHE0044	Health and Environmental Communication	4	2196
	Specialization: Communication for Development				
Theory	DC	MCPM0045	Programme Management	3	2197
Theory	DC	MCSA0046	Situation Analysis for Communication Strategy	4	2198
Theory	DC	MCCA0047	Planning Models and Communication Ap-proaches	4	2199
Total Credits				19	
SEMESTER – IV					
Theory	DC	MCMC0048	Media and Cultural Studies	3	2200
Practi-cum	DC	MCIP6020	Internship	5	2207
	Specialization: Electronic Media				
Theory	DC	MCFA0053	Film Appreciation	3	2203
Project	DC	MCFP6021	Final Project	5	2207
	Specialization: Print Media				
Theory	DC	MCBJ0050	Business Journalism	3	2201
Project	DC	MCFP6021	Final Project	5	
	Specialization: Communication for Development				

GTheory	DC	MCPM0051	Project Monitoring and Evaluation	3	2202
Project	DC	MCFP6021	Final Project	5	
Total Credits				16	
TOTAL PROGRAMME CREDITS				82	

LIST OF VALUE-ADDED COURSES

Course Type	Course Code	Name of Paper	T-L-P	Cred-its	Page No.
Theory & Practicum	MCCS6122	Communication Skills	1-0-1	2	2208
Theory & Practicum	MCCW6123	Creative Writing	1-0-1	2	2209
Theory & Practicum	MCEM6124	Event Management	1-0-1	2	2210

DEPARTMENT OF PSYCHOLOGY**MASTER OF SCIENCE PSYCHOLOGY (Clinical/Counselling Psychology) Course Structure**

SEMESTER I					
Type of Course	Category	Course Code	Course Title	Credits	Page No.
Theory	Core Course	PCTP0020	Theories of Personality	4	2218
		PCMH0021	Concepts of Mental Health and Illness-I	4	2219
		PCRM0022	Research Method and Statistics in Social Sciences	4	2220
		PCCP0023	Cognitive Psychology	3	2221
	Elective 1: One Course to Be Opted				
	SE	PCEC0013	Eastern Approaches to Psychology and Counselling	3	2217
	SE	EDET0015	Education Technology	3	2099
	SE	SWEM0038	Environment and Disaster Management	3	2293
	Elective 2: One Course to Be Opted				
	DE	MCML0027	Media Literacy	3	2181
	SE	EDLR0007	Leadership and Social Responsibility	3	2095
	SE	SWGS0039	Gender Studies	3	2294
	SE	EGET0007	English Language Teaching	3	2144
	SE	PCGP0024	General Psychology	3	2222
Practicum	DC	PCPP6026	Psychological Assessment-I (Practicum-I)	2	2242
Practicum	DC	PCPG6018	Personal Growth	P/NP	2237

		Total Credits		23	
SEMESTER II					
Theory	DC	PCCM0025	Concepts of Mental Health and Illness-II	4	2223
	DC	PCBP0026	Bio- psychology	3	2225
	DC	PCPT0027	Psychological Testing	4	2225
	Elective 1: One Course to Be Opted				
	SE	PCHT0028	Health Psychology	3	2226
	SE	SWDS0044	Introduction to Disability Studies		2301
	DE	MCRC0026	Rural Communication		2179
	Elective 2: One Course to Be Opted				
	SE	PCSP0006	Introduction to Social Psychology	3	2216
	SE	EDPC0037	Peace Education and Conflict Management		2120
	SE	SWEM0038	Environment and Disaster Management		2293
	SE	LSNE0020	North-East Indian Literature in English		2148
Practi- cum		PCPP6027	Psychological Assessment-II (Practicum-II)	2	2243
Field Work		PCFW6028	Field Work	2	2244
	DC	PCFA6019	Psychological First Aid	P/NP	2238
		Total Credits		21	
SEMESTER III (COUNSELLING PSYCHOLOGY SPECIALIZATION)					
Theory	DC	PCFP0029	Foundations of Counseling Psychology	4	2227
	DC	PCCY0030	Child and Youth Counseling	3	2228
	DC	PCDR0031	Disability Studies and Rehabilitation Psy- chology	4	2229
Practi- cum	DC	PCRP6020	Research Project Phase-I	4	
	DC	PCPR6029	Practicum-III	2	2244
	DC	PCSI6021	Supervised Internship Phase-I	4	
	DC	PCIP6022	Summer Internship	P/NP	
	DC	PCST6023	Study Tour	P/NP	
		Total Credits		21	
		SEMESTER IV (COUNSELLING PSYCHOLOGY SPECIALIZATION)			
Theory	DC	PCAT0032	Addiction and Trauma Counselling	3	2230
	DC	PCMF0033	Marriage and Family Counselling	4	2231
Practi- cum	DC	PCPR6030	Practicum-IV	2	2245

	DC	PCSI6024	Supervised Internship Phase-II	8	2241
	DC	PCRP6025	Research Project Phase-II	6	
		Total Credits		23	
		SEMESTER III (CLINICAL PSYCHOLOGY SPECIALIZATION)			
Theory	Core Course	PCFC0034	Foundations of Clinical Psychology	4	2232
		PCPG0035	Psychodiagnostics	4	2233
		PCRP0036	Forensic Psychology	3	2234
Practi-cum		PCRP6020	Research Project Phase-I	4	2238
		PCPR6029	Practicum-III	2	
		PCSI6021	Supervised Internship Phase-I	4	2239
Practi-cum		PCIP6022	Summer Internship	P/NP	2239
		PCST6023	Study Tour	P/NP	2240
		Total Credits		21	
		SEMESTER IV (CLINICAL PSYCHOLOGY SPECIALIZATION)			
Theory	Core Course	PCPC0037	Psychotherapy	4	2235
		PCNP0038	Neuropsychology	3	2236
Practi-cum	Practicum	PCPR6030	Practicum-IV	2	
		PCSI6024	Supervised Internship Phase-II	8	
		PCRP6025	Research Project Phase-II	6	2241
		Total Credits		23	
		TOTAL PROGRAMME CREDITS		88	

LIST OF ELECTIVES COURSES – MSc Psychology					
Course Type	Category	Course Code	Name of Paper	L-T-P	Page No
Theory	Elective – I (Semester I)	PCEC0013	Eastern Approaches to Psychology and Counselling	3-0-0	
Theory	Elective – II (Semester II)	PCSP0006	Introduction to Social Psychology	3-0-0	

LIST OF VALUE-ADDED COURSES – MSc Psychology				
Course Type	Course Code	Name of Paper	L-T-P	Page No
Theory & Practicum	PCWO6033	Working for Diversity	2-0-0	
Theory & Practicum	PCSO6034	School Psychology	2-0-0	2247
Theory & Practicum	PCCO6035	Community Mental Health	2-0-0	2247
Theory & Practicum	PCLS6036	Life Skills Education	2-0-0	2248

DEPARTMENT OF PUBLIC ADMINISTRATION

MA PUBLIC ADMINISTRATION

(With Specialisations in Human Rights-HR/ International Relations -IR/ Public Policy-PP)

Course Structure

SEMESTER I					
Type of Course	Category	Course Code	Course Title	Cred-its	Page No.
Theory	DC	PASE0001	State and its Elements	3	2253
	DC	PAIA0002	Introduction to the Public Administration	3	2254
	DC	PACD0003	Comparative and Development Admin- istration	3	2255
	DC	PAPP0004	Public Policy	3	2255
	Elective Paper				
	DE	PAEP0005	Engaged Policy and Governance	3	2256
			Elective Group I		
	DE	PAHR0024	Introduction to Human Rights (HR)	3	2272
	DE	PAIR0025	Introduction to International Relations (IR)		2273
Orientation	Mandatory Course	PASL0200	Service Learning		2270
		Total Credits		18	
SEMESTER II					
Theory	DC	PAAP0007	Administrative Theory and Principles	3	2257
	DC	PAIA0008	Indian Administration	3	2258
	DC	PAPP0009	Public Personnel Administration	3	2259
	DC	PARM0010	Research Methodology	3	2260
	ELECTIVE GROUP I				
	DE	PAIC0026	Issues in Contemporary International Relations (HR/IR)	3	2274
	DE	PAPF0027	Policy Formulation- Structures and pro- cesses (PP)		2275

	ELECTIVE GROUP II				
	DE	PALM0028	Labour Migration, Citizenship and Governance (HR/IR)	3	2275
	DE	PAOB0012	Organizational Behaviour (PP)		2261
Value Added Course - I	Mandatory	PAEP0021	Environmental Policy and Administration		2268
Theory	Service Learning	PASL0200	Service Learning		2270
	Total Credits			18	
SEMESTER III					
Theory	DC	PABF0013	Budget and Financial Administration in India	3	2262
	DC	PASW0014	Social Welfare Administration	3	2263
	DC	PAEG0015	Environmental Governance	3	2264
	DC	PACA0016	Citizens and Administration	3	2265
	ELECTIVE GROUP I				
		PASE0029	India in South East Asian Politics (HR/IR)	3	2276
		PAPP0030	Public policy in India (PP)		2277
Project	DC	PADP6001	Dissertation – Phase I	3	2267
Value Added Course - II		PADV0031	Data Management and Visualisation		2278
Value Added Course - III		PAIG0023	Innovation in Governance		2269
Practical	Service Learning	PASL0200	Service Learning-(Community Engagement)		2270
		Total Credits		18	
SEMESTER IV					
Theory	DC	PADL0017	Decentralization and Local Governance	3	2265
	DC	PAEG0018	E-Governance	3	2266
	ELECTIVE GROUP I				
	DE	PAIO0032	International Organisations and National Interest (HR/IR)	3	2278
	DE	PAPI0033	Policy Implementation (PP)		2279
	ELECTIVE GROUP II				

	DE	PACG0034	China and the Global System (HR/IR)	3	2280
	de	PAPO0035	Policy Analysis (PP)		2281
Project	DC	PADP6005	Dissertation – Phase II	6	2268
Practical	Service Learning	PASL0200	Service Learning-(Community Engagement)		2270
	Total Credits			18	
	Total Programme Credits			72	

VALUE ADDED COURSES					
Course Type	Category	Course Code	Name of Paper	Credits	Page No.
Theory & Practical	Value Added	PAEP0021	Environmental Policy And Administration	2	2268
		PAIG0023	Innovation In Governance	2	2269
		PADV0031	Data Management and Visualisation	2	2278

DEPARTMENT OF SOCIAL WORK
MASTER OF SOCIAL WORK
Course Structure of MSW Programme

SEMESTER I						
TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE No
Theory	Departmental core	SWHI0035	History, Ideologies and fields of Social Work	3-0-0	3	2288
Theory	Departmental core	SWGD0036	Human Growth and Development	2-0-0	2	2289
Theory	Departmental core	SWIS0037	Introduction to Indian Society, Polity and Economics	2-0-0	2	2290
Theory	Departmental core	SWCS0070	Social Work with Communities and Social Action	3-0-0	3	2292
Theory	School Elective	SWEM0038	Environment and Disaster Management	3-0-0	3	2293
Theory	Departmental Elective	SWGS0039	Gender Studies	3-0-0	3	2294
Practicum	Departmental Core	SWFR6008	Concurrent Field Work	0-0-16	6	2341
SEMESTER II						
TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE NO

Theory	Departmental core	SWPF0040	Social Work Practice with Individuals and Families	3-0-0	3	2296
Theory	Departmental core	SWPG0041	Social Work Practice with Groups	3-0-0	3	2297
Theory	Departmental core	SWRS0042	Social Work Research and Statistics	3-0-0	3	2298
Theory	Departmental core	SWWA0043	Social Welfare Administration	3-0-0	3	2300
Theory	Departmental Elective	SWDS0044	Introduction to Disability Studies	3-0-0	3	2301
Theory	Departmental Elective	SWEM0038	Environment and Disaster Management	3-0-0	3	
Practicum	Departmental Core	SWFW6009	Concurrent Field Work II	0-0-16	6	2342
Practicum	Departmental Core	SWSL0200	Participatory Service Learning – Rural Practicum	30-0-50 in 10 days	2	2345
SEMESTER III						
TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE NO
Theory	Departmental core	SWSJ0045	Social Justice, Human Rights & Para-legal Education	3-0-0	3	2302
Theory	Departmental core	SWES0046	Emerging Social Work Perspectives and Integrated Approach	3-0-0	3	2304
Theory	Departmental core	SWCA0047	Computer Applications for Social Sciences (Lab)	0-0-2	2	2342
Theory	Departmental Elective	SWRT0048	Community Development: Rural, Tribal and Urban	3-0-0	3	2305
Theory	Departmental Elective	SWGC0049	Governance and Community Development	3-0-0	3	2307
Theory	Departmental Elective	SWCS0050	Family Centered Social Work Practice	3-0-0	3	2308
Theory	Departmental Elective	SWPC0051	Social Work Practice with Children	3-0-0	3	2309
Theory	Departmental Elective	SWMS0052	Medical Social Work	3-0-0	3	2311

Theory	Departmental Elective	SWHS0053	Mental Health and Social Work	3-0-0	3	2312
Theory	Departmental Elective	SWOD0054	Organisational Structure, Behaviour and Development	3-0-0	3	2313
Theory	Departmental Elective	SWDO0055	Policies for Development Organisations - Urban, Rural and Tribal Communities	3-0-0	3	2315
Theory	Departmental Elective	SWCP0056	Introduction to Child Psychology and Development	3-0-0	3	2316
Theory	Departmental Elective	SWRC0057	Rights of the Child – Legal Framework, National And International Instruments	3-0-0	3	2317
Project	Departmental Elective	SWRP6020/ /SWCP6022	Research Project Phase I/ SWAYAM Course 1/ Community Development Project I	2-2-2/3-0-0/2-2-2	3	2344 2346
Internship	Departmental Core	SWFW6010	Continuous Field Work I	0-0-200 In one month	6	2343

SEMESTER IV

TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE NO
Theory	Departmental core	SWSP0058	Social Development and Social Policy	3-0-0	3	2319
Theory	Departmental core	SWPM0059	Project cycle Management and Resource Mobilisation	3-0-0	3	2320
Project	Departmental Elective	SWRP6021/ - /SWCP6023	Research Project Phase II / SWAYAM Course 2/ Community Development Project II	2-2-2/3-0-0/2-2-2	3	2344 2346
Theory	Departmental Elective	SWHP0060	Community Health and Population Management	3-0-0	3	2321
Theory	Departmental Elective	SWDC0061	Community Development Practice with Disempowered Communities	3-0-0	3	2322
Theory	Departmental Elective	SWWE0062	Development Concerns and Women Empowerment	3-0-0	3	2323
Theory	Departmental Elective	SWSN0063	Families With Special Needs	3-0-0	3	2325
Theory	Departmental Elective	SWPW0064	Psychiatric Social Work	3-0-0	3	2326
Theory	Departmental Elective	SWCH0065	Community Health and Services	3-0-0	3	2328
Theory	Departmental Elective	SWHR0066	Human Resource Management: Social Work Perspective	3-0-0	3	2329
Theory	Departmental Elective	SWCI0067	Corporate Social Responsibilities - Concepts & Ideologies	3-0-0	3	2330

Theory	Departmental Elective	SWSP0068	Children with Special Needs	3-0-0	3	2331
Theory	Departmental Elective	SWRP0070	Child Rights and Child Protection	3-0-0	3	2333
Internship	Departmental Core	SWCF6012	Continuous Fieldwork II	0-0-200 In one month	6	2343
Internship	Departmental Core	SWIN6013	Internship	0-0-200 In one month	P/NP	2344
VALUE ADDED COURSES						
TYPE	CATEGORY	COURSE CODE	COURSE TITLE	L-T-P	CREDITS	PAGE NO
Theory & Practicum	Value Added	SWRB6014	Results Based Management of Projects and programmes	15-0-15	2	2335
Theory & Practicum	Value Added	SWAW6015	Academic Writing, Research Proposal Development and Dissertation Writing Course	15-0-15	2	2334
Theory & Practicum	Value Added	SWWD6016	Working with Diversity	15-0-15	2	2336
Theory & Practicum	Value Added	SWLS6017	Life skills for competency development	15-0-15	2	2337
Theory & Practicum	Value Added	SWFT6018	Family Therapy	15-0-15	2	2339
Theory & Practicum	Value Added	SWCD6019	Introduction to Communication for Development (C4D) for Social Work	15-0-15	2	2340

Note: Mandatory Course EDPC0201: Indian Polity and Constitution

SCHOOL OF HUMANITIES AND SOCIAL SCIENCE

SCHOOL OF HUMANITIES AND SOCIAL SCIENCES

DEPARTMENT OF ECONOMICS

VISION

To envision excellence in quality education and moulding intellectually competent persons in economics for creating novel ideas through innovative teaching and research contributing to the modern society.

MISSION

Empower the students with critical understanding of economic theory, analytical treatment and empirical interpretations of economic issues.

Make the students aware of recent and ongoing developments in the field of economics.

Enhance the skill and efficiency of the students for better employability in competitive job markets.

Programme Outcomes – MA Economics

- PO 1: **Critical Thinking:** Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- PO 2: **Effective Communication:** Speak, read, write and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media and technology.
- PO 3: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO 4: **Effective Citizenship:** Demonstrate empathetic social concern and equity centered national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO 5: **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO 6: **Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
- PO 7: **Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

Programme Specific Outcomes – MA Economics

- PSO 1: **Knowledge of Economic Structure:** Ability to understand theories of basic economic structure and enhanced policy making. It also provides detailed knowledge of Indian Economy especially in post independence period.
- PSO 2: **Applications of Mathematical and Econometric Methods:** To acquaint with the basic and applied mathematical and econometric methods to solve real economic problems. This develops skills required for empirical research.
- PSO 3: **Growth and Sustainable Development Outlook:** To acquaint with in-depth knowledge of growth and sustainable development policies and strategies.
- PSO 4: **Understanding of Trade and Financial Policies:** To equip with the fundamental strategies and principles governing trade and relations across countries.

PSO 5: **Perspective of Sectoral Knowledge:** To equip with the knowledge of sectoral behaviour, sector specific theories and policies.

PSO 6: **Population and Behavioural Studies:** To understand the principles of population and human decision making behaviour guided by cognitive skills.

MAPPING OF COURSES TO POS/PSOS – MA ECONOMICS

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
1.1	H						M	H		M			M
1.2	H		M					H		M		L	
1.3	M	M						M	H				M
1.4	M			M	L					H	M	H	
1.5		M					M			M	H	L	
1.6			M			H		H		H		M	
2.1	M						M		H		M		H
2.2	H						M	M	H				H
2.3		M			M			H		M		L	
2.4	M		M			H	M		H			M	
2.5			H	M				L			M	H	
2.6		M	H						H				M

3.1		H	M		H		H		M	H			L
3.2	L			H		H				H	H	M	
3.3		H	M		M				M				H
3.4	M		H			M		H		M		H	
3.5		M	M		H			M				H	H
3.6			H	M		M				M		H	M
3.7		M				H			M	H		H	
4.1	H	M			M			H		M	H		
4.2			M	M		L	H			H		M	H
4.3		H	M		M				H				M
4.4	H						M		H				M
4.5			M		H	L				M		H	H
4.6	L	M						H		M	H		
4.7				M		M	M		M	H		H	
4.8			H		M			M		H		M	
4.9	H				M		L			M		H	H

DETAILED SYLLABUS – MA ECONOMICS

THEORY COURSES

ENML0046 : MICRO ECONOMIC ANALYSIS (4-0-0)

COURSE OUTCOMES

Describe the detail concepts of microeconomics (Remembering)

Illustrate the behaviour of economic agents as well as the behaviour of the firms (Understanding)

Apply microeconomic concepts and theories to analyse real-life situations (Applying)

Illustrate the interactions of Microeconomics with other branches of Economics (Analyzing)

Elucidate the effects of economic policies on microeconomic behaviour and thus on the overall economic activities (Evaluating)

Develop ideas and critical insights for analysing real-life economic problems (Creating)

Module I: Choice under Risk and Uncertainty (12 hours)

The von-Neumann-Morgenstern Axioms; Expected Utility Theory; Risk Aversion; Certainty Equivalent and Risk Premium;

Reducing Risk – Diversification, Insurance, Information; Comparative Risk Aversion; The Demand for Risky Assets; The State Preference Approach to Choice under Uncertainty

Module II: Imperfect Market Structure: Oligopoly (15 hours)

Basic Market Structure; Non-collusive Oligopoly – Cournot, Bertrand, Stackelberg, Paul Sweezy; Collusive Oligopoly – Cartels, Price Leadership, Single Basing-point Price; The Mark-up Rule

Module III: Factor Pricing and Income Distribution (15 hours)

Review of Factor Pricing under Perfectly Competitive Markets; Factor Pricing Under Imperfectly Competitive Markets;

Monopolistic and Monopsonistic Powers; Labour Union and Collective Bargaining; Bilateral Monopoly; Elasticity of Factor Substitution; Technological Progress and Factor Share; Pricing of Fixed Factors – Rents and Quasi Rents

Module IV: The Theory of Public Choice (10 hours)

Pareto Optimality; Social Welfare Functions – Bergson & Samuelson, Arrow; Maximisation of Social Welfare; Compensation Criteria; Arrow's Impossibility Theorem; The Theory of Second Best; Social vs. Private Costs and Benefits

Module V: Market Failures (8 hours)

Externalities and Inefficiency; A Simple Bilateral Externalities; Public Goods and Free Riders Problems; Imperfect Markets; Asymmetric Information and Markets for Lemons; Moral Hazard; Adverse Selection; Signaling

Suggested Readings

A. Koutsoyinnis, Modern Microeconomics, International Edition, Macmillan Press Ltd

Baumol, W.J., Economic Theory and Operations Analysis, 1982.

C. Snyder & W. Nicholson, Fundamentals of Microeconomics, Cengage Learning (India), 2010

D. Salvator, Principles of Microeconomics, 5th Edition, OUP

Hal R. Varian, Intermediate Microeconomics, a Modern Approach, W.W. Norton and Company/Affiliated East-West Press (India), 8th Edition, 2010

Karl E. Case & Ray C. Fair, Principles of Economics, Pearson Education Inc., 8th Edition, 2007.

N. Gregory Mankiw, Economics: Principles and Applications, India edition by South Western, a part of Cengage Learning, Cengage Learning India Private Limited, 4th Edition, 2007.

R. S. Pindyck, D. N. Rubinfeld & P. L. Meheta, Microeconomics, 7th Edition, Pearson, New Delhi

Mapping of COs to Syllabus

Course comes	Out-	Module I	Module II	Module III	Module IV	Module V
CO1		M				
CO2			H		H	
CO3		H				M
CO4					M	
CO5			H			
CO6				H		H

ENMY0047: MACROECONOMIC ANALYSIS (4-0-0)

COURSE OUTCOMES

Describe the detail concepts of macroeconomics and its related terms. (Remembering)

Identify the behaviour of macroeconomic variables and their interdependences in a closed as well as in an open economy. (Understanding)

Apply macroeconomic variables and concepts in examining the real-life situation (Applying)

Evaluate the role of macroeconomic variables in smooth functioning of an economy and its dynamics. (Analyzing)

Elucidate the effects of macroeconomic changes and policies on overall growth and development of an economy. (Evaluating)

Formulate and develop macroeconomic models and tools for analyzing real-life macroeconomic situations. (Creating)

Module I: Consumption and Investment Functions (12 hours)

Theories of Consumption – Absolute Income, Relative Income, Life Cycle, Permanent Income; Theories of Investment – The Present Value Criterion for Investment, Marginal Productivity of Capital, The Marginal Efficiency of Capital and Investment,

Financial Theory of Investment; Lags in Investment; Portfolio Disequilibrium and the Transmission Mechanism

Module II: Money Demand, Inflation and Unemployment (15 hours)

Post-Keynesian Theories of Demand for Money – Friedman, Patinkin, Baumol, Tobin; Determinants of Money Supply; Patinkin's Real Balance Effect; Theories of Inflation; Inflation and Unemployment – Phillips Curve Analysis; Trade-off vs. No Trade-off – Tobin, Friedman; The Inflationary Pressure Curve; Adaptive and Rational Expectations; Okun's Law; Keynesianism vs.

Monetarism

Module III: New-Classical Macroeconomics (10 hours)

Main Features of New-Classical Model; Rational Expectation – Barrow's View; Rational Expectations and the Real Business Cycles – Kydland, Prescott; Expectations of Future Variables – Sargent, Muth; Macroeconomic Imbalances; Lucas Aggregate Supply Function; The Rational Expectations Hypothesis and its Critique

Module IV: Cyclical Fluctuation (8 hours)

Characteristics of Cyclical Fluctuation; Business Cycle in Market Economies; Short-Term vs. Long-Term Growth Trend; Theories of Business Cycles – Samuelson, Hicks, Kaldor, Schumpeter; Impact of Recession on Trade Imbalances

Module V: Open Economy Macroeconomics (15 hours)

IS-LM Analysis in Open Economy; Mundell-Fleming Model; Marshall-Lerner Condition; Interest-Rate Differentials; Inflation and Unemployment in the Open Economy; Fiscal Policies with Exchange Rate and Inflation; Floating Exchange Rates with Zero and Perfect Capital Mobility; Exchange Rate Expectations; Exchange Rate Overshooting

Suggested Readings

Andrew B. Abel & Ben S. Bernanke, Macroeconomics, Pearson Education, Inc., 7th Edition, 2011

Dornbusch, Fischer and Startz, Macroeconomics, McGraw Hill, 11th Edition, 2010.

Errol D'Souza, Macroeconomics, Pearson Education, 2009.

N. Gregory Mankiw, Macroeconomics, Worth Publishers, 7th Edition, 2010.

Olivier Blanchard, Macroeconomics, Pearson Education, Inc., 5th Edition, 2009.

Paul R. Krugman, Maurice Obstfeld & Marc Melitz, International Economics, Pearson Education Asia, 9th Edition, 2012.

Richard T. Froyen, Macroeconomics, Pearson Education Asia, 2nd Edition, 2005.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1		H			
CO2	M			H	
CO3			H		H
CO4	H				
CO5		H		M	
CO6			H		

ENMM0048: MATHEMATICAL METHODS IN ECONOMICS (4-0-0)**COURSE OUTCOMES**

Identify the body of basic mathematics that enables economic analysis (Remembering)

Explicate the usage of the concepts of mathematics in Economics (Understanding)

Apply mathematical techniques to elucidate economic problems (Applying)

Assess the role of economic theory and draw inference in context of mathematical techniques (Analysing)

Explain the solution concepts for economic problems with a variety of economic applications (Evaluating)

Develop or build mathematical models to analyse real economic problems (Creating)

Module I: Optimization with Equality Constraint (12 hours)

Solving Equality Constrained Optimization without Lagrange Multiplier; Lagrange Characterization – Single and Multi- constraint Cases; Complementary Slackness Condition; Sensitivity Analysis; Income Expansion Path

Module II: Optimization with Inequality Constraint and Input-Output Model (13 hours)

Binding and Non-binding Constraints; Solution with One and Two Inequality Constraints; Kuhn-Tucker Method; Mixed Constraints – Solution with Equality and Inequality Constraints; Basic Structure of Input-Output Model; Open and Closed Model; Hawkins-Simon Condition; Static and Dynamic Model

Module III: Difference and Differential Equations (15 hours)

Solution of First Order Difference Equations; Economic Applications; Solution of Second Order Difference Equations –

Homogeneous and Non-Homogeneous Equations; Economic Applications of Second Order Homogenous and Non- Homogeneous Equation – Cobweb Market Model, Market Model with Inventory, Determining Dynamic Market Equilibrium Price; Plotting Differential Equation – Phase Diagram

Module IV: Basic Game Theory (20 hours)

Appraisal of Normal Form Games; Games with Perfect Information – Strategic Games, Nash Equilibrium and Existence Properties, Application to Market Equilibrium and Pricing; Extensive Form Games with Perfect Information – Pure Strategy and Nash Equilibrium, Sub-game Perfect Equilibrium, Backward Induction, Bargaining Game (Split-the-Pie); Extensive Form Games with Imperfect Information – Principles for the Equivalence of Extensive Games, Mixed and Behavioural Strategies, Nash Equilibrium; Repeated Games – Finitely Repeated Games and Backward Induction, Infinitely Repeated Games; Dependent Strategies

Suggested Readings

Allen, R.G.D., Mathematical Analysis for Economists, Macmillan and Co Ltd.

Chiang A.C. & K. Wainwright, Fundamental Methods of Mathematical Economics, McGraw Hill International Edition

Hoy, L., McKenna, Rees & Stengos, Mathematics for Economics, Prentice Hall, 2004.

J. M. Henderson and R. E. Quandt, Micro-economic Theory – A Mathematical Treatment

K. Sydsaeter & P. Hammond, Mathematics for Economic Analysis, Pearson Educational Asia: Delhi, 2002.

T. Yamane, Mathematics for Economist: An Elementary Survey, 2nd Edition, Prentice Hall of India Pvt. Ltd., New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2	M			
CO3				H
CO4	H			M
CO5			H	
CO6		M	H	

ENEO0049: ECONOMICS OF DEVELOPMENT (4-0-0)**COURSE OUTCOMES**

Define the key aspects of economic development. (Remembering)

Explain the role of various measurement of economic development. (Understanding)

Identify the various theories and approaches to economic development. (Applying)

Analyse the uses of various development theories of growth. (Analyzing)

Explain the importance of development theories. (Evaluating)

Discuss the various key aspects of dualistic development theories and its applicability. (Creating)

Module I: Measurement of Economic Development (10 Hours)

Measurement of economic development – National Income/GDP and Per Capita Income as an Index of Development; Alternative Measures of Development Gap: HDI, GDI and related indices; Structural Changes in the Development Process – Kuznets

Module II: Theories and Approaches to Economic Development (17 Hours)

Evolution in the Concept of Economic Development – Growth to Sustainable Development; Approaches to Development –

Income Approach and Criticism; Sen's Capability Approach; Establishment Space in Economic Development; Theories of

Economic Development – Karl Marx and Development of Capitalist Economy; Theory of Social Change; Surplus Value and Profit

Module III: Theories of Growth (15 Hours)

Summary of Classical Growth Models – Structural Model and Limitations; A Brief Review of Neo-classical Growth Models – Production Function in Neo-classical Growth; Instability of Growth; Solutions of Instability Problem; The Convergence Debate;

Endogenous Growth Models – Arrow, Uzawa-Locus, Romer; The New Economic Geography – Krugman

Module IV: Development Strategies and Dualistic Pattern of Development (18 Hours)

Big Push – Rosenstein-Rodan; Balanced Growth – Nurkse; Unbalanced Growth – Hirschman; Critical Minimum Efforts – Leibenstein; Structural Change Models - Lewis, Fei-Renis; Rural-Urban Migration– The Harris-Todaro Model; Core- Periphery Models; The Process of Cumulative Causation – Myrdal; Neo-Colonial Dependence Model

Suggested Readings

Barro & Salai-Martin, Economic Growth, Prentice Hall of India.

Basu, K., Analytical Development Economics: Oxford Economic Papers.

Meier, G.M., Leading Issues in Economic Development, Oxford Economic Papers.

Roy, D., Development Economics, Oxford Economic Papers.

Thirlwal, A. P., Growth and Development, Palgrave.

Todaro, M.P., Development Economics, Pearson.

UNDP, Human Development Reports, Oxford Economic Papers.

World Bank, World Development Reports, Oxford Economic Papers.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1		M		
CO2	M	H		
CO3				H
CO4			H	
CO5				H
CO6			H	

ENMB0050: MONEY AND BANKING (3-0-0)**COURSE OUTCOMES**

Learn basic ideas of monetary theory and the effects of monetary variables on the macroeconomic system. (Remembering)

Understand the working of non-banking financial institution and international financial institutions. (Understanding)

Develop the ability to understand the role of monetary forces and real forces and their interconnection in shaping and influencing the monetary and related policies both at the national and international levels. (Applying)

Understand the working of Indian banking system and the inter connectivity of the banks. (Analyzing)

Enable to evaluate the trend of financial reform in the field of financial inclusion. (Evaluating)

Understand the various determinant of demand and supply of money and its role in balancing the growth of the economy. (Creating)

Module I: Supply and Demand for Money (11 hours)

Money Supply – Theoretical and Empirical Attempts to Define Money; Components of Money Supply; Money Creation by the Banking System; High Powered Money and Money Multiplier; Measures of Money Supply and Liquidity in India; Balance Sheet of Central Bank; Demand for Money; Interest Sensitivity of Demand for Money – A Review of Classical, Keynesian and Monetarist Theories of Demand for Money

Module –II: Theories in Rate of Interest (12)

Term Structure of Interest Rates; Expectations Theory; Liquidity Premium Theory; Structure of Interest Rates in India; Monetary Policy – Targets, Goals and the Trade Offs among Alternate Goals; Lags in Operation; Keynesian and Monetarist Views on Transmission Mechanism; Rules vs. Discretion

Module-III: Banking Structure in India (11 hours)

Central Banking – Main Functions; Policy Tools, Recent Monetary Policy of RBI; Money Aggregates Targeting; Interest Targeting and Inflation Targeting Approaches of RBI; Autonomy of RBI; Commercial Banking – Types of Commercial Banks in India; Credit Creation Process; Major Developments in Commercial Banking in India since Reforms (including Mergers); Recent Developments on Financial Inclusion; Performance of Private and Public Banks

Module –IV: Non-Banking Financial Institutions (11 hours)

Role, Growth and Structure of Non-Banking Financial Institutions (NBFIs) in India; Types and Control of Non-Banking Financial Companies (NBFCs); International Monetary System: IMF as provider of International Liquidity; Constituents of International Money and Capital Markets

Suggested Readings

- Bhole, L.M., Financial Institutions and Markets. Tata Mcgraw Hill. 2016.
- Bofinger, P., Monetary Policy: Goals, Institutions, Strategy and Instruments. Oxford University Press, 2001.
- Dennis Geogrey, E.J., Monetary Economics, Longman, 1981.
- Desai, V., The Indian Financial System and development, Himalaya Publishing House, 2019.
- Diulio, A. E., Theory and Problems of Money and Banking, International Edition (Schaum's Outline Series), 1987.
- Fabozzi, F. J. & Franco, Capital Markets Institutions and Instruments, (4th ed.), New Jersey: Prentice Hall, Modigliani, 2009.
- Gordon, E. & Natarajan, K., Financial Markets & Services, Himalaya Publishing House, 2019.
- Handa. J., Monetary Economics, 2nd Edition, Routledge, London, 2009.
- Howells, P. & Bain, K., The Economics of Money, Banking and Finance, Prentice Hall, Pearson Education Ltd., 2002.
- Khan, M.Y., Indian Financial System, Tata Mcgraw Hill, 2017.
- Kulkarni, G., Modern Monetary Theory, New Delhi: Macmillan, 1999.
- Mankiw, N.G., Macro-economics. New York: Macmillan, Worth Publishers, 2008.
- Mohan, R., Monetary Policy in a Globalized Economy – A Practitioner's View, Oxford University Press concerned, 2009.
- Walsh, Carl E., Monetary Theory and Policy, Third Edition, The MIT Press Cambridge Massachusetts, 2010.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2			M	
CO3		H		

CO4			H	
CO5		M		H
CO6				H

ENIP0051: INDIAN ECONOMIC DEVELOPMENT (3-0-0)**COURSE OUTCOMES**

Learn the key issues related to the Indian economy. (Remembering)

Understand the economic reforms and its impact on Indian economy. (Understanding)

Identify the policies and performance in different sector (Applying)

Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Analyzing)

Explain the economic reform and its impact in Indian economy. (Evaluating)

Discuss their understanding of the usefulness of various development policies. (Creating)

Module I: Indian Economic Development: An Overview (10 hours)

Growth and Structure of the Indian Economy – Planned Economic Development, Development Strategy after Independence; Economic Growth, Distribution and Structural Change since Independence; Critical Evaluation of Trend and Issues in

Demography – Education, Health, Poverty, Inequality, Unemployment

Module II: Economic Reforms (12 hours)

Economic Reforms Since 1991 – Liberalization, Privatization, Globalization; Major Developments in Post Economic Reforms

Period; Critical Evaluation of the Changing Structure of the Indian Economy – Pre and Post-reform Eras

Module III: Sectoral Development (13 hours)

Issues and Concern in Indian Agriculture – Land Reform, Green Revolution, Agricultural Price Policy; Agriculture and WTO;

Industrial Development in India – Industrial Growth since 1991, New Industrial Policy and its Impact; Trends in Exports and Imports – Foreign Trade Policy; Assessment of Performance of Service Sector in India in the Contemporary Period

Module IV: Macroeconomic Policies and their Impact in Indian Economy (10 hours)

Financial Sector Reform and Impact of Monetary Policy; Reforms in Banking Sector; Capital Market and its Reform; Reforms in fiscal Policy – Fiscal Responsibility and Budget Management (FRBM) Act; Reform in Indian Labour Market in Post-liberalization Period

Suggested Readings

Kapila, U., Economic development and policy in India, Academic Foundation, 2009.

Rakesh Mohan, India's Financial Sector and Monetary Policy Reforms, in Shankar Acharya and Rakesh Mohan, Editors,

India's Economy: Performances and Challenges: Development and Participation, Oxford University Press, 2010.

Pulapre Balakrishnan, The Recovery of India: Economic Growth in the Nehru Era, Economic and Political Weekly, November, 2007.

Pulapre Balakrishnan, Ramesh Golait & Pankaj Kumar, Agricultural Growth in India Since 1991, RBI DEAP Study No. 27, 2008.

Rakesh Mohan, India's Financial Sector and Monetary Policy Reforms, in Shankar Acharya and Rakesh Mohan, editors,

India's Economy: Performances and Challenges: Development and Participation, Oxford University Press, 2010.

A. Ahsan, C. Pages & T. Roy, Legislation, Enforcement and Adjudication in Indian Labour Markets: Origins, Consequences and the Way Forward, in D. Mazumdar and S. Sarkar, Editors, Globalization, Labour Markets and Inequality in India, Routledge, 2008.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4				H
CO5			H	
CO6				L

ENSM0052: STATISTICAL METHODS IN ECONOMICS (4-0-0)

COURSE OUTCOMES

Define and explain the measures and approaches of various statistical tools and techniques (Remembering & Understanding)

Apply statistical distribution and probability theory for estimation (Applying)

Analyze the results of hypothesis testing and statistical inferential outcomes (Analysing)

Evaluate the underlying assumptions of various analysis tools and techniques and suggest recommendations to the decision making processes (Evaluating & Creating)

Module I: Distribution Theory (15 hours)

Review of Distribution Theory – Discrete and Continuous Distribution; Truncated Distribution – Poisson Only; Compound Distribution – Binomial, Poisson; Random Vectors; Joint Distributions; Variance-covariance Matrix; Transformations of Bivariate Random Variables; Bivariate Normal Distributions

Module II: Probability Theory (15 hours)

Review of Axiomatic Approach to Probability and Baye's Theorem; Expectations of Functions of Random Variables; Conditional Expectation and Distribution; Conditional Variance; Applications; Characteristic Function of a Random Variable

Module III: Sampling Techniques (15 hours)

Basics of Sampling – Random and Non-random sampling; Random Sampling and Estimates of a Population Mean; Ratio Method Estimation – Concept, Bias; Ratio Estimators in Simple Random Sampling and Stratified Random Sampling

Module IV: Statistical Inference (15 hours)

Methods of Constructing Estimators; Theory of Hypothesis Testing – Test Function, Randomized and Non-randomized Tests; Interval Estimation – Confidence Intervals; Relationship with Tests of Hypotheses; Inference on Population Mean – Comparing two Population Means; Inference on Variance – Comparing two Population Variance; Likelihood Ratio Tests and their Properties; Large Sample Theory – Delta Method; Derivation of Large Sample Standard Error

Suggested Readings

Johnson N. L. & Kotz. S., Distributions in Statistics Vol-I, II and III, John Wiley and Sons, New York, 1996

Rohatgi, V. K., Introduction to Probability Theory and Mathematical Statistics

Larsen, R., Marx, M. An introduction to mathematical statistics and its applications, Prentice Hall, 2011.

Miller, I., & Miller, M., J. Freund's mathematical statistics with applications, 8th ed, Pearson, 2017

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	M		
CO2	M		H	
CO3		M		H
CO4			H	

ENEM0053: ECONOMETRIC METHODS (4-0-0)**COURSE OUTCOMES**

Define the basic concepts of econometrics and statistics. (Remembering)

Explain the concepts of simple linear regression and its associated topics. (Understanding)

Apply the regression models estimating regression parameters using OLS. (Applying)

Analyse the results of regression models with hypothesis testing and different statistical tests. (Analysing)

Evaluate the regression models along with diagnostics and model specification. (Evaluating)

Create and design hypothesis of economic problems and advance regression models with qualitative variables. (Creating)

Module I: Linear Regression and Diagnostic Analysis (18 hours)

Overview of the Classical Linear Regression Models - Simple and Multiple; Methods of Estimation-Methods of Moments, Method of Least Squares, Maximum Likelihood Method; Properties of Estimator; Goodness of Fit - R Square and Adjusted R Square; Hypothesis Testing for Regression Coefficients; Analysis of Variance (ANOVA); Problems with Linear Regression - Specification Bias, Autocorrelation, Heteroscedasticity, Multicollinearity; Outliers – Leverage and Influence; Tests for Outliers; Test for Linearity; Tests of Omitted Variables

Module II: Advanced Models in Regression (12 hours)

Use of Instrumental and Dummy Variables; Models with Qualitative Dependent Variables – Probit, Logit and Tobit Probability Models; Simultaneous Equation Models – Nature and Problems; Simultaneity Bias; Structural, Reduced-form and Recursive Models; Identification Problem – Rank and Order Conditions; Identification and Multicollinearity; Over Identified Linear Model – Generalised Method of Moments

Module III: Estimation of Simultaneous Equation Models (10 hours)

Indirect Least Squares (ILS); Method of Instrumental Variables (IV); Two Stage Least Squares (2SLS); Limited-Information Maximum Likelihood Method; Exogeneity and Causality – Weak and Strong Exogeneity, Tests for Exogeneity, Granger Causality

Module IV: Dynamic Econometric Models (10 hours)

Lagged Variables – Meaning and Importance; Distributed Lag Models – Koyck and Almon Approaches; Autoregressive Models – Partial Adjustment Model and Adaptive Expectation Models

Module V: Basics of Time Series Analysis (10 hours)

Stationary and Nonstationary Time Series; Box-Jenkins Approach; Unit Roots Tests – Null and Alternative Hypotheses under Unit Root Tests; Cointegration and Cointegrating Regression

Suggested Readings

Dougherty, C., Introduction to Econometrics, 4th ed., Oxford University Press, 2011.

Gujarati, D., & Porter, D., Essentials of Econometrics, 4th ed., McGraw-Hill, 2010.

Kmenta, J., Elements of Econometrics, Khosla Publishing House, 2008.

Maddala, G., & Lahiri, K., Introduction to Econometrics, 4th ed., Wiley, 2009.

Maddala, G.S., Introduction to Econometrics, 3rd Ed, Wiley India, 2009.

Madnani, G.M.K., Introduction to Econometrics: Principles and Applications, CBS Publishers & Distributors, 2009.

Wooldridge, J., Introduction to Econometrics: A Modern Approach, 5th ed., Cengage Learning, 2014.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				M
CO 2				H	
CO 3	H			M	
CO 4		H	M		H
CO 5	H		H		
CO 6		H			

ENPS0054: PUBLIC ECONOMICS (4-0-0)

COURSE OUTCOMES

Define the main concepts in public economic policies. (Remembering)

Explain the concepts of public goods, public expenditures and taxation. (Understanding)

Identify the main issues of budgeting and fiscal policies. (Applying)

Evaluate economic concepts of income redistribution. (Analyzing)

Explain the evaluation of public investment projects and decision making in the public sector. (Evaluating)

Discuss their understanding of the usefulness and problems related to government subsidies and income support (Creating)

Module I: Government Activity and Public Economic Policies (15 hours)

Efficiency, Markets and Governments – Markets, Prices, Efficiency Conditions; Market failure – A Preview of the Basis for Government Activity and the Functions of the Government; Equity vs. Efficiency – Positive and Normative Analysis; Externalities and Government Policy – Market Failures, Externalities and Efficiency; Public Choice Theory – Meaning, Outcomes of Collective Choice; The Choice Process – Unanimity, Majority Rule, Cyclical Voting and the Voting Paradox, Arrow's Theorem

Module II: Theories of Public Goods, Public Expenditures and Taxation (15 hours)

The Theory of Public Goods; Provision of Private Goods and Public Goods – Markets and Government; The Demand for a Pure Public Good; Efficient Output of a Pure Public Good – Partial and General Equilibrium Analysis; Individual Action; Voluntary Cooperation and Efficiency; Local Public Goods; Voting Models of Public Goods; The Theory of Public Expenditure – Tiebout, Samuelson, Buchanan; Theories of Taxation; Tax Neutrality; Direct vs. Indirect Taxes and Equity; Buoyancy and Elasticity Estimates of Taxation; Tax Efforts; The impact of Taxes on Market Prices and Efficiency

Module III: Budgeting, Fiscal Policies and Income Redistribution (15 hours)

Program Budgeting – It's Application; Zero-Based Budgeting; Budgeting Policies; Theory of Fiscal Policy; Fiscal Policy with

Special Reference to Under-developed Countries; Federal-Fiscal Relation in India; Income Redistribution – Taxes, Government Expenditures and the Distribution of Income, Welfare, Social Security and the Social Safety Net; Demographic Changes and the

Future of Social Security; The Impact of Social Security on Savings and Work Incentives; Government Subsidies and Income Support – The Basis and Trade-off

Module IV: Public Investment Projects and the Public Sector (15 hours)

Public Utilities and Project Evaluation – Cost-Benefit Analysis; Distributional and Political Considerations; Problem of Government Failure – Privatization, Devolution, Rules vs. Discretion; Citizen Decision Making;

Public and Private Sectors – Lack of Residual Claimant, Citizens and Rational Ignorance, Collective vs. Individual Consumption, Lack of Revealed Preference; Measuring and Valuing Public/Private Output

Suggested Readings

Buiter, W.H., Principles of Budget and Fiscal Policy, MIT Press, 1990.

Browning E K & Browning J M, Public Finance and the Price System, Pearson Education, Singapore.

Hyman D N, Public Finance: A Contemporary application of Theory to Policy, Thomson South Western Jha, Raghbendra, Modern Theory of Public Finance, Wiley Eastern, Delhi, 1987.

Ulbrich, H., Public Finance in Theory and Practice, Thompson South Western.

Mukherjee, S., Ghose, A. & Nag, N. N., Analytical Public Finance. Public Economics – Public Choice - Public Policies, New Central Book Agency (P), Kolkata

Musgrave, Richard A., The Theory of Public Finance, Tata McGraw Hill, N.Y., 1959.

Ghosh A & Ghosh C, Public Finance, PHI Learning Private Limited, Delhi.

Musgrave & Musgrave., Public Finance in Theory and Practice, McGraw Hill, Singapore.

Cullis, John & Jones, Philip, Public Finance and Public Choice, McGraw Hill.

Ursula, H., Public Finance, James Nisbet and Co., London, 1968.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2		H	H	
CO3		M		M
CO4			H	
CO5			M	
CO6				H

ENDV0055: INDIAN ECONOMIC DEVELOPMENT AND POLICY (4-0-0)

COURSE OUTCOMES

Understand the recent economic reforms in Indian economy since 1991. (Remembering)

Explain the sector wise reform ranging from agriculture to service sector and foreign trade as well.

(Understanding)

Identify the main issues of reform and policy debate and its performance in Indian Economy. (Applying)

Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario.

(Analyzing)

Explain the trends and performance in service sectors. (Evaluating)

Discuss their understanding of the usefulness of various development policies. (Creating)

Module I: Economic Reforms Since 1991 (14 hours)

Indian Economy During Reforms – An Assessment; Main Aspects of New Economic Policy and its Relevance; Recent Issues of

Indian Economy – National Institution for Transforming India (NITI Aayog), Demonetization, Goods and Service Tax (GST), The Insolvency and Bankruptcy Code (IBC), Digital India, Make in India

Module II: Sectoral Development and Recent Reforms (18 hours)

Issues and Concern in Indian Agriculture – Agriculture Price Policy, Farm Law, Indian Agricultural Industry Reform; Industrial reform – MSME Development, Impact of Financial Reforms on Industrial Sector; Foreign Trade – Current Position of Balance of

Payments of India, Export-Import Policy (EXIM); Foreign Direct Investment (FDI); Service Sector – Reasons for Rapid Service

Sector Growth, Information and Communications Technology (ICT), India's Information Technology (IT) and ITES Industry

Module III: Major Issues of Indian Economy (15 hours)

Poverty, Inequality and Inclusive Growth – A Critical Assessment; Employment and Unemployment – Policy Implications; Rural

Development – Role of Cooperatives, Agriculture Diversification, Organic Farming; Sustainable Economic Development; Privatization and Disinvestment Debate; Regional Imbalances

Module IV: Performance of Indian Economy (13 hours)

Indicators of Development – Physical Quality of Life Index (PQLI), Human Development Index (HDI), Gender Development Indices

(GDI); Inequality-Adjusted Human Development Index Indicators of India's Economic Performance – Fiscal and Financial Sector

Reforms and Recent Changes in the Policy; Recent Changes in Monetary Policy in India and its Impact; Centre State Finance Relations; Finance Commission in India

Suggested Readings

Dutt Rudder & K.P.M Sunderam, Indian Economy. S Chand & Co. Ltd. New Delhi, 2017.

Mishra S.K & V.K Puri, Indian Economy and – Its Development Experience. Himalaya Publishing House, 2017.

Kaushik Basu, The Oxford Companion to Economics of India, Oxford University Press, 2007.

Kapila U, Indian economy since independence, Academic foundation, New Delhi

Government of India, Economic Survey (Annual), Economic Division, Ministry of Finance, New Delhi.

Ahluwalia, I.J. & I.M.D. Little (Eds.), India's Economic Reforms and Development

(Essays in honour of Manmohan Singh),

Oxford University Press, New Delhi, 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		M		
CO3	M		H	
CO4				H
CO5		H		H
CO6				M

ENPB0056: PUBLIC FINANCE (3-0-0)

COURSE OUTCOMES

Know about Indian tax system and its type and reforms over the years (Remembering)

Discuss the various types of grants available and the mechanism of availing those grants (understanding)

Develops analytical framework that facilitates the evaluation of public policy and subsequently inform the public debate. (Applying)

Evaluate the process of budget allocation and discuss the trend of government expenditure (Analyzing)

Examining the working of various international financial institution in the context of globalization (Evaluating)

Develop administrative skill with the knowledge of government fiscal policy (creating)

Module I: Taxation and Budget: (13 hours)

Indian Tax System; Revenue of the Union; Major Taxes in India; Base of Taxes; Direct and Indirect Taxes; Reforms in Direct and Indirect Taxes; Taxes on Goods and Services – GST; Analysis of Central and State Government Budgets; Kinds of Budget; Different Concepts of Budget Deficits; Lack of Flexibility in Central and State Budgets; Shrinking Size of Development Finance Through Budgets; Trends in Public Expenditure; Non Plan Expenditure; Growth of Subsidies Public Debt; Trends in Internal and External Debt; Crowding out of Private Investment and Activity; Devolution of Resources and Grants; Reports of Finance Commissions in India; Transfer of Resources from Centre and State to Local Bodies; Panchayati Raj Finances

Module II: Government expenditure and Theories of Public Expenditure (11 hours)

Public Policy and Expenditure Allocation of Resources; Provision of Public Goods; Voluntary Exchange Models; Demand Revealing Schemes for Public Goods; Contributions of Clarks; Groves and Leyard; Tiebout Model; Stabilization Policy; Keynesian Case for Stabilization Policy; Wagner's Law of Increasing State Activities; Wiseman-Peacock Hypothesis; Pure Theory of Public Expenditure; Structure and Growth of Public Expenditure; Criteria for Public Investment; Social Cost-benefit Analysis

Module III: Deficit Financing: Concept and its Relation with Inflation (10 hours)

Deficit Financing in India; Issues Relating to Public Debt; Debt Burden Analysis and Management of Public Debt; Domar's concept of Debt Sustainability; Public Debt in India; Need for Rule Based Fiscal Consolidation; Fiscal Responsibility and Budget Management (FRBM) Act 2003; Recent Amendments to FRBM Act

Module IV: Intergovernmental Grants in Theory and Practice (11 hours)

Growth and Decline of Federal Grants; Purposes of Grants; Correcting Spatial Externalities; Redirecting Priorities; Types of Grants – General Purpose vs. Categorical, and Project grant. Lump-sum or Matching, Open-ended vs. Close-ended, Matching Grants; Various Classification; Efficiency and Equity Effects of Grants; Indifference Analysis of Grants;

Suggested Readings

Aronson, J.R., Public finance, New York: McGraw-Hill International, 1985.

Atkinson, A.B., & Stiglitz, J.E., Lectures on public economics. New Jersey: Princeton University Press, 2007.

Basu, K., & Maertens, A., The new Oxford companion to economics in India, New York: Oxford University Press, 2012.

Bhatia, H. L., Public Finance, Vikas Publishing House Private Ltd., 2006.

Brown, C.V., & Jackson, P. M., Public Sector Economics, United Kingdom: Wiley-Blackwell, 1990.

Buchanan, J. M., & Musgrave, R. A., Public Finance and Public Choice: Two contrasting visions of the state, Cambridge, Massachusetts: MIT Press, 1990.

Cullis, J., Jones, P., & Jones, P.R., Public Finance and Public Choice: Analytical perspectives, New York: Oxford University Press, 2009.

Musgrave, R.A., & Musgrave, P.B., Public Finance in Theory and Practice, New York: McGraw Hill Book Company, 1989.

Rao, M.G., & Sen, T. K., Fiscal Federalism in India: Theory and Practice, Macmillan India, 1996.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1		M		
CO2	H			
CO3		H		
CO4			H	
CO5	H			M
CO6				H

ENRM0057: RESEARCH METHODOLOGY IN ECONOMICS (4-0-0)

COURSE OUTCOMES

Describe the different types of research and the needs of research in Economics (Remembering)

Identify the essential conditions helpful for the formulation of research hypothesis and evaluate the various tools and techniques of sampling to collect data (Understanding and Applying)

Gain knowledge of statistical software for analyzing data and assess the relative importance of various analytical tools and techniques (Analyzing and Evaluating)

Formulate logical arguments for a research problem (Creating)

Module I: Basics of Research (10 hours)

Meaning, Types, Characteristics and Scope of a Scientific Research; Steps Involved in Scientific Research; Literature Review and

Identification of a Research Gap; Formulation and Types of Hypothesis and/or Research Questions; Objectives; Research

Design; Reference and Documentation; Limitations and Ethical Issues in Research

Module II: Sample Design and Data Processing (12 hours)

Nature and Sources of Data; Types of Data – Cross Sectional, Time Series, Pooled; Accuracy of Data; Types of Sampling, Determination of Sample Size, Sampling Procedure; Choice of Sampling Technique; Errors in Sampling; Processing of Data; Validation of Field Work; Editing and Coding; Classification and Presentation

Module III: Data Analysis (15 hours)

Qualitative and Quantitative Analysis; Univariate and Multivariate Analysis; Descriptive and Inferential Analysis; Testing of Hypotheses – Single and Multiple Comparison; Non-Parametric Tests; Test for Randomness; Advanced Data Analysis Techniques; Multidimensional Scaling; Basics of Computer and its use in Research; Introduction to Different Software (Excel, SPSS, STATA, EVIEWS, etc.); Entering Data in Software; Defining and Recoding Variables; Computing new Variables; Data Analysis with Statistical Software (Use Practical Examples)

Module IV: Report Writing and Interpretation of Results (10 hours)

Types of Report; Importance of Report; Steps in Report Writing; Citation Styles; Footnotes and Bibliography; Presentation and Interpretation of Results; Research Findings and Suggested Recommendations

Module V: Statistical Software for Data Analysis (13 hours)

Basics of Computer and its use in Research; Introduction to Different Software (Excel, SPSS, STATA, EVIEWS, etc.); Entering Data in Software; Defining and Recoding Variables; Computing new Variables; Data Analysis with Statistical Software (Use Practical Examples)

Suggested Readings

Krishnaswamy, O.R., Research Methodology in Social Science, Himalaya Publishing House, Bombay, 2002.

Jerry W. Willis, Foundations of Qualitative Research: Interpretive and Critical Approaches, Sage

Tandon, B.C., Research Methodology in Social Sciences

Subramanian, N., Introduction to Computers

Bruce, B. & Howard, L., Qualitative Research Methods for the social sciences, London: Pearson, 2014.

Flick, U., An Introduction to Qualitative Research, Sage Publications, 2014.

Bryman Alan, Social Research Methods, Oxford University Press, Oxford

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		M		H	
CO3	H				H
CO4			M		

ENES0058: ENVIRONMENTAL ECONOMICS AND SUSTAINABILITY (4-0-0)

COURSE OUTCOMES

Define the basic concepts of environmental economics, including its key principles and methods.

(Remembering)

Understand the environmental issues in relation to the theory of externalities, public goods, and welfare.

(Understanding)

Apply environmental principles concerning the choice of instruments for controlling pollution and the relative strength and weaknesses of environmental policies based on command-and-control and market-based instruments. (Applying)

Analyze environmental problems using various economic techniques and to assess various environmental policies and issues. (Analysing)

Evaluate and examine the methods developed for valuing environmental goods and services for sustainable development. (Evaluating)

Develop and design various approaches to examine issues in the contemporary environmental discourse from and economists' point of view. (Creating)

Module I: Economics of Resources (12 hours)

Economics of Natural Resources; Resources and its Management; Optimal use of Renewable Resources; Common Property Resources and Open Access; Tragedy of Commons; Non-renewable Resources – Economic Issues Relating to use of Nonrenewable Resources; Optimal Depletion; Backstop; Exploration and Technological Progress

Module II: Environmental Issues and Regulation (13 hours)

Problems of Market Failure - Public Bads and Externalities; Environment Degradation as Market Failure; Externality – Environmental Damage as Negative Externality; Social Choice of Optimum Pollution; Pigouvian Tax; Coase Theorem; Property Rights; Pollution – Environmental Pollution as a Public Bad; Optimal Pollution; Pollution Control – Market Based Instruments, Emission Fees, Tradable Pollution Permits, Hybrid Instruments, Double Dividend Hypothesis; Environmental Policies in India

Module III: Valuation of Environmental Goods (15 hours)

Ordinary Goods vs. Environmental Goods; Use and Non-use Values; Willingness to Pay and Willingness to Accept; Valuation Methods for Environmental Goods; Direct Methods or Stated Preference Methods – Contingent Valuation; Indirect or Revealed Preference Methods – Hedonic Pricing Method, Travel Cost Method

Module IV: Global Environmental Concerns and Sustainable Development (20 hours)

Climate Change, Loss of Biodiversity, Ozone Depletion, Pollution Havens; Sustainable Development – Concept, Notions and Different Approaches to Sustainability; Measurement of Sustainability; Sustainable Accounting – United Nations' System of Environmental and Economy Accounting; Brundtland Commission; Sustainable Industrialization; Environmental Impact Assessment; Meaning of Resource Conservation; Material Substitution; Recycling – Optimum Recycling; Waste Management; Micro Planning for Eco-preservation – Watershed and Joint Forest Management, Wildlife Management; Role of International Organizations – IPCC, UNEP, Earth System Governance Project

Suggested Readings

Bhattacharya, Rabindra N., Environmental Economics: An Indian Perspective, New Delhi: Oxford University Press, 2002.

Hanley, N., J.F. Shogren & B. White, Environmental Economics in Theory and Practice, Macmillan, 1997.

Kolstad, Charles D., Environmental Economics, Oxford University Press, New Delhi, 1999.

Lewis, Lynne, & T. H. Tietenberg, Environmental Economics and Policy, Routledge, 2020.

Pearce, DW & R. Turner, Economics of Natural Resource Use and Environment, John Hopkins Press, Baltimore, 1991.

Seneca, Joseph J., & Michael K. Taussig, Environmental Economics, New Jersey: Prentice-Hall, 1984.

Shankar, U., Environmental Economics, Oxford University Press, New Delhi, 2001.

Tietenberg, T., Environmental Economics and Policy, Harper Collins, New York, 1994.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M			
CO 2				
CO 3	M		H	
CO 4		M		M
CO 5		H		
CO 6				H

ENEG0059: AGRICULTURE ECONOMICS – ISSUES AND MANAGEMENT (4-0-0)

COURSE OUTCOMES

Draw distinctive features of agriculture resources and production (Remembering)

Recognize and identify different market forms and role of government in agriculture credit (Understanding and analyzing)

Explain the trade-off between agriculture and non-agriculture to achieve sustainable agricultural development and in sensitizing overall development (Evaluating)

Use of economic theories in optimizing the production and distribution of agricultural products (Creating)

Module I: Agricultural Resources and Production (15 hours)

Resources in Agriculture; Land as a Resource; Land Capability; Issues in Utilization of Land; Competition for Agricultural Land; Effects of Urbanization; Land Degradation; Water as a Resource; Institutional Arrangements and Issues in Water Allocation; Managing Disasters – Drought, Flood, Famine; Production Function in Agriculture; Substitutability of Factors; Farm Size and Laws of Return

Module II: Agricultural Markets and Pricing (20 hours)

Role of Marketing in Agriculture; Scope of Agricultural Marketing; Characteristics of Agricultural Commodities; Classification of Markets; Producer's Surplus-Marketable and Marketed Surplus; Marketing Functions, Approaches to Marketing Efficiency

Estimators; Marketing Approaches; Market Structure Approaches; Problems in Agricultural Marketing; Suggestions to Improve Agricultural Marketing; Role of Government in Agricultural Marketing

Module III: Agricultural Finance (13 hours)

Function of Prices; Types of Price Instability; Measurement of Instability; Cobweb Model; Problems of Agricultural Credit in

India; Need for Agricultural Finance; Requisites of Good Credit System; Classification of Credit or Loss; Institutional Agencies in Agricultural Credit; Co-operative Movement in India; Higher Financing Agencies; Programmes of Rural Development

Module IV: Farm Management (12 hours)

Meaning and Scope; Farm Management-its Relationship with other Sciences; Farm Management Decisions; Law of Diminishing Returns; Principle of Factor and Product Substitution; Equi-marginal Returns; Principle of Comparative Advantage; Types of Farming; Farm Planning- Characteristics and Limitations; Size of Farm- Factor influencing Size of Farm; Farm Efficiency Measures- Physical Efficiency and Financially Efficiency

Suggested Readings

Acharya, S.S. & Agarwal, N.L., Agricultural Marketing in India. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd., 2012.

Johl, S.S. & Kapur, T.R., Fundamentals of Farm Business Management, Kalyani Publishers, Ludhiana, 2006.

Kahlon, A.S. & Singh, K., Managing Agricultural Finance: Theory and Practice, Allied Publisher Ltd., New Delhi, 1984.

Lekhi, R. K. & Singh, J., Agricultural Economics: An Indian Perspective, Ludhiana: Kalyani Publishers, 2015.

Penson, Capps, Rosson & Woodward, Introduction to Agricultural Economics, 7th Edition

R. S. Deshpande & Arora, S., Agrarian Crisis and Farmer Suicide, (eds.), Sage India Publications, 2010.

Reddy, S.S. & Ram, P.R., Agricultural Finance and Management, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi, 2000.

Reddy, S.S., Ram, P.R., Sastry, T.V.N, & Devi, I.B., Agricultural Economics, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India, 2015.

Soni, R., Leading Issues in Agricultural Economics, New Delhi: Vishal Publishing, 2004

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3	M			H
CO4			M	

ENED0060: ECONOMICS OF EDUCATION (4-0-0)

COURSE OUTCOMES

Know Understand the concept of welfare economics and its applicability in education sector

(Remembering)

Understand the educational financing from the point of view of Economics (Understanding)

Gain policy level understanding for improvement of health sector from economics prospective. (Applying)

Explore approaches of economic theory to health sector. (Analyzing)

The students can evaluate the investment pattern in education and also understand the direct and indirect benefits of education in development of society. (Evaluating)

Get an idea on various scopes to do research on education and health sector by applying the different economics theories. (Creating)

Module I: Economics of Education (15 hours)

Human Capital – Types, Components; Human Capital Theory; Education as an Instrument for Economic Growth; Demand for Education; Supply of Education; Determinants of Demand for Education; Costs of Education – Private Costs, Social Costs; Benefits of Education – Direct, Indirect, Social; Wastage and Stagnation in Education – Causes and Measures; Manpower Planning –Meaning, Techniques of Forecasting

Module II: Education and Budget Allocation (15 hours)

Measurement and Trends; Correlation between Alternative Measures of Wellbeing; The Concept of Knowledge Economy – The Spread of Education across the World; Budgetary Allocations across Space and Time; Institutional Design; Alternative Systems for Service Delivery; The Role of Imperfect Information, Incentives and Contracts

Module III: Education and Planning (15 hours)

Approaches to Educational Planning – Production Function Models, Manpower Requirement Approach, Input-Output Model, Gender Based Approach; Educational Planning in Developing Countries with Special Reference to India; Vocational Education in India; New Education Policy

Module IV: Discrimination and Inequality in Education (15 hours)

Models of Preference-based and Statistical Discrimination; Effective Policies to Address Historical Inequalities; Evaluating Policy Impact – The Estimation of Treatment Effects in Randomized Experiments and in Observational Data

Suggested Readings

Banerjee, A. & Somanathan, R., The Political Economy of Public Goods, 2007.

Becker G.S., Human Capital (2nd Edition), National Bureau of Economic Research, New York, 1974.

Becker, G., Investment in Human Capital: a Theoretical Analysis, The Journal of Political Economy, 70(5), 9-49, 1962.

Benabou, R., Workings of a City, Quarterly Journal of Economics, 108(3), 619-652, 1993.

Cohn E. & T. Gaske, Economics of Education, Pergamon Press, London.

Galanter, M., Competing Equalities: Law and the Backward Classes in India, University of California Press, 1984.

McMohan, W.W., Education and Development: Measuring the Social Benefits, Oxford University Press. 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3			H	
CO4		H		
CO5			H	M
CO6				H

ENHE0061: HEALTH ECONOMICS (4-0-0)

COURSE OUTCOMES

Learn the detail concepts of health economics and application of economic concept in the health sector. (Remembering)

Develop ideas and critical understanding on the health system in the context of Indian scenario. (Understanding)

Identify the demand and supply gap in healthcare system to suggest healthcare professionals and policy-makers. (Applying)

Assess the role of government in health care delivery system and identifying the scope of health financing. (Analyzing)

Evaluate the health care programmes and policy to provide decisions concerning the allocation of resources. (Evaluating)

Develop or build economic perspective for research problem in health sector. (Creating)

Module I: Basics of Health Economics (18 hours)

Concepts, Definition of Health Economics; Measures of Health Status; Topics in Health Economic Theory – Production Function of Health, Grossman's Model of Demand for Health; Supply-side Health Economics; Theory of Health Behavior; Market of Health Insurance

Module II: Economic Evaluation in Healthcare (18 hours)

Economic Evaluation in Healthcare – Concepts, Importance; Types of Economic Evaluation in Healthcare – Cost Minimization

Analysis, Cost Effectiveness Analysis, Cost Benefit Analysis, Cost Utility Analysis; Health Technology Assessment – Basic Concept, Importance of HTA in Health Economics

Module III: Public Policy on Health (12 hours)

Public Policy in Health Care Delivery – Role of State, Rationale for Government Intervention in the Health Sector – Public and Private sector; Health Financing; Concept and Calculating Methods of HALE, QALYs and DALYs

Module IV: Health Sector in India (12 hours)

Overview of Health Care in India; Health System of India – Post Reform Scenario; Health Outcomes; Socio-economic

Determinants of Health; Different Dimension of Health - Poverty, Malnutrition, Gender Perspectives in Indian context

Suggested Readings

Henderson, J. W., Health Economics & Policy, (3e), Thomson South-Western, Latest Edition, 2007.

David Wonderling, Reinhold Gruen & Nick Black, Introduction to Health Economics, Open University Press, 2005.

Sherman Folland, Allen Goodman & Miron Stano, Economics of Health and Health Care, Routledge, 8th edition, 2017 4. Jack, W., Principles of Health Economics for Developing Countries, Washington, D.C.: The International Bank for Reconstruction and Development/The World Bank, 1999.

World Health Organisation, The economics of the social determinants of health and health inequalities: A resource book. World Health Organisation, 2013.

Stephen Morris, Nancy Devlin, David Parkin & Anne Spencer, Economic Analysis in Healthcare, 2nd Edition, Wiley, 2012.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M			
CO3		M	H	
CO4				H
CO5		H		H
CO6			M	

ENEI0062: ECONOMICS OF INDUSTRY (4-0-0)**COURSE OUTCOMES**

Recall the concepts of micro economics concepts of price, market type, business motives (Remembering)

Understand basic models of the behaviour of firms and industrial organization and how they can be applied to policy issues (Understanding)

Assess economic situations – particularly those determining the relationships among firms within an industry and the strategies that each firm can adopt –, relate them to concrete problems and provide policy recommendations. (Applying)

Understand the minimal cost input factor quantities for a firm and optimal selling prices, supply quantities and resulting profits of firms in different market structures (Analyzing)

Discuss the need of competitive environment and the degree competition for a healthy functioning of a market. (Evaluating)

Develop the ability to calculate market concentration with different index and understand the relation between competition level and market concentration. (Creating)

Module I: Exploring the Subject Matter of Industrial Economics (15 hours)

Meaning, Scope, Need and Significance of the Study of Industrial Economics; Types and Choice of form of Organization;

Business Motives – Alternatives Types of Motives/Goals; Industrial Profile – Private Sector, Large, Medium and Small Scale

Industries; Integration; Industrial Combinations – Causes, Mergers and Amalgamations, Diversification

Module II: Theories of Industrial Location (15 hours)

Approaches to Industrial Location Analysis – Alfred Weber's Theory, Serfant Florence's Theory, Market Area Theory, Central Place Theory of Losch; Industrial Imbalances – Causes and Remedies; Government Policy and Approach for Backward Regions in India

Module III: Industrial Efficiency, Productivity and Pricing (15 hours)

Economic Efficiency – Meaning; Factors Determining Efficiency; Productivity – Norms and Measurement; The Competitive Environment; Market Concentration – Meaning and Measurement; Pricing in Practice – Cost-plus Pricing, Variable Cost Pricing, Target Rate of Return Pricing, The Going Rate Pricing, Transfer Pricing

Module IV: Indian Industrial Growth and Finance (15 hours)

Industrial Policy in India- Role of Public and Private Sectors; Trends in Indian Industrial Growth after 1991 Industrial Policy; Role of MSME in India; Sources of Industrial Finance – GDR, ADR; Disinvestment as a Sources of Finance; Choice of Funding – External vs. Internal Sources, Financial Statements – Balance Sheet; Profit and Loss Account; Analysis of Financial Ratios; Project Appraisal and Capital Budgeting

Suggested Readings

Barthwal, R.R., Industrial Economics, Wiley Eastern limited, New Delhi, 1985.

Cherunilam, F. Industrial Economics: Indian Perspective (3rd Edition), Himalaya Publishing House, Mumbai, 1994.

Desai, B., Industrial Economy of India, Himalaya Publishing House, Mumbai, 1999.

Divine, P.J. & R.M. Jones et. al., An Introduction to Industrial Economics, George Allen and Unwin Ltd., London, 1976.

Government of India, Economic Survey (Annual).

Hay, D.A. & Morris D.J., Industrial Economics: Theory and Evidence, Oxford University Press, New Delhi, 1979. 7. Mishra & Puri (latest edition), Indian economy, Himalaya publisher

Seth R., Industrial Economics, Ane Books Pvt Ltd.

Singh, A & A.N. Sandhu, Industrial Economics, Himalaya Publishing House, Mumbai, 1988.

Sivaya, K.V. & Das, V.B.M., Indian industrial economy, Sultan Chand, Latest edition.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2	H	M		
CO3			H	
CO4		H		
CO5			M	H
CO6				H

ENIN0063: INTERNATIONAL ECONOMICS (4-0-0)

COURSE OUTCOMES

Define and illustrate the key concepts, principles, models and practical applications of international economics including international trade and international finance. (Remembering & Understanding)

Apply the theories and models of international trade for economic growth and global welfare and critically comment on international economic policy. (Applying)

Analyse the links between trade, international finance, economic growth and globalization, with a particular emphasis on the experiences of developing countries. (Analysing)

Evaluate international trade policies regarding increase in exports, international debt, and international institutions to solve domestic problems like inflation, unemployment and value of currency etc. (Evaluating & Creating)

Module I: International Trade Theory (18 hours)

The Law of Comparative Advantage; Production Frontier with Increasing Costs; Gains from Trade with Increasing Costs; Offer Curves; Terms of Trade; Factor Endowments and the Heckscher-Ohlin Theory; Economies of Scale, Imperfect Competition and International Trade; Stolper-Samuelson Theorem; Specific Factors Model, Leontief Paradox; Technological Gap Model; Product Cycle Theory; The Gravity Model

Module II: International Trade Policy (12 hours)

Trade Restrictions – Tariffs, Partial and General Equilibrium Analysis of a Tariff, Optimum Tariff, Tariff structure; Nontariff Trade Barriers and the New Protectionism; Economic Integrations – Free Trade Areas, Customs Unions, Common Markets, Optimum

Currency Area, Economic Union, Political Union; Dumping; Retaliation Against Dumping; International Cartels

Module III: Balance of Payments and Foreign Exchange Markets (10 hours)

Balance of Payments – Current and Capital Account; Foreign Exchange Markets – Types and Functions; Exchange Rates – Absolute and Relative Purchasing Power Parity Theory, Exchange Rate and the Balance of Payments, Portfolio Balance Model and Exchange Rates, Exchange Rate Dynamics; Spot and Forward Rates, Currency Swaps, Futures, and Options; Foreign Exchange Risks – Hedging, Speculation, Interest Arbitrage

Module IV: International Exchange Rate Determination (10 hours)

Exchange Rate Determination – Absolute Purchasing Power Parity Theory, Relative Purchasing-Power Parity Theory; Monetary

Approach to Balance of Payments and Exchange Rate – Fixed Exchange Rates, Flexible Exchange Rates;

Module V: International Resources Movements and Managements (10 hours)

International Capital Flows - Foreign Portfolio Investment (FPI), Foreign direct investment (FDI); Its determinants and benefits; International Labor Migration – Motives, Welfare Effects; International Monetary System – Classic Gold Standard, Bretton Woods System, WTO and International Trade; International Debt Crisis; Recycling of Petro-Dollars; Causes of Debt Crisis; Secondary Market for Debt of Developing Countries

Suggested Readings

Bhagwati, Jagdish N., International Trade: Selected Readings, Cambridge, Mass: MIT Press, 1987.

Chacholiades, M., International Trade: Theory and Policy, McGraw Hill, 1988.

Cherunilam, F., International Economics, McGraw Hill India, 5th Edition, 2008.

Kindleberger, C.P., International Economics, R.D. Irwin, Homewood, 1963.

Krugman, Paul R., & Maurice Obstfeld, International Economics. Harlow: Pearson Education, 2011.

Mannur, H.G., International Economics, Vikas Publishing, New Delhi, 2010.

Reinert, Kenneth A., An introduction to international economics: new perspectives on the world economy, Cambridge University Press, 2020.

Salvatore, D., International Economics, Wiley, 11th Edition, 2013.

Sodersten, Bo, & Geoffrey Reed, International Economics. Basingstoke: Macmillan, 2004.

Sodersten, International Economics, Basingstoke: Palgrave Macmillan Limited, 1999.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	M				
CO 2		M		M	
CO 3	M		H		M

CO 4		H		H	
CO 5					H
CO 6				H	

ENPE0064: POPULATION ECONOMICS (4-0-0)**COURSE OUTCOMES**

Highlight various policies on population control measures (Remembering)

Develop the knowledge of the different models, theories about the relationship between population growth and development (Understanding)

Develop the ability to relate the changes in social and political economy due to demographical changes. (Applying)

By the end of the course the students are expected to learn the two important concepts of Fertility and Mortality and relate the factors for change in population in a particular region. It gives an idea about calculation of different rates of fertility and mortality. (Analyzing)

The students will be in a position to narrate the international and internal migration of India. Identify the factors responsible for internal and international Migration. (Evaluating)

Discuss the models of population projection and help in focusing the future policy measures (Creating)

Module I: Population and Development (15 hours)

Demography –Meaning and Scope; Evolution of Population Policy in India – The Shift in Policy from Population Control to

Family Welfare, to Women Empowerment; Family Planning Strategies and their Outcomes; Measures of Population Change; Population Structure; Population Distribution; Theories of Population – Malthus, Optimum Theory of Population; Theory of

Demographic Transition – Views of Meadows, Enke and Simon; Population and Development – Demographic Dividend

Module II: Distributional Pattern of Population (15 hours)

Population Trends in the Twentieth Century; Population Explosion and its Dynamics; Pattern of Age and Sex Structure in

Developed and Less Developed Countries; Determinants of Age and Sex Structure; Demographic Effects of Sex and Age Structure; Economic and Social Implications; Age Pyramids Projections

Module III: Fertility, Nuptiality and Mortality (15 hours)

Fertility – Emerging Issues in Fertility Control; Fertility Analysis; Social Structure and Fertility Change; Nuptiality Concept and Analysis of Marital Status – Single Mean Age at Marriage, Synthetic Cohort Methods, Trends in Age at Marriage; Mortality – Death Rates, Crude Age-specific; Mortality at Birth and Infant Mortality Rate; Sex and Age Pattern of Mortality; Levels and Trends of Mortality rate in Developed and Less Developed Countries; Life Table Construction and Uses; Concepts of Stable Population; Methods of Population Projection

Module IV: Migration and Urbanization (15 hours)

Internal and International Migration Flows; Internal Migration its Effect on Population Growth and Pattern; Factors Affecting Migration; Theories of Migration Related to Internal Migration; International Migration Flows; Dynamics of the International Migration Process; Urbanization Growth and Distribution of Rural-urban Population in Developed and Developing Countries; Population Growth, Employment and Housing in Mega Cities in Developing Countries; Gravity Model

Suggested Readings

Amsden, A.H., The Economics of Women and Work, Penguin, Harmondsworth, 1980.

- Baud, I.S.A., Form of Production and Women's Labour, Gender Aspects of Industrialization in India and Mexico, Sage, N.D. 1992,
- Bhole, L.M. Financial Institutions and Markets, Tata Mcgraw Hill, 2016.
- Bogue, D.J., Principles of Demography, John Wiley, NY, 1971.
- Boserup, E. Women's Role in Economic Development, George Allen and Unwin, London, 1970.
- Chenery, H. & N. Srinivasan (eds.), Handbook of Development Economics, Vol. I & II, Elsevier, Amsterdam, 1989.
- Chiang, C.L., Life Tables and Mortality Analysis, W.H.O., Geneva, 1974.
- Coale, A.J. & E.M. Hoover, Population Growth and Economic Development in Low Income Countries: A Case Study of India's Prospects, Princeton University Press, Princeton, 1958.
- John, R. W., Population: An Introduction to Concepts and Issues, (7th ed.), New York: Wadsworth Publishing Company, 2002.
- King, M. & M.A. Hill (eds.), Women's Education in Developing Countries: Barriers, Benefits and Politics, John Hopkins, Baltimore, 1993.
- Shryock, H. S. et. al., The Methods and Materials of Demography, New York: Academic Press, 1976.
- Srinivasan, K., Basic Demographic Techniques and Applications, New Delhi: Sage Publications, 1998.
- Thompson, W. S. & Lewis, D. T., Population Problems, New Delhi: Tata McGraw Hills Publishing Co., 1976.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		H		
CO3	H			
CO4		M		M
CO5			H	L
CO6				H

ENOR0065: OPERATIONS RESEARCH (4-0-0)

COURSE OUTCOMES

Familiar with basic ideas, characteristics and different phases of Operations Research (Remembering)
 Describe the basic concepts of convex sets and linear programming method (Understanding)
 Identify situations where linear and non-linear programming problem can be applied (Applying)
 Perform sensitivity analysis to assess the magnitude of change of a linear programming (Analysing)
 Develop strong analytical skills and logical argument to work on with complex issues (Evaluating)
 Formulate linear programming model of a real-world problem and demonstrate the solution process (Creating)

Module I: Basics of Operations Research (10 hours)

Meaning and Definition; Phases of an Operations Research Study; Importance and Scope; Limitations of Operations Research; Operations Research in Decision Making; Application of Operations research

Module II: Assignment and Transportation Problems (15 hours)

Assignment Problem – Concept, Nature, General Formulation; Solution of Assignment Problems – Hungarian Method; Transportation Problem – Concept, Nature, General Formulation; Solution of Transportation Problems – North West Corner Method; Dual Transportation Model; Difference between Transportation and Assignment Problem

Module III: Network Analysis (15 hours)

Basic Concepts; Classic and Modern Network Models – PERT and CPM; Drawing of Network Activity; Critical Path; Determination of Floats – Total Float, Free Float and Independent Float; Social Networking Problems; Pivotal Agents in Social Networks

Module IV: Linear Integer Programming and Models of Inventory (20 hours)

Modeling with Integer Variables; Canonical and Standard forms; Branch and Bound Methods; Applications – Production Planning, Scheduling; Algorithms for Integer Optimization – Cutting Plane Methods, Approximation Algorithms; Problem of the Economic Order Quantity; Problem with Price Breaks; Static Multi-commodity Model with Limited Capacity of the Stock; Dynamic Problems – Basic Concepts

Suggested Readings

A. Ravindran, D. T. Phillips & James J. Solberg, Operations Research- Principles and Practice, John Wiley & Sons, 2005.

A.M. Natarajan, P. Balasubramani & A. Tamilarasi, Operations Research, Pearson

Avriel, Mordecai, Nonlinear Programming: Analysis and Methods, Dover Publishing, 2003.

Bazaraa, Mokhtar S. & Shetty, C. M., Nonlinear programming. Theory and algorithms, John Wiley & Sons, 1979.

F.S. Hillier & G.J. Lieberman, Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill, 2010.

J. K. Sharma, Operations Research Theory and Applications, Macmillan

Martin J. Osborne, An Introduction to Game Theory, Oxford University Press

Ravindran, A., Phillips, D. T., & Solberg, J. J., Operations Research- Principles and Practice (2nd Ed.). New Delhi: Wiley India, 2007.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2		M		
CO3	M		H	
CO4		H		M
CO5			M	
CO6			H	M

ENGE0066: GENDER ECONOMICS (4-0-0)

COURSE OUTCOMES

Relate the demography concepts to understand the demography of female population (Remembering)

Articulate connections between global, regional and local issues and their relation to women's experiences and to human rights. (Understanding)

Examine the various gender indices to understand the framework of policy relating to gender issues. (Applying)

Explore the factors responsible for gender discrimination in India (Analyzing)

Evaluate the role of technology and institutions in addressing the problem of gender inequalities. (Evaluating)

Analyze interconnection between good governance, gender budgeting, Democratic decentralization and women empowerment. (Creating)

Module I: Concept and Importance of Gender Economics (15 hours)

Importance of Gender Economics; Women in Patriarchal and Matriarchal Societies and Structures; Gender Bias in the Theories of Values; Distribution and Population; Demography of Female Population; Causes of

Declining Sex Ratios and Fertility Rates in LDCs and Particularly India; Women and their Access to Nutrition, Health, Education and Community Resources and their Impact in Female Mortality and Fertility; Gender Planning Frameworks and Tools; Gender Inequality Indices – GII, MPI, WEIA, SIGI, GDI, GEM; Gender Inequalities in India; Gender and National Planning; Theories of Gender Inequality

Module II: Decision Making, Economic Activity and Women (15 hours)

Factors Affecting Decision Making by Women; Property Rights; Access to and Control Over Economic Resources and Assets; Power of Decision Making at Household, Class, Community Level; Economic Status of Women and its Effect in WPR, Income Level, Health and Education in Developing Countries; Concept and Analysis of Women's Work – Visible and Invisible Work, Economically and Socially Productive Work; Female Contribution to National Income

Module III: Labour Market, Technology, Environment and Women (15 hours)

Factors Affecting Female Entry in Labour Market; Supply and Demand for Female Labour in Developed and Developing Countries; Studies of Female work Participation in Agricultural and Non-agricultural Rural Activities; Wage Differentials in Female Activities; Determinants of Wage Differentials – Gender, Education, Skill, Productivity, Efficiency, Opportunity; Structure of Wage Across Regions and Economic Sectors; Impact of Technological Development and Modernization on Women's Work Participation; Women and Environment – Female Activities and Environmental Concerns; International Agreements

Module IV: Social Security, Gender Planning and Development Policies (15 hours)

Effectiveness of Collective Bargaining; Review of Legislation for Women's Entitlement Protection of Property Rights; Schemes for Safety net for Women; Need for Female Labour Unions; Affirmative Action for Women and Improvement in their Economic and Social Status; Gender Mainstreaming in Development Policies; Gender Sensitive Governance – Gender Budgeting, Democratic Decentralization (Panchayats) and Women's Empowerment in India; The Kudumbashree Experience in Kerala, A comparative assessment on Gender policies between developed and developing countries (with special reference to Asian countries); Gender and technology based education institution in development and developing countries.

Suggested Readings

Agarwal, Bina, A Field of One's Own: Gender and Land Rights in South Asia, Cambridge; Press, Cambridge, 1994.

Amsden, A.H., The Economics of Women and Work, Penguin, Harmondsworth, 1980.

Beneria, L. & M. Roldan, The Crossroads of Class and Gender, University of Chicago Press, Chicago, 1987.

Beneria, Lourdes, GunseliBerik, and Maria Floro, Gender, Development and Globalization: Economics as if all People Mattered, Second Edition, Routledge, London, 2015.

Bonnie G Smith, Women's Studies: The Basics, Routledge, London, 2013.

Borerup, E., Women's Role in Economic Development, George Allen and Unwin, London, 1970.

Government of India, Towards Equality - Report of the Committee on the Status of Women in India, Department of Social Welfare, Ministry of Education and Social Welfare, New Delhi, 1974.

Government of India, Shram Shakthi, Report of the National Commission on Self employed Women and Women works in the Informal Sector, Ministry of Human Resource Development, New Delhi, 1987.

Irene Tinker, Persistent Inequalities: Women and world development, New York: Oxford University Press, 1990.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	M			
CO2	H			
CO3				H
CO4		H		

CO5		L	H	
CO6				H

ENFE0067: FINANCIAL ECONOMICS (4-0-0)**COURSE OUTCOMES**

Learn the key concepts of financial economics. (Remembering)

Understand the fundamental concept and application of financial field. (Understanding)

Identifying the current financial issues and problems to provide better decision-making to investors. (Applying)

Illustrate the trading in the stocks market and analyze the complexities of the derivative market. (Analyzing)

Evaluate the financial policy and programme to provide financial advice to policymakers. (Evaluating)

Use of financial economics concept in solving real life problems.(Creating)

Module I: Investment Theory and Portfolio Analysis (18 hours)

Overview of Investment Evaluation Methods and Evaluation Criteria; Fixed-income Securities; Bond Prices; Spot Prices; Discount Factors; Arbitrage; Yield-to-maturity; Price Sensitivity; Interest Rate Sensitivity and Duration; The Term Structure of Interest Rates; Yield Curves; Spot Rates and Forward Rates; Portfolios of Assets – Measurement of Return and Risk; Effects of Diversification; Optimal Portfolio Choice; Mean-variance Frontier of Risky and Risk-free Asset; Portfolio Weights

Module II: Options and Derivatives (15 hours)

Options and other Derivatives – Concepts, Definitions; Interest Rate Futures; Futures and Hedging; Hedging Strategies; Option Markets – Call and Put Options; Bounds for Option Prices; Put-call Parity; Option Pricing Formula – Binomial Approach; Factors

Affecting Option Prices; Option Trading Strategies; Option to Expand; Valuation of Real Option; Pricing of other Derivatives; Numerical Problems for Derivative Pricing

Module III: Corporate Finance (12 hours)

Types of Corporate Financing – Owner's Funds, Debt Funds; Strategy of Corporate Financing and Corporate Value; The role of

Capital Market in Explaining Corporate Performance; Portfolio for Corporate Bonds; Corporate Debt and Dividend Policy, The Modigliani-Miller Theorem; Capital Asset Pricing Model and its Use in Corporate Finance

Module IV: Valuation of Financial Assets (15 hours)

Concept of Value; The Time Value of Money and Asset Pricing – The Valuation of Debt Instruments; The Equilibrium Price and Quantity of Bonds – Loanable Fund Approach, Demand and Supply Approach; Valuing Stock and other Assets – Income Stocks and Growth Stocks; Equilibrium Price and Value of Stock Transactions

Suggested Readings

David G. Luenberger, Investment Science, Indian Edition, 2012.

Basu, Sankarshan, Hull, John C., Options Futures and Other Derivatives, Pearson Education, Inc, 8th Edition, 2013. 3. Brealey, Richard A., Myers, Stewart, C., Allen, Franklin, & Mohanty Pitabas, Principles of Corporate Finance, Tata McGraw- Hill Education, 10th Edition, 2013.

William Sharpe, Gordon Alexander & Jeffery Bailey, Investments, Prentice Hall of India, 6th Edition, 2003. Stephen A. Ross, Randolph W. Westerfield & Bradford D. Jordan, Fundamentals of Corporate Finance, McGraw-Hill, 7th Edition, 2005.

Thomas E. Copeland, J. Fred Weston & Kuldeep Shastri, Financial Theory and Corporate Policy, Prentice Hall, 4th Edition, 2003.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H			
CO2	M	H		
CO3			H	
CO4		H		M
CO5			M	
CO6				H

ENLE0069: LABOUR ECONOMICS (4-0-0)**COURSE OUTCOMES**

Define and relate the main concepts of labour economics. (Remembering & Understanding)

Identify the main issues of wage determination. (Applying)

Analyse the theoretical issues in labour economics. (Analyzing)

Explain the practical applicability of theories related to labour productivity and labour mobility and appraise the key issues of Indian labour market to solve the problems in labour market. (Evaluating & Creating)

Module I: Introduction to Labour Economics (10 Hours)

Concept, Nature and Scope of Labour Economics; Labour Market – Concept, Labour Supply, Labour Demand; Measuring the Labour Force, Workers Preferences, Time and Budget Constraints, Hours of Work Decision; Production Function; Imperfections in the Labour Market.

Module II: Theories of Wage Determination (15 hours)

Theories of Wage – Classical, Neo-classical, Modern; Employment Decision in the Short Run and Long Run; Long Run Demand for Labour; Labour Market Equilibrium – Equilibrium in a Single Competitive Labour Market, Competitive Equilibrium Across Labour Markets, Non-competitive Labour Markets; Wage Determination in Organized and Unorganized Sector; Human Capital Theory of Wage

Module III: Wage Differentials, Labour Efficiency and Discrimination (15 Hours)

Homogenous Workers and Jobs; Heterogeneous Workers and Jobs; The Hedonic Wage Function; Alternative Pay Schemes and Labour Efficiency; Theory of Optimal Fringe Benefits; Labour Efficiency – Education in the Labour Market, Schooling Model; Efficiency Wage Models; Segmentation and Discrimination in Labour Market – Race and Gender in the Labour Market, The Crowding Model, Employer and Employee Discrimination; Measuring Discrimination – The Oaxaca Decomposition; Relation between Wage and Employment; Impact of Trade Union and Collective Bargaining on Employers

Module IV: Labour Productivity, Unemployment and Migration (10 Hours)

Labour Productivity – Concept, Measurement; Wages, Prices and Employment; Unemployment – Frictional, Structural, Demand-deficient Unemployment; Measurement of Unemployment – The Stock-Flow Model; Reducing Unemployment – Public Policies; Labour Mobility; Migration as an Investment in Human Capital; Determinants of Migration; Consequences of Migration; The Economic Benefits of Immigration

Module V: Issues in Indian Labour Market (10 Hours)

Features of Indian Labour Market – Size and Composition in the Organized and Unorganized Labour Market; Major issues in the Indian Labour Market; Labour Productivity in India; Labour Turnover and Absenteeism in India; Women and Child Labour in India; Agricultural and Rural Labour; Labour Market Institutions of Minimum Wage; Employment and Wage Policy in India; Informal Labour and Social Security Measures; Globalization and Labour Market; Labour Statistics in India

Suggested Readings

Ashenfelter, Orley & Richard Layard, The Handbook of labour Economics. Vol. 1 and 2, New York: North-Holland, 1986, Vol. 3A, 3B and 3C, 1999.

Butler, A.D., Labor Economics and Institutions, American Publishing Company, ND, 1972.

Datt, G., Bargaining Power, Wages and Employment: An Analysis of Agricultural Labour Market in India. George J. Borjas, Labour Economics, McGrawhill, New York, 2000.

Government of India, Reports on The National Commission on Labour.

Marshall, F.R., V.M. Briggs, & A.G. King, Labour Economics, Richard D. Irwin Inc., Homewood, Illinois, 1984.

McConnell, C.R., S.L. Brue & D.A. Macpherson, Contemporary Labour Economics, McGraw Hill, NY, 2009.

Michael Hopkins, Labour market planning revisited, Palgrave Macmillan, 2002.

Rees, A., Economics of Work and Pay, Harper and Row, NY, 1973.

ENBE0070: BEHAVIOURAL ECONOMICS (4-0-0)

COURSE OUTCOMES

Learn the principles and methods of Behavioural Economics (Remembering)

Identify the systematic departures of economic behaviour from the prediction of the neoclassical model (Understanding)

Get the idea of how behavioural principles have been applied to economic problems (Applying)

Understand the principles behind the behavioural approach for the development of analytical tools in Economics (Analysing)

Incorporate psychologically motivated assumptions into economic models (Evaluating)

Interpret how behavioural models change the predictions for equilibrium behaviour and their implications for optimal policy (Creating)

Module I: Introduction to Behavioural Economics (10 hours)

Behavioural Economics Meaning, Definitions; Behavioural Economics and the Standard Economic Models; Scope and Methodology of Behavioural Economics; Applications

Module II: Decision-making under Risk and Uncertainty (13 hours)

Preferences and Choice; Anomalies in Expected utility Theory; Alternatives to Expected Utility Theory – Disappointment,

Decision-Weighting, Rank-dependent Utility; Role of Reference; Dependent Preference in Risky and Risk Free Choices

Module III: Intertemporal Decision-making (13 hours)

Discounted Utility Model; Alternative Choice Models – Time Preferences, Time Inconsistent Preferences; Utility and Consumption Independence; Independence of Discounting from Consumption

Module IV: Behavioural Game Theory (13 hours)

Nature and Equilibrium of Behavioural Game Theory; Mixed Strategies and Iterated Games; Modelling of Social Preferences; Inequality Aversion Model; Reciprocity Model

Module V: Basic Behavioural Macroeconomics (11 hours)

Neo-Keynesian Rational Expectation Model; Rational Expectation and Attainment of Business Cycle and Labour Market

Equilibrium; Determination of Asset Price; Stability Analysis of Macroeconomic Models

Suggested Readings

Peter Diamond & Hannu Vartiainen, Introduction to Behavioural Economics and Its Applications, Princeton University Press, 2012.

BD Bernheim, S Della Vigna & D Laibson, Handbook of Behavioural Economics-Foundations and Applications - North Holland, 2019.

Sanjit Dhami, The foundations of Behavioural Economics, Oxford, 2020.

N. Wilkinson & M. Klaes, An Introduction to Behavioral Economics, Palgrave Macmillan, 2012.

Paul De Grauwe & Yeumei Ji, Behavioural Macro Economics -Theory and Policy, Oxford University Press, 2019.

G. Akerlof, Behavioural Macroeconomics and Macroeconomic Behaviour, Nobel Prize Lecture, 2001.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO1	H				
CO2		M			
CO3			M		H
CO4	M			H	
CO5				H	
CO6			H		H

ENNE0071: ECONOMY OF NORTH EASTERN REGION (4-0-0)

Course Objectives:

This course is designed to expose the students to the overview of North East Economy. It explains the trend and performance of agriculture, industry and service sector in the context of North East scenario. It also includes the evaluation of various developmental policies for structural transformation of the region.

Course/Learning Outcomes

At the end of the course the students would be able to:

Define and understanding of macroeconomics policies and their impact of North East Economy.

(Remembering)

Explain the policies and Performance in Agriculture. (Understanding)

Identify the policies and performance in Industry. (Applying)

Evaluate the impact of various development policies in Agriculture and Industry in the Indian Scenario. (Analyzing)

Explain the trends and performance in service sectors and the scope of growth of enterprises in the North Eastern region and the role of various policies in it. (Evaluating)

Discuss the usefulness of various development policies and the different development initiatives in the North Eastern region along with some of the reasons for its failure. (Creating)

Module I: Overview and Characteristics of North East Economy (20 hours)

North Eastern Region as an economy; Characteristics of the economy; Trend and Pattern of GDP growth in NER; Demographic features of the NE economy; Poverty and Inequality in NER comparison with the Indian economy; Trends of Employment and Unemployment; Recent developments in human resource.

Module II: Agriculture in North East Economy (15 hours)

Agriculture: features and challenges; Growth of Agricultural Sector in NE; Agricultural Finances-Sources and Limitations; Agricultural Policies of NE States; Agriculture-Industry linkage especially in NER, Problems of Agricultural Marketing in NE.

Module III: Industry and Service Sectors in North East Economy (20 hours)

Industry: growth, composition and challenges, Growth of Micro Small and Medium Enterprises (MSME); North East Industrial and Investment Promotion Policy (NEIIPP) 2007 & 2015; Services sector; Trends,

growth and challenges; Rural economy, Diversification of rural employment; Infrastructure and regional economic development, Nature and characteristics of Public finance for NER trends and challenges.

Module IV: Structural Transformation and Institutions in North East (20 hours)

Institutions and economic Development; Governance and development-government failure and its correction; Local selfgovernment and development; Community participation and development, community failure; Role of DONER and NEC; New development initiatives in NER, Vision Document 2020 and Act East Policy

Suggested Readings:

Banerjee and Kar (1999): Economic Planning and Development of North-Eastern States, Kanishka, ND.
 Deb, B.J & B. Dutta Ray (2006): Changing Agricultural Scenario in North-East India, Concept Publication, New Delhi
 Dikshit, K. R and J K Dikshit (Eds.) (2014): North East India Land People and Economy, Springer
 Maithani, B.P. (1997): Local Self-Government in North-East India: An Appraisal, NIRD, Hyderabad
 Menon, S. (Ed.) (2007): India's North East Economy-Problems and Prospects, ICFAI Univ. Press, Hyd.
 Mishra, B. (2006): Fiscal Policy in North-East India, Akansha Publishing House, ND.
 Nayak. P. (Ed.) (2010): Growth and Human Development in North- East India, Oxford University Press.
 RBI (2006): Report of the Committee on Financial Sector Plan for North Eastern Region, RBI.
 World Bank (2007): Development and Growth in Northeast India The Natural Resources, Water, and Environment Nexus

ENDI6003: DISSERTATION PHASE-I (2-0-0)

Course Description:

The MA students would be required to do project work and submit dissertation. The project work is to be related to the specialization area chosen by the student. Dissertation submitted by the students would be evaluated by External Examiners appointed by the University. The work for the MA dissertation is spread over Semester III and Semester IV as Dissertation Phase-I and Dissertation Phase-II respectively. The total dissertation grades are distributed between the two semesters i.e. 2 credits in Semester III and 4 credits in Semester IV equaling 6 credits in total.

Course Objectives:

The aim of the course is to equip the students with presentation skills and develop academic writing skill. Moreover, the students will also be able to apply the statistical research training acquired in the taught element of the program by designing an appropriate research strategy and research methodology to carry out the research.

The Structure of the Course:

In Dissertation Phase-I, the students have to independently think of a research idea and, by the end of the semester, has to defend a research proposal based on the idea i.e. need to present the Synopsis by the end of the third semester. The total credit in Dissertation Phase-I equals to 2 credits.

Structure of Dissertation Phase-I

Sl. No.	Tentative Stages to be completed	Tentative Duration
1.	Research idea or concept note, i.e., Statement of the Problem	First month
2.	Review of Literature	Second month
3.	Research Methodology Sampling, Sample size determination, Selection of sample, Analytical tools to be used, Questionnaire preparation, Preliminary exploration of data i.e.	Third month and Fourth month (3/4 common classes)

	Pilot Survey	
4.	Synopsis Presentation Submission of Modified Synopsis to the Head of the Department	Before the commencement of the end semester examination (date will be notified later) Evaluation by the end of Third Semester (Based on Synopsis)
5.	Students have to collect all the required data during the semester break (between 3 rd and 4 th semester)	

ENDI6004: DISSERTATION PHASE-II (4-0-0)

Course Descriptions:

The MA students would be required to do project work and submit dissertation. The project work is to be related to the specialization area chosen by the student. Dissertation submitted by the students would be evaluated by External Examiners appointed by the University. The work for the MA dissertation is spread over Semester III and Semester IV as Dissertation Phase-I and Dissertation Phase-II respectively. The total dissertation grades are distributed between the two semesters i.e. 2 credits in Semester III and 4 credits in Semester IV equalling 6 credits in total.

Course Objectives:

The aim of the course is to fine-tune the dissertation he/she working in the Phase-I and during the work, the students will also learn how to apply the statistical and econometric tools in their own research.

The Structure of the Course:

In Dissertation Phase-II, the student has to carry out data analysis and write the dissertation and defend it by the end of the fourth semester. The dissertation will include original research question(s) if any, critical review of the relevant literature, analytical tools employed in response to the research questions, data analysis and interpretation. Finally, the students need to submit the dissertation to the university authority maintaining all instructions provided by the university. Under the process, the students will be guided by an assigned supervisor of the department to do the work. The total credit in Dissertation Phase-II equals to 4 credits.

Structure of Dissertation Phase-II

Sl. No.	Tentative Stages to be completed	Tentative Duration
1.	Validation of data, data entry and preliminary analysis of data (drawing graphs, trend lines, etc.)	First month
2.	Main data analysis	Second month
3.	Dissertation writing and Proof reading	Third and fourth month
4.	Submission and Viva Voce	Evaluation by the end of Fourth Semester

DEPARTMENT OF EDUCATION

VISION:

To build a pool of intellectually competent educational leaders and teacher educators leading on the process of education in general and teacher education in particular which nurtures individual autonomy and social development by ensuring quality with peace across the globe

MISSION:

The Mission of the Department is to facilitate the expression of leaders hidden within the students, developing sound cognitive, affective and psychomotor abilities and making them a sound citizen of the country and world as a whole.

PROGRAM OUTCOMES - MA EDUCATION

PO 1: **Critical Thinking:** To inculcate critical thinking among the students.

PO 2: **Effective Communications:** To generate an ability among the students to communicate their thoughts and ideas from one end to another clearly for making others comfortable in understanding.

PO 3: **Scientific Temper:** To inculcate scientific temper among the students to be judicious and logical in their thinking and presentation.

PO 4: **Effective Citizenship:** To enable the students to possess the qualities of a good citizen and prove to be a productive member of the society.

PO 5: **Ethics:** To create ethical values among the students to be a righteous individual.

PO 6: **Environment and Sustainability:** To create environmental awareness among the students lashing with the sense of sustainability.

PO 7: **Gender Sensitization and social commitment:** To sensitize the students about the gender variability and its utility in harmonious ways of life.

PO 8: **Self-directed and life-long learning:** To create a positive attitude among the learners to have the zeal for self-directed and life-long learning.

PROGRAM SPECIFIC OUTCOMES - MA EDUCATION

PSO 1: **Educational Foundations and Educational Leadership:** To equip the PG students with foundations of education and inculcating educational leadership among the students.

PSO 2: **Skill Based Competence:** To inculcate some skills relating to teaching, research, leadership, management computer etc.

PSO 3: **Curriculum and Pedagogical Issues:** To make the PG students well aware of the curriculum planning and designing and pedagogy to transact the curriculum effectively and testing the students.

PSO 4: **Ethics and Social Responsibility in Education:** To produce morally upright PG students who are to contribute in environmental sustainability and social development.

MA List of Courses

1.1 Philosophical Foundations of Education	3.2 Principles and Techniques of Teaching and Pedagogy
1.2 Fundamentals of Educational Psychology	3.3 Teacher Education
1.3 Emerging Trends in Education	3.4 Measurement and Evaluation in Education
1.4 History and Development of Education in India	3.5 Educational Law and Government Policy
1.5 Educational Technology	3.6 Financial Management and Accounting
1.6 Leadership and Social Responsibility	3.7 Life Span Development and Education

1.7 Journaling – a Technique for Personal and Academic Growth	3.8 Learning and Individual Differences
2.1 Sociological Foundations of Education	3.9 Dissertation Phase I
2.2 Research Methodology in Education	3.10 Educational Seminar II
2.3 Knowledge and Curriculum	3.11 Teaching Practice
2.4 Developing Educational Leadership	4.1 Organisational Communication
2.5 Human Development and Learning	4.2 Educational Administration
2.6 Peace Education and Conflict Management	4.3 Ethics and Social Responsibility in Education
2.7 Educational Seminar I	4.4 Counselling Skills for Educational Psychologists
2.8 Computer Applications for Social Sciences (Lab)	4.5 Child and Adolescent Mental Health
2.9 School Visits	4.6 Dissertation Phase II
3.1 Curriculum Development and Instruction	4.7 Internship

Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PSO 1	PSO 2	PSO 3	PSO 4
1.1 Philosophical foundations of Education	H	H	H	L	M	M	M	H	H	H	H	H
1.2 Fundamentals of Educational Psychology	H	H	H	M	L	M	L	H	H	H	H	H
1.3 Emerging Trends in Education	H	M	H	M	M	M	M	H	H	H	H	M
1.4 History and Development of Education in India	H	M	M	M	L	L	M	H	H	H	H	H
1.5 Educational Technology	H	M	H	M	H	H	M	H	H	H	H	H
1.6 Leadership and Social Responsibility	H	H	H	H	H	H	H	H	H	H	H	H
1.7 Journaling	H	H	M	M	H	L	H	H	H	H	H	H
2.1 Sociological Foundations of Education	H	L	H	H	M	M	H	H	H	H	H	M
2.2 Research Methodology and Statistics in Social Sciences	H	H	H	H	H	M	H	H	M	H	M	H
2.3 Knowledge and Curriculum	H	L	M	M	M	L	M	H	M	H	H	H
2.4 Developing Educational Leadership	M	H	M	H	H	M	H	H	H	H	H	H
2.5 Human Development and Learning	M	H	M	M	M	M	H	H	M	H	H	H
2.6 Peace Education and Conflict Management	M	H	H	H	H	H	M	H	H	H	H	M
2.7 Educational Seminar-I	H	H	H	M	H	M	H	H	H	H	H	H
2.8 Computer Application for Social Sciences (Lab)	H	H	H	M	H	H	L	H	H	H	H	H
2.9 School Visits	M	H	M	H	H	H	H	H	H	H	H	H
3.1 Curriculum Development and Instruction	M	M	H	M	M	L	L	H	H	H	H	H
3.2 Principles and Techniques of Teaching and Pedagogy	H	H	H	H	H	H	H	H	H	H	H	H
3.3 Teacher Education	H	H	H	H	H	M	H	H	H	H	H	H
3.4 Measurement and Evaluation in Education	H	M	H	M	H	M	H	H	M	H	H	H
3.5 Educational Law and Government Policy	M	L	M	H	H	M	M	H	H	H	H	H
3.6 Financial Management and Accounting	M	L	L	L	H	L	M	H	L	H	L	H
3.7 Life Span Development and Education	H	L	H	H	M	M	H	H	H	H	H	H
3.8 Learning and Individual differences	H	H	H	M	M	H	H	H	M	H	H	H
3.9 Dissertation Phase-I	H	H	H	H	H	M	H	H	H	H	H	H
3.10 Educational Seminar-II	H	H	H	M	H	M	H	H	H	H	H	H
3.11 Teaching Practice	H	H	H	H	M	L	H	H	H	H	H	H

4.1 Organisational Communication	H	M	M	M	L	M	H	H	H	H	H	
4.2 Educational Administration	M	M	H	L	L	M	H	H	H	H	H	
4.3 Ethics and Social Responsibility in Education	H	M	H	H	H	H	H	H	H	H	M	
4.4 Counselling Skills for Educational Psychologists	H	M	H	L	L	M	H	M	H	H	H	
4.5 Child and Adolescent Mental Health	H	H	M	H	H	M	M	H	H	H	H	M
4.6 Dissertation Phase-II	H	H	H	H	H	M	H	H	H	H	H	H
4.7 Internship	H	H	H	H	M	M	H	H	H	H	H	H

Mandatory course**EDSL0200: Service learning (A community-university engagement programme)**

Credits: NC

DETAILED SYLLABUS MA EDUCATION DETAILED SYLLABUS**EDLR0007: LEADERSHIP AND SOCIAL RESPONSIBILITY (3-0-0)****COURSE OUTCOMES**

State the meaning of leadership and the qualities of a true leader. (Remembering)

Discuss the concept of leadership and management and the different theories and styles of leadership. (Understanding)

Analyze the role of individual social responsibility and the social responsibility of educators. (Analysis)

Identify the role of leadership in the decision-making process and find out the techniques that improves decision making process. (Application)

Discuss the role of leadership in policy formulation and find out the effect of leadership in social entrepreneurship. (Application)

Module I: Leadership and Management (13 Lectures)

Understanding Leadership; Its need and function; Styles and Theories of Leadership Styles of leadership (Autocratic, Democratic, Laissez Faire) and Theories of Leadership (Great Man Theory, Trait Theory, Fiedler's Contingency Theory, Hersey and Blanchard's Situational Theory, Tannenbaum and Schmidt Leadership Continuum); Changing roles of Leadership; Concept of Management, functions of Management, Leadership and Management issues; Discipline in Leadership, Leadership-A bridge to improved practice, Ways to improve Staff Achievement; Staff motivation, Performance and Personal Organization .

Module II: Social Responsibility (10 Lectures)

Concept of Social Responsibility, Types of Social Responsibility, Its need, Changing role; Social Engagement; Individual Social Responsibility and Corporate Social Responsibility, Social Responsibility of the Educators.

Module III: Leadership and Decision Making (12 Lectures)

Decision Making process; Types of Decision Making, Key steps in Decision Making, techniques of effective Decision Making; Barriers towards Decision Making, Ways of mitigating Barriers in Decision Making; Importance of Decision Making in Educational Institution, Organisational Behaviour, Leadership and Decision Making.

Module IV: Leadership Implementation and Implantation (10 Lectures)

Leadership and implantation; Leadership roles in Policy Formulation; Complexity of joint actions; Economic theory and program implementation; Implantation as exploration; Volunteerism; social entrepreneurship.

Suggested Readings

Bass, B. M. Transformational leadership: Industry, military, and educational impact, Mahwah, NJ: Erlbaum (1998).

David, B. Leadership in Organizations There Is a Difference between Leaders and Managers, New York: University Press of America (2009).

Friedman, A. A. Beyond mediocrity: transformational leadership within a transactional framework.

International Journal of Leadership in Education, 7(3), 203-224 (2004).
doi:10.1080/1360312042000213877.

Fullan, M. Leadership and sustainability. New Delhi: Sage publication Ltd. (2005).

Kouzes, J.M., & Posner, B.Z. The leadership challenge. San Francisco, CA: Jossey- Bass. (2002).

Lee G. & Bolman, T. Deal Reframing Organizations Artistry, Choice, and Leadership. San Francisco: Jossey- Bass. (2008).

Rogers, C. Transition, self-regulation, independent learning and goal theory. Psychology of Education Review, 36(2), 26-31 (2012).

Starratt, R. Ethical Leadership. San Francisco: Jossey- Bass (2004).

Williams, M. Leadership for leaders. New Delhi: Vinod Vasishtha (2006).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	H		M	
CO 3		H		
CO 4	M		H	
CO 5		M		H

EDTE0013: EMERGING TRENDS IN EDUCATION (3-0-0)

COURSE OUTCOMES

Recall contemporary issues, techniques in education. (Remembering)

Explain/ identify/ classify the contemporary issues and techniques in education. (Understanding)

Use the new techniques of teaching in practice. (Application)

Appraise the present educational institutions regarding the challenges and hurdles faced. (Evaluation)

Formulate actionable strategies to prevailing problems in the educational system. (Creation)

Module I: Recent Pedagogical and Delivery Techniques (10 Lectures)

Distance Education – Purposes, functions, organization and management of Distance Education Programme; e-learning – Nature, Characteristics, Styles, Arrangement for e-learning in an educational institution; Virtual Classrooms – Modus operandi, Advantages and Limitations. Teleconferencing and; Video conferencing – Meaning, types, Educational Advantages.

Module II: Recent Techniques in Education (10 Lectures)

Language laboratory - Need, Types, Functioning, Uses and Applications; Team Teaching-Meaning, Definition, Objectives, Principles, Types, Organization, Procedure and steps, Advantages and Limitations; Co-operative learning and collaborative learning-Key elements-Implementing the elements.

Module III: Autonomy, Accountability and Accreditation (8 Lectures)

Autonomy-Meaning, Need; Academic, Administrative and Financial Autonomy, Objectives, Salient Features, Advantages of Autonomous colleges; Accountability and Accreditation; Accreditation process, Assessment and Accreditation –NAAC, NBA-ISO, Accreditation and Certification.

Module IV: Challenges in School Education (10 Lectures)

Current student related Challenges: Parental Involvement, Drugs and Violence, School safety. Current Teacher related challenges: Diverse learning needs, Quality and expectations, Pupil- Teacher ratio. Teacher mentee /mentor programs. Current School related challenges- Technology issues, Bullying, harassment and ragging.

Module V: Learning Environment in Educational Institutions (7 Lectures)

The concept of Institutional environment, The classroom learning environment- Disciplinary problems, The effects of the Institutional environment on Academic performance, Punishment and its effects. Creating Trustworthy school environments; Guidance and Counselling.

Suggested Readings

- Associates, A. F. Leading Academic Change: Essential Roles for Departmental Chairs. San Francisco: Jossey-Bass Publishers (2000).
- Associates, H. D. Higher Education in the Era of Digital Competition – Choice and Challenges (2000). Modison: WI Atwood Publishing.
- Association of Indian Universities. Privatization of Higher Education (2003)
- Association of Indian Universities: Accountability and Autonomy in Higher Education. (1998).
- Association of Indian Universities: Excellence in Achieving Social Relevance in Higher Education (1993).
- Chauhan, S.S Innovations in Teaching Learning Process. New Delhi, Vikas Publication (2004).
- Gandhi, M.M . Autonomy and Accountability in Higher Education- An Indian Perspective. IOSR Journal of Research and Method in Education (2013). Vol. 3, Issue 5 (Nov-December) pp. 33-37. Retrieved from <http://www.iosrjournals.org/iosr-jrme/papers/Vol-3%20Issue-5/F0353337.pdf?id=7370>.
- Govindasamy, T. Successful implementation of e-learning: Pedagogical considerations. The internet and higher education (2001), 4(3), 287-299.
- Haynes, N. M. Creating safe and caring school communities: Comer school development program schools. Journal of Negro Education (1996), 308-314.
- Hernes, G and Martin, M. (eds) . Accreditation and the global Higher education market (2008). UNESCO: International Institute for Educational Planning. Retrieved from <http://unesdoc.unesco.org/images/0016/001635/163514e.pdf>. Accessed on 19 July, 2016.
- Holmberg, B. . Theory and Practice of Distance Education. 2nd Edition. Routledge (2005).
- Mangal, S.K. Essentials of Educational Technology. Ludhiana, Tandon Publications (2005).
- Mclsaac, M. S. and Gunawardena, C. N. (2005). Distance Education. Retrieved from <http://www.aect.org/edtech/ed1/pdf/13.pdf>. Accessed on 19 July, 2016.
- Mehta, R. Crisis in Higher Education. Delhi : Kalpaz Publications (2004).
- Ministry of Human Resource Development Department of Secondary and Higher Education (2005). Report of the Government of India Central Advisory Board of Education (CABE) Committee on Autonomy of Higher Education Institutions. Retrieved from http://mhrd.gov.in/sites/upload_files/mhrd/files/document-reports/Autonomy HEI.pdf. Accessed on 19 July, 2016.
- Narkhede, S. Challenges of higher Education in India. New Delhi: Sarup and Sons (2001).
- Pollack, I., and Sundermann, C. Creating safe schools: A comprehensive approach. Juvenile Justice(2001), 8(1), 13-20.
- Purushotham, H.R. Team Teaching: An Alternative to Lecture Fatigue(2009). Edutracks, 9(1), 5-7.
- Singh, A. and G.D.Sharma. . Higher Education in India: The Institutional Context (ed.), New Delhi: Konarch(1989).

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO1	H	H	H	H
CO2	H	H		

CO3	M	H		
CO4	M	M	H	H
CO5				H

EDDE0014: HISTORY AND DEVELOPMENT OF EDUCATION IN INDIA (3-0-0)

COURSE OUTCOMES

Recall the characteristic features of education in ancient India, Pre- Independent India and post- Independent India. (Remembering)

Explain, compare and draw generalizations about the various educational commissions and policies. (Understanding)

Justify the relevance of different educational features from ancient to post- independent India in present day educational system. (Application)

Critically analyze the various policies and commissions in terms of their relevance and implementation. (Analysis)

Trace the contribution of each period to the shaping of the present education system. (Evaluation)

Construct ways and means of improving the quality and quantity of Indian education system. (Creation)

Module I: Ancient Indian Education (8 Lectures)

Fundamentals of Ancient Indian Education, Salient features, purpose of studying Vedas, Relevance of Ancient Indian education in the 21st Century. Chief Characteristics of Vedic Educational System; Education in post Vedic (Buddhist) period – features; Female education; Swadhyaya (Self-Education, State patronage and Growth of education, Primary Education (Maktabas), Higher Education (Madrassas), Female Education, Student and Teacher relationship

Module II: Education during Pre Independent India (13 Lectures)

Anglicization of Education 1836-1855- Exponents of Oriental Education, The Anglicists, Macaulay's Minutes and its effect, Wood's Despatch – 1854, India Education Commission regarding Primary, Secondary and University Education, The University Commission (1902), The Hartog Committee (1928-29), The Filtration Theory of Education. Important Development in Education during 1921-1931- Inter University Board, Establishment of new Universities, Teachers Training, Technical Education

Module III: Education during Post Independent India (14 Lectures)

Various Commission and policies in Education - Secondary Education Commission 1953, Education Commission 1964-66, National Policy on Education 1986, Ramamurthy Review Committee 1990, National Commission on Teacher 1983-85, Problems of Indian Education- Wastage and Stagnation, Examination Reform, Inclusive Education and Education of the Marginalized.

Module IV: Current Government Policies (10 Lectures)

DPEP, National policy on ICT, Panchayat Raj Act, Rashtriya Madhyamik Shiksha Abhiyan, Rashtriya Uchchatar Shiksha Abhiyan, SSA, RTE, NAEP, National Knowledge Commission, NAS, SPQEM, NEP-2020.

Suggested Readings

Acharya, P. Indigenous vernacular education in pre-British era: Traditions and problems. Economic and political weekly, 1981-1988. (1978)

Dash, M. Education in India: Problems and Perspectives, Eastern Book Corporation (2000)

Ghosh, S. C. History of Education in India, Eastern Book Corporation. (2007)

Govt. of India, report of the University Education Commission, Vol -I, Simla.(1949)

Jain, M. History in the New NCERT Textbooks Fallacies in the IIC Report, Delhi NCERT. (2003)

Lall, M. The Challenges for India's Education System, Chatham House: London (2005)

M.H.R.D, Report of the University Education Commission (1948), Ministry of Education, New Delhi,

Govt. of India (1948)
 M.H.R.D. Challenges of Education (1985). A policy perspective, Ministry of Education, New Delhi, Govt. of India (1985)
 M.H.R.D. Report of the Secondary Education Commission (1952). Ministry of Education, New Delhi, Govt. of India (1952)
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 Ramchandra, P. and Ramkumar V., Education in India. Eastern Book Corporation. (2005)
 Rawat, P. L. , History of Indian Education: Ancient to Modern, Delhi Bharat Publication.(1956)
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http://www.teindia.nic.in/Files/Reports/CCR/Yash%20Pal_committe_report_lwb.pdf
http://ncte-india.org/ncte_new/pdf/NCFTE_2010.pdf
<http://www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf>
 MHRD. National Education Policy 2020.
https://www.education.gov.in/sites/upload_files/mhrd/files/NEP_Final_English_0.pdf

Mapping of COs to syllabus

Course Outcomes	Module I	Module II	Modul III	Module IV
CO1	H	H	H	H
CO2		H	H	H
CO3	M	H	H	H
CO4		H	H	H
CO5	M	H		
CO6			M	H

EDET0015: EDUCATIONAL TECHNOLOGY (3-0-0)

COURSE OUTCOMES

State the nature, scope and approaches of Educational Technology. (Remembering)
 Describe the teaching models and explain the concept of instructional design. (Understanding)
 Analyze the different instructional approaches in the process of teaching and learning. (Analysis)
 Discuss the nature of the process of communication and the application of ICT in the teaching learning process. (Application)
 Identify the various software and hardware and state its use both in face to face and virtual classroom platforms. (Application)

Module I: Educational and Behavioural Technology (13 Lectures)

Meaning, nature and scope; Historical perspective of Educational Technology; Approaches- Software, hardware and system; Utility and problems of Educational technology in Formal and non-formal education; Behavioural Technology: teacher behaviour and teaching behaviour, teaching skills, Micro Teaching; SSST and FIACS.

Module II: Designing Instructional System (12 Lectures)

Teaching learning process, variables, levels, functions, taxonomies of instructional objective, instructional strategies, PI, PSI, MI, CAI, BMLS.

Module III: Process of Communication and ICT (10 Lectures)

Concept and process of communication, Barriers to communication, Principles of communication, Mass Media and multimedia; Concept and need of ICT.

Module IV: Emerging trends in Educational Technology (10 Lectures)

Distance Education; Open learning system; New technologies- Videotapes, Radio, Teleconferencing, CCTV, INSAT, EDUSAT, Internet, Broadband; Resource centres for Educational Technology: CIET, UGC, IGNOU, NIOS; 3D printing, mobile learning, Gamification, Flipped, blended learning /classrooms, Cloud computing, Massive open online course (MOOCs), Flash notes, Virtual Reality, Wearables, etc.

Suggested Readings

- Ahalt, S. Ten Emerging Educational Technology. Renci White paper Series, Vol. 3, No. 1 pp.1- 18 (2015).
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 Hooft, M. V. Mobile, Wireless, connected information clouds and learning. Emerging technologies for learning. Vol. 3.pp. 30-46.(2008).
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 Joyce, and B Weil, Models of Teaching, Prentice Hall, New Jersey.
 Mangal S.K. Foundations of Educational Technology, Prakash Brothers Ludhiana.
 Mclsaac, M. S. and Gunawardena, C. N. (2005). Distance Education. Retrieved from <http://www.aect.org/edtech/ed1/pdf/13.pdf>. Accessed on 19 July, 2016.
 Nayak, A.K. Classroom Teaching Methods and Practices: APH, Publishing Corporation.
 Passi, B.K. Becoming Better Teacher, Micro Teaching Approach, Sahita Mudranalya, Ahmedabad.(1976).
 Sachdeva, M.S. A New Approach to Educational Technology, Vinod Publications.
 Sharma R.A. Technological Foundations of Educational Publications Meerut.
 Sharma, R.A. Technology of Teaching: International Publishing House.(1983)
 Venkataiah: Educational Technology, APH Publishing Corporation New Delhi.
 19. Walia. J.S. Essentials of Instructional Technology; Paul Publishers Punjab.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			H
CO 2		H		M
CO 3		H		
CO 4			H	H
CO 5	H			H

SPECIALISATION: EDUCATIONAL LEADERSHIP**EDEL0019: DEVELOPING EDUCATIONAL LEADERSHIP (3-0-0)****COURSE OUTCOMES**

Explain the importance of education and describe the educational system and institutions (Understanding)

Appraise the nature of collaboration and role played by stakeholders in the field of education. (Evaluation)
Critically analyze the curriculum content and pedagogy existing in schools. (Analysis)
Illustrate the role of leadership in the process of inclusion. (Application)
Describe the various features of good leadership in the field of education. (Remembering)

Module I: Education system and Institutions (15 Lectures)

Education as an ideal (What is education?; Aims of education); Education as a system; School as a social institution.

Decentralisation of Education: Education- a concurrent subject in the Constitution; Structure of the educational system in India; Study of the structure at the state level; Linkages within the system.

Roles and responsibilities of the personnel involved: Teacher as an academic leader, Head teacher as a school leader, CRC, BEO, DEO, DIET Principal, SCERT Director, NCERT Director, Panchayati Raj Institutions.

Reflecting on one's own experiences of schooling to understand school as a social institution, nature of relationships among the various stakeholders in the school and overarching values as stated by the school

Module II: Stakeholder Collaboration (10 Lectures)

Parent, learners, community, teachers as stakeholders: their expectations and roles. Ensuring their participation.

Analysis of research on impact of stakeholder participation, challenges and principles for successful collaboration.

Module III: Leadership for Inclusion (10 Lectures)

School Culture: Meaning and components; Hidden curriculum.

Zones of exclusion. Analysing curriculum-content and pedagogy to critically examine school processes; Identifying school processes that cause exclusion.

Synthesizing principles of inclusive institutional culture.

Module IV: Constructing 'Educational Leadership' (15 Lectures)

Leadership for quality education, equity and inclusion, continuous professional development of teachers, creation of learning communities, ensuring autonomy of learners, teachers and other staff, contextualisation of the curriculum.

Crafting vision and mission for an educational institution. Critical review of the vision based on the parameters of educational aims, ideals of administration and values of democratic society. Assess an educational issue to arrive at strategic principles, action plans, resource management to address the issue.

Suggested Readings

Apple, M. W., & Beane, J. A. Democratic schools. Association for Supervision and Curriculum Development, 1250 North Pitt Street, Alexandria, VA 22314 (1995).

Batra, S. (2003). From School Inspection to School Support. In Sood, N. (ed). Management of School Education in India. NIEPA: New Delhi. 2. Early, P., and Weindling, D. (2004).

Cheney, G. R., Ruzzi, B. B., & Muralidharan, K. A profile of the Indian education system. Prepared for the New Commission on the Skills of the American Workforce.(2005).

Dewey, J. Democracy and Education. New York: Macmillan. (1916).

Fullan, M. Why Teachers Must Become Change Agents. In Educational Leadership, 50 (6).(1993).

Govinda, R. Capacity Building for Educational Governance at Local Levels. Paper presented at the International Consultation on Educational Governance at Local Levels. Held at UNESCO, Paris 27-28 February 2001.(2001).

7. NCERT. position paper on aims of education. New Delhi: NCERT Preamble to the Constitution of India concerning values for teachers.(2006).

School as a social institution, Andre Baitelle.

Sheshagiri K.M. Decentralisation of Education in India: Reflections from Kerala and Rajasthan.
 Wren, D. J. (1999). School culture: Exploring the hidden curriculum. *Adolescence*, 34(135), 593.
 A Changing Discourse: From Management to Leadership. In Early, P. and Weindling, D. (ed).
 Understanding School Leadership. Paul Chapman Publications: UK.
 Senge, P. M. (1990). Organizations as learning communities.
 Pollard, A. (2002). Reflective Teaching. Continuum: London. Chapters – 1,8,9. 39.
 Hargreaves, A. (2000). Teachers and Teaching: History and Practice, Vol. 6, No. 2, 2000 Four Ages of Professionalism and Professional Learning.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			M
CO 2		H		
CO 3			H	M
CO 4			H	
CO 5	M			H

SPECIALISATION: EDUCATIONAL PSYCHOLOGY

EDDL0020: HUMAN DEVELOPMENT AND LEARNING (3-0-0)

COURSE OUTCOMES

Explain the nature of child and childhood education. (Understanding)
 Characterize the nature of human growth, maturation and development. (Application)
 Appraise the nature and theories of development. (Evaluation)
 Describe an understanding about adjustment mechanism in social context. (Remembering)
 Classify the differently abled persons and discuss their educational implications. (Analysis)

Module I: Understanding Child and Childhood (10 Lectures)

Importance of understanding child and childhood; capabilities of children belonging to different socio-economic and cultural backgrounds; idea of multiple childhood; nature-nurture debate; language development; learning and acquisition; promoting autonomy in children.

Development of case studies of children belonging to different backgrounds

Module II: Development and Learning (13 Lectures)

Stages of development; growth and maturation; Adolescence: why it is a sensitive period, the importance of recognizing issues related to adolescence; Erikson's stages of psycho-social development; Vygotsky's theory on social constructivism; Piaget's Theory of Cognitive development. Piaget and Vygotsky debate

Developing a personal narrative of experiences of adolescence

Module III: Enabling learning and Understanding learning of differently abled persons (12 Lectures)

Bronfenbrenner's ecological systems; theory of development; social context of learning; enabling school environment; promoting independence of thought and action; parenting at different stages of development; Understanding differently abled persons and their educational implications: ADHD, autism, dyslexia. juvenile delinquency.

Module IV: Psychology of Adjustment and Adjustment Mechanisms (10 Lectures)

Adjustment as a process; a theory of cognitive adaptation. frustration and conflict; causes of maladjustment; contribution of Freud, Adler, Jung and Neo-Freudians to understand maladjustment, adjustment mechanisms. conflicts and defence mechanisms, mental hygiene.

Suggested Readings

- Arkoff & Abe. 'Adjustment and Mental Health'. New York, McGraw- Hill (1968).
- Bjorklund, D. 'Child and Adolescence Development-an integrated approach'. Blasi Wadsworth Cengage Learning Publications. (2010).
- Bronfenbrenner, Urie. 'The ecology of human development'. Harvard University Press Cambridge. (1979).
- Crow & Crow. 'Understanding Our Behavior'. N.Y. Alfred A Knoff Publications (1956).
- Erickson, H.Erik. 'Childhood and Society'. W.W. Norton Publication. (1993).
- Erickson, H.Erik. 'Stages of Psychosocial Development'. Green Verlag, Gmbtt (2005).
- Freud S. 'Psychopathology of Everyday Life-The Basic Writings of Sigmund Freud'. New York, Modern Library. (1938).
- Kostelnik, J.M., Gregory, M.K., Soderman. K.A., & Whiren, P.A. 'Guiding children's social development and learning'. Wadsworth Cengage Learning Publications (2012).
- Kozulin A., Gindis, B., Ageyev., S.V & Miller, M.S. 'Vygotsky's Educational Theory in Cultural context'. Cambridge University Press. (2003).
- Lahner, George. 'The Dynamics of Personal Adjustment'. New Jersey: Prentice -Hall. (1964).
- Lerner, J. 'Learning Disabilities-Diagnosis and Teaching Strategies'. Boston Houghton Mifflin. (1985).
16. Lock, A & Strong, T. 'Social Constructionism – Sources and Stirrings in Theory and Practice'. Cambridge University Press (2010).
- Mangal, S.K. 'Educating Exceptional Children-An Introduction to Special Education'. PHI 19. Learning Private Limited, Delhi (2010).
20. Mangal, S.K. 'Abnormal Psychology'. N.D-Sterling Publications (revised edition) (1987).
21. Mangal, S.K. 'Advanced Educational Psychology'. PHI Learning Private Limited, Delhi, (2002).
- McLoughlin, J.A and Netick, A. 'Defining Learning Disabilities- A new and co-operative direction'. Journal of Learning disabilities. (1983).
- Newman, M.B & Newman, R.P. 'Development through Life-A psycho-social approach'. 12th edition, Cengage Learning Stamford. (2006).
- Sinha, AKP, Singh, R.P. 'Manual for Adjustment, Inventory for College Students'. Agra, National Psychology Corporation. (1971).
- Telford, C.W & Sawrey, J.M. 'The Exceptional Individuals'. New Jersey, Prentice-Hall. (1967).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2		H		H
CO 3			H	
CO 4			H	
CO 5	M			H

EDTP0022: PRINCIPLES & TECHNIQUES OF TEACHING AND PEDAGOGY (3-0-0)

COURSE OUTCOMES

- Explain the nature of teaching. (Understanding)
- Mention the theories of teaching and different models of teaching. (Analysis)
- Distinguish the different methods of teaching. (Application)
- Narrate the concept of pedagogy in the process of teaching and learning. (Evaluation)
- Communicate the various Recent Developments in Pedagogy. (Application)

Describe the aspects of teaching in connection to various skills. (Analysis)

Module I: Concept and aspects of teaching (10 Lectures)

Teaching: Concept, nature and scope; Teaching competency: Understanding the child, understanding the subject, contextualization, punctuality, regularity, integrity, humility, accountability, humanism, empathy, enthusiasm; Skills of teaching: Explaining, questioning, stimulus variation, reinforcement, achieving closure, etc.; Integration of different teaching skills and Strategies of teaching: Autocratic, Permissive, Democratic. Study the biographies of famous teachers and develop teacher profiles within historical and contemporary perspectives.

Module II: Theories and models of teaching (10 Lectures)

Principles and maxims of teaching; Theories of teaching: behaviourism, cognitivism, constructivism, co-operative approach; Models of teaching: information processing models, social models, behavioural models and personal models Demonstration on models of teaching by students.

Module III: Teaching Methods (15 Lectures)

Teacher-centred methods: lecture, demonstration, team-teaching, mastery learning strategy; Learner-centred methods: programmed learning, personalized system of instruction, problem solving method; Activity-centred methods: seminar, workshops, peer-tutoring, group discussion, projects, heuristic method, panel discussion, brainstorming, symposium and roleplay; Teaching aids: significance, types and uses Classroom teaching practice.

Module IV: Recent developments in Pedagogy (10 Lectures)

Pedagogy: concept and significance; History of pedagogy: Indian, Greek and Roman history of pedagogy; Innovative pedagogy: crossover learning, learning through argumentation, incidental learning, learning by doing, embodied learning; Pedagogical approaches for diversity in society and its interface with the classroom. *Analysis of teaching in a real classroom situation*

Suggested Readings

Aggarwal, J. C. Principles, methods and techniques of teaching. Delhi: Vikas Pub House.
Anderson. L. W. et al. International Encyclopedia of Teaching and Training Education, Pergmon press.
Joyce, B. & Weil, M. Models of teaching. New Delhi: Prentice Hall.
Jangira, N. K. Professional Enculturation: Innovative Experiments in Teaching and Training, New Delhi; Bookworth of India.
Ashton-Warner, S. Teacher. New York: Simon & Schuster.
Hall, G. E. & Quinn, L. F. & Gollnick, D. M. Introduction to Teaching: Making a Difference in Student Learning. Sage Publisher.
Puri, U. Teaching Techniques. ND: Pragun.
Sharma, B. L. & Saxena B. M. Methods of Teaching. Meerut: R. Lall.
Sharma, T. R. & Bhargava, R. Modern Teaching Aids. Agra: HP Bhargav Books.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	H	H
CO 2	H	H	M	H
CO 3	M	H	M	
CO 4	H		H	H
CO 5	M	M	H	H
CO 6	H		M	

EDTE0023: TEACHER EDUCATION (3-0-0)

COURSE OUTCOMES

Describe the concept of teacher education. (Understanding)

Explain teaching as a profession. (Application)

Identify the structure of teacher education programmes. (Application)

Illustrate the recent trends of teacher education. (Remembering)

Prepare the course structure of Teacher Education with integrated Teacher Education Programmes. (Analysis)

Distinguish the various aspects of teaching as a profession. (Evaluation)

Module I: Concept and Fundamentals of Teacher Education (13 Lectures)

Meaning, nature and scope of teacher education; Aims and objectives of teacher education; Historical perspectives of teacher education - Kothari Commission, National Commission on Teachers (1983-85), NPE (1986), Revised POA (1992); Recent developments in teacher education - NCF 2005, NKC 2007 & NCFTE 2009. History and status of Teacher Education in North East India. Problems and issues of Teacher Education in N.E. India. Comparative analysis of Teacher education in the past and present.

Module II: Teaching as a Profession (12 Lectures)

Approaches to teacher education: Behaviouristic and constructivist approaches; Modification of teaching behaviour: Simulated teaching, Flanders' Interaction Analysis; Performance appraisal of teacher; Teacher effectiveness; Code of conduct and ethics in teacher education.

Classroom observation and analysis using Flanders' Interaction Analysis.

Module III: Structure of Teacher Education Programmes (10 Lectures)

Role of professional organizations and bodies of Teacher Education; Pre-service and In-service teacher education; Teacher education by open and distance learning; Role of different agencies in quality assurance – MHRD, UGC, NCERT, NCTE, SCERT, NAAC, RIE, SIE, IASE, UGC-HRDC

Analysis of a distance learning teacher education programme

Module IV: Recent trends in Teacher Education (10 Lectures)

Internship, Practice teaching for developing an effective teacher, Integrated Teacher education programme; Action research; ICT in teacher education; preparing teachers for inclusive classrooms; Issues and challenges in teacher education. Analyse the course structure of an integrated teacher education programme.

Suggested Readings

Aggarwal J.C. Teacher education, theory and practices. New Delhi: Doaba Home.

Altekur. A.S. Education in ancient India. Banaras: Nand Kishore Bros.

Anderson.L.W. et al. International Encyclopedia of Teaching and Training Education. Pergmon press.

Biddle, B. J. and Ellena. Contemporary research on teacher-effectiveness.

Buch. M.B. First survey of research in Education. Baroda: SERD.

Buch.M.B. Second survey of research in Education. Baroda: SERD.

Buch.M.B. Reading in in-service education. Sardar Patel Palasane, M.M. University.

Dunkin Michael J. The international encyclopedia of teaching and teacher education, Pergmon education forum, Vol 4 no 12, New York.

Harvilas, S. and Naik .J.P. A history of education in India. Bombay: Macmillan and co.

Hittlilman, D.R. A model for a competency based teacher preparation in Program- teacher education Forum, vol 4 no 12, New York.

Jangira N.K. Teacher training and teacher effectiveness an experience in Teaching. New Delhi: National Publishing House.

Kumar. T. P. Teacher education. APH Publishing Corporation.

NCERT: The Third Indian year book on education. New Delhi: NCERT. 1968.

NCTE, Teacher education curriculum (1978): A Framework. New Delhi: NCERT.

Shrimali .K.L. Better teacher Education. New Delhi: Ministry of education Govt. of India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	M	H	H	M
CO 2	H	M	H	H
CO 3	H	H	H	H
CO 4	M	M	M	H
CO 5	H	H	H	H
CO 6	H	H	H	M

EDME0024: MEASUREMENT AND EVALUATION IN EDUCATION (3-0-0)

COURSE OUTCOMES

Describe the conceptual framework of educational measurement and evaluation.(Applying)

Mention different dimensions of educational measurement and evaluation. (Remembering)

Explain the concepts of reliability and validity of test scores. (Remembering)

Identify the tools and techniques to be used in the process of educational measurement and evaluation (Analyzing)

Apply the process of construction and standardization of tools. (Applying)

Find out reliability and validity of a tool. (Applying)

Module I: Educational Measurement (7 Lectures)

Overview of measurement and assessment; Types of measurement - psychological and physical; Functions of measurement - Prognosis, Diagnosis, Research; Scales of measurement, Properties and Types - Nominal, Ordinal, Equal interval, Ratio; General problems of measurement; High stakes' testing, Performance and portfolio assessment. Critical evaluation of the current trends in educational measurement

Module II: Dimensions of Educational measurement and Evaluation (10 Lectures)

Diagnostic, Aptitude, Achievement, Intelligence; Mode of assessment - formal, informal, formative, summative, continuous, terminal, process, product, internal and external; Process of assessment - Teacher-made test, standardized test, Norm reference test and criterion reference test.

Review of Stanford-Binet Test and General Aptitude Test Battery (GATB)

Module III: Reliability and Validity of a Test (8 Lectures)

Overview of reliability - Methods of estimating reliability with computation - test retests method, Equivalent forms method, Split half method, Kuder-Richardson method; Inter-rater consistency; Interpreting reliability coefficient; factors influencing reliability measures.

Nature of validity, major considerations in validation – content consideration, construct consideration, test-criterion relationship, consideration of consequences; Methods of estimating validity; factors influencing validity; Relationship between reliability and validity.

Practice session on estimating reliability and validity.

Module IV: Tools and techniques for educational measurement (10 Lectures)

Overview of constructing various types of objective tests; Guidelines for writing objective test items; Essay questions: forms, uses, guidelines for constructing, scoring criteria. Interpretive exercises: nature, forms, and uses of the interpretive exercises, Advantages and limitations.

Administration of a group test of intelligence using a standardized tool.

Module V: Standardization of a test (10 Lectures)

Planning the test: Determining the objective and test specification, preparing the preliminary format- writing, arrangement, review and editing of test items; tryout of the test - administration, scoring and item analysis; preparing the final form of the test - selection of items, fixing the time limit, direction to the examinee, preparation of scoring key; administration of the final form of the test- determining validity, reliability, norms, standard scores; manual of the test, interpretation of test results, characteristics and uses of standardized test. Students will prepare, administer and standardize a test, following the set procedures of standardization of a test.

Suggested Readings

Gregory, R. J. Psychological testing: History, principles and application. Delhi: Pearson Education pvt. Ltd.
Kaplan, R.M. & Saccuzzo, D. P. Psychological testing: Principles, applications, and issues. Kundli Haryana: Thomson Wadsworth.

Kubiszyn, T. & Borich, G. Educational testing and measurement: Classroom application and practice. Kundli Haryana: John Wiley & Sons, Inc.

Linn, R. L. & Gronlund, N. E. Measurement and assessment in teaching. New Delhi: Pearson Education.

Sharma, R. A. Essentials of measurement in education and psychology. Meerut: R. Lall Book Depot.

Sidhu, K. S. New approaches to measurement and evaluation. New Delhi: Sterling Publishers Pvt. Ltd.

Ebel, R. L. & Frisbie, D. A. Essentials of educational measurement. New Delhi: Prentice-Hall of India Pvt. Ltd.

Patel, R. N. Educational evaluation theory and practice. Mumbai, India: Himalaya Publishing House Pvt., Ltd.

Singh, A. K. Tests, measurements, and research methods in behavioural sciences. Patna: Bharati Bhawan Publishers and Distributors.

Swain, S. K., Pradhan, C., & Khato, P. K. Educational measurement statistics and guidance. New Delhi: Kalyani Publishers.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		M	
CO 2		M		H
CO 3	H		H	
CO 4	M			H
CO 5		H	H	
CO 6	H			H

SPECIALISATION: EDUCATIONAL LEADERSHIP**EDFM0026: FINANCIAL MANAGEMENT AND ACCOUNTING (3-0-0)****COURSE OUTCOMES**

Describe accounts and finance in relation to education. (Application)

Illustrate the various processes of taxation regulations related to education. (Evaluation) CO3 Work out the double entry accounting. (Analysis)

Illustrate the process of budgetary control and Auditing. (Application)

Identify the Process of Deduction of Tax and computation of Tax at source. (Remembering)

Explain the importance and working of Balance Sheet in accounting. (Evaluation)

Module I: Introduction (8 Lectures)

Evaluation of Financial Accounting; Difference between Accounting and Bookkeeping; Accounting Concepts; Principles, Bases and Policies.

Module II: Journal (8 Lectures)

Double Entry Accounting; Journal; Posting; Ledger.

Module III: Balance Sheet (8 Lectures)

Trial Balance; Final Account – Trading Account, Profit And Loss Account, Receipt And Payment Account; Income Expenditure Accounts; Balance Sheets.

Module IV: Financial Management (10 Lectures)

Decision Making; Meaning and Scope; Cost Analysis; Budgetary Control; Standard Costing; Financial Analysis; Relevant Cost; Management Accounting Framework; Function of Management Accounting; Internal Audit; School Accounting and Auditing; Investment.

Module V: Taxation Management (11 Lectures)

Basic Concepts; Deduction from Gross Total Salaries; Income From House, Property; Profits and Gains of Business and Profession; Capital Gains; Income from other Sources; Set off and Carry Forward of Losses; Assessment of Individuals and Computation of Tax at Source, Assessment of Companies and Fringe Benefit and Service Tax. VAT/ GST.

Suggested Readings

Block, S. B., G. A. Hirt, & B. R. Danielsen. Foundations of Financial Management. New York, NY: McGraw-Hill/Irwin.

Das, K.R., Sinha, K.M., & Choudhury, P. Theory and practice of bookkeeping and accountancy. Guwahati: lawyers book stall.

Lal, J & Srivastva, S. Financial Accounting: Principles & Practices. New Delhi: Chand Publications.

Wilson, M. Advanced Accountancy. Chennai: Scitech Publications.

Mapping of COs to Syllabus

Course comes	Out-	Module I	Module II	Module III	Module IV
CO 1		H	H	M	H
CO 2		H	H	H	H
CO 3		H	H	H	M
CO 4		H	H	H	H
CO 5		M	M	M	H
CO 6		H	H	H	M

EDLE0027: LIFE SPAN DEVELOPMENT AND EDUCATION (3-0-0)**COURSE OUTCOMES**

Recognize the meaning, concept, process, nature, and scope of life, development, life span development, and emotions of an individual. (Remembering)

Understand the biological bases and anatomical structures controlling human development along with understanding emotional development and its associated components. (Understanding)

Analyze theories of development M1 and issues of human development at various stages. (Analysis)

Apply the principles and knowledge of the theories of development and human anatomy in educating children as well as mitigating bio-psycho-socio-emotional issues. (Application)

Evaluate the influence of socialization on the development process of an individual. (Evaluation)

Creating models to bring about a balanced emotional development of students. (Creation)

Module I: Introduction to LifeSpan Development (8 Lectures)

Life Span Perspective: Importance of studying Life-Span Development, Characteristics of life-span development, Nature of Development, Scope of Lifespan development. Theories of Development (Brief discussion of all theories), Influence of Socialization and Development.

Analyze the role of education in socialization and development of the child.

Module II: Biological Bases of Human Development and Anatomy of the Nervous system (14 Lectures)

The Evolutionary perspective and Heredity-Environment Correlations, genetic foundation, Conception, effect of Teratogens on Prenatal Development, Neonatal health - Low birth weight, Neonatal Assessment; Neuron: Structure, types and functions. Structure of the nervous system, physiological basis of the action potential (neural response); Structure and function of the brain: fore brain, midbrain, hindbrain, cerebral cortex, temporal, parietal and occipital lobes; prefrontal cortex; The effect of hormones on the nervous System. Debate on heredity and environment: essential factors affecting human development.

Module III: Physical development across lifespan (11 Lectures)

Physical growth during childhood, adolescence and old-age brain development across lifespan, Bio- Psycho- Social health model, aging, biological theories of aging and death.

Discussion on educational implications of stages of physical development.

Module IV: Emotional and Moral Development (12 Lectures)

Development of Emotion, Temperament, Attachment, Love, intimacy, sexuality, self-identity, gender identity and personality across the life span.

Theories of moral development. Changes in moral reasoning (Kohlberg 's Theory). Development of values, Religion, Spirituality and Meaning in Life, Fowler 's Theory

'Emotions are springs of human actions'- A group discussion on teachers' role in bringing about balanced emotional development of students.

Suggested Readings

Berk, L.E. Child Development. New Delhi: Prentice Hall.

Bhaskar, R. Fundamentals of child psychology. Delhi: Swastik Publishers and Distributors.

Carlson, N.R. Physiology of behaviour. Boston.

Chatterjee, C., Suhita, P., Priyadarshi, C. and Vijayaraghavan, M. (Eds). Discourses on Aging and Dying. Los Angeles: Sage.

Hurlock, E.B. Child development. New Delhi: Tata McGraw-Hill Publishing Company Limited.

Hurlock, E.B. A Life-Span Approach. New Delhi :Tata McGraw-Hill Publishing Company Limited.

Leukel, F. Introduction to physiological psychology. New Delhi: CPS Publishers.

Mallon, B. Dying, death and grief, working with adult bereavement. Los Angeles: Sage.

Mishra, A.K. Psychology of Aging. Jaipur: Sublime Publications.

Morgan, T.H and Steller, A. (1965). Physiological Psychology. New York: McGraw Hill.

Santrock, J.W. Life –Span development. New Delhi: Tata McGraw-Hill.

Santrock, J.W. Child Development. New Delhi: Tata McGraw-Hill Edition.

Sharma, R. N. and Sharma, R. Child Psychology. New Delhi: Atlantic.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			M
CO 2		H		H
CO 3	H	H		
CO 4	M	H	H	H
CO 5	H			
CO 6				H

EDLI0028: LEARNING AND INDIVIDUAL DIFFERENCES (3-0-0)

COURSE OUTCOMES

Recognize the concept, nature, process, laws, types, and methods of learning. (remembering)

Understand the relationship of learning with interest, motivation, maturation, and individual difference.

(Understanding)

Analyse various factors influencing learning. (Analysis)

Apply the laws and theories of learning, use components of learning to solve problems, and utilize the knowledge of individual differences to facilitate adequate provisions. (Application)

Evaluate the educational implications of learning and effectiveness of learning styles. (Evaluation)

Create a conducive environment of learning. (Creation)

Module I: Understanding Learning (10 Lectures)

Learning: Concept and Scope; Nature of learning: learning as a process and learning as an outcome; Laws of learning; Types of learning: factual, associations, conceptual, procedural, generalizations, principles and rules; Methods of effective learning; Learning curves - Types, features and its educational implications; Plateaus in Learning; Learning styles. Students analyze their own learning styles.

Module II: Factors Influencing Learning (12 Lectures)

Factors influencing learning - Intellectual, Emotional, Physical and Social; Concept and nature of attention, determinants of attention, relationship with interest; Concept, nature and types of motivation – intrinsic, extrinsic and achievement; Learning and maturation; Learning to think, reason and solve problems. Discuss the role of a teacher in addressing various factors influencing learning.

Module III: Transfer of learning (10 Lectures)

Transfer of learning - Concept, Importance, Nature; Types of transfer of learning; Theories of transfer of learning - Theory of mental discipline, Theory of identical elements, Theory of generalization and theory of ideals; Methods of enhancing transfer of learning.

Developing a narrative of personal experiences on the basis of transfer of learning in various situations.

Module IV: Individual Difference (13 Lectures)

Concept of individual difference; Dimensions of individual difference; Determinants: Role of heredity and environment, their inter-relationship; Types/varieties of individual differences - Physical, mental, motor, emotional, interest and aptitude, attitudes, social and moral development. Individual difference and education; Influence of individual differences on learning outcomes; Provisions for individual differences in educational institutions; Implications of individual differences for organizing educational programmes. Sharing session on the problems and issues related to individual differences as faced by the students.

Suggested Readings

Bhatnagar, S. Advanced Educational Psychology. Agra: Bhargava Book House.

Chand, T. Educational Psychology. Agra: Bhargava Book House.

Crow, R.B. & Crow, A. Educational Psychology. New Delhi: Eurasia Publishing House.

Decece, J. P. The Psychology of Learning & Instruction. New Delhi, Prentice Hall.

Dhir, R.N. Educational Psychology. Chandigarh: Abhishek Publication.

Driscoll, M. P. Psychology of Learning for Instruction. Boston, Allyn and Bacon.

Gagne, R. M. The Conditions of Learning. New York, Rinehart & Winston.

Guilford, J.P. The Nature of Human Intelligence. New York: McGraw Hill.

Hall, C & Hall, E. Human relations in education. Routledge.

Holt, J. How children fail? Penguin.

Hulac, D. M., & Benson, N. Getting Students to Work Smarter and Harder: Decreasing Off- Task Behaviour through Interpersonal Techniques. School Psychology Forum, 5(1), 29-36.

Judd, C.H. Educational Psychology, Guwahati: Nivedita DK Distributions.

Kumar, K. What is worth teaching? Orient Black Swan.

Kuppuswamy, B. Advanced Educational Psychology. Jalandhar: Jalandhar University.

M. Gauvain & M. Cole, (Eds). Readings on the development of children. New York: W. H. Freeman & Co.

Mangal, S. K. Essentials of Teaching Learning and Information Technology. Ludhiana: Tandon Publishers.

Mapping of COs to Syllabus

Course comes	Out-	Module I	Module II	Module III	Module IV
CO 1		H			
CO 2			H		H
CO 3			H		
CO 4		H	H	H	
CO 5		H	H	H	H
CO 6			M	M	M

EDOC0029: ORGANISATIONAL COMMUNICATION (4-0-0)**COURSE OUTCOMES**

Understand the concept, scope, importance, process, types, advantages, and barriers of communication in an organization. (Understanding)

Apply skills of presentation utilizing visual aids, implement decision making techniques for effective communication. (Application)

Analyse the communicative dimensions of team work and violation of professional boundaries. (Analysis)

Create and draft business letters and design and develop conflict management strategies. (Creation)

Understand the concept, need, significance, and execution of administrative feedback in organizational communication. (Understanding)

Evaluate the modes of effective communication and feedback models in an organization. (Evaluation)

Module I: Conceptual Framework of Communication (10 lectures)

Concept and functions of Communication; Communication and four senses; Communication process, communication model and its elements; scope of communication

Module II: Organisational Communication (12 lectures)

Relationship between Organisation and Communication; common modes of communication in an organisation: writing, conversation, reading, media, charts, proceedings, T.V. telephone, e-mail and other modes of communication; Formal and informal communication; practical approaches in understanding administrative communication: cross communication, downward communication, upward communication

Module III: Communication Techniques (13 lectures)

Presentation skills, effective use of voice in presentation: articulation, tone, pitch; making effective presentations; use of visual aids in presentation; communication in teams: project teams, quality improvement teams, virtual teams; communicative dimension of team work- roles, norms, decision- making processes and management of conflict.

Module IV: Feedback and professional boundaries (10 lectures)

Feedback, Administrative feedback, models of feedback, assessing the listening skills; maintaining Professional Communication- professional boundaries, violation and maintaining of boundaries

Suggested Readings

Baker, G.S. Fitly Spoken: Developing Effective communication and social skills. NewYork: Paperback.

Gillis, T. The IABC Handbook of organisational communication: A guide to internal communication, public relations, Marketing and Leadership. New York: Jossey-Bass.

Hardman, E. Active Listening 101: How to turn down your volume to turn up your communication skills.

Hargie, O. Skilled Interpersonal Communication: Research Theory and Practice.London: Routledge.

Harris, E. T. and Nelson, D. M. Applied Organisational Communication: Theory and practice in a global environment.

London: Routledge.

Krishnamacharyulu, R. & Lalitha. Business communication: Global Media.

Lewis K. L. Organisation change: Creating change through strategies communication. New York. Wiley.
 Miller, K. Organisational Communication: Approaches and Processes: London: Wadsworth Publishing.
 Tourish, D and Hargie, O. Key Issues in organizational communication. London: Routledge.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		H	H	
CO 3		H	H	
CO 4		H	H	
CO 5				H
CO 6				H

SPECIALIZATION: EDUCATIONAL LEADERSHIP

EDEA0030: EDUCATIONAL ADMINISTRATION (3-0-0)

COURSE OUTCOMES

Recognize the nature, scope, objectives, significance, and elements of educational administration.

(Remembering)

Understand the characteristics of successful and democratic administration along with understanding the concept of school, school management, supervision and its features, evaluation and its principles, and role of headmaster and teachers in school management. (Understanding)

Apply democratic educational administration in practical situations and the principles of evaluation in supervisory works. (Application)

Analyse the duties of educational administrators/school managers including headmaster and teachers. (Analysis)

Evaluate democratic administration, functional basis of supervision, and roles of educational administrators. (Evaluation)

Utilize creative ways towards infrastructural resource management and supervisory programmes. (Creation)

Module I: Conceptual Framework of Educational Administration (12 Lectures)

Nature and scope of educational administration; Objectives of educational administration; Elements of educational administration; Characteristics of successful administration; Democratic administration.

Module II: School Management (10 Lectures)

Concept of School; Need of school; School management; Headmaster/Principal as the school manager and her/his qualities; Role of teachers and community in school management; Infrastructural resource management.

Module III: Concept of Supervision (12 Lectures)

Meaning of supervision; Difference between supervision and administration; Effective supervision; Functional basis of supervision; Supervision as leadership. Module IV: Evaluation and Supervision (11 Lectures) Concept of evaluation; Principles of evaluation; Evaluation of supervisory programme; Evaluation of Educational administrative programme; Evaluation as a continuous programme for quality improvement.

Suggested Readings

Adams, H.P & Duckey, F.G. Basic Principles of supervision.

Arif, S., & Sohail, A. What Really Works in Leading a School? International Journal of Learning, 16(10), 695-707.

Boghossian, P. Behaviorism, Constructivism, and Socratic Pedagogy. Educational Philosophy & Theory, 38(6), 713-722.

Cara, C. The Power of One with Many Revisited: Creating Inclusive, Accessible, Collaborative Education for All. *International Journal of Learning*, 14(8), 221-233.

Chandler, L. Design Dynamics and Mastery: A Multi-modal Teaching Tool for Design Students. *International Journal of Learning*, 14(5), 51-57.

Donahoo, S. & Hunter, R. Teaching Leaders to Lead Teachers: Educational Administration in the Era of Constant Crisis. *Advances in Educational Administration*, Volume 10, 1–4. Elsevier Ltd.

English, F. (ed.). *Encyclopedia Educational leadership and Administration* (Vol.1), Sage Publication: Thousand Oaks.

Stanley, A. G. & Samier, E. A. *Political Approaches to Educational Administration and Leadership*. Routledge: New York.

Starratt, R. *Centering Educational Administration: Cultivating Meaning, Community, and Responsibility*. Lawrence Erlbaum Associates, Publishers: New Jersey

Tarc, A. Education as Humanism of the Other. *Educational Philosophy & Theory*, 37(6), 833- 849.

White, R. & Cooper, K. (Ed.). *Principals in Succession Transfer and Rotation in Educational Administration*. Springer: New York.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	H	
CO 3	H		M	H
CO 4		H	M	
CO 5	H	H	H	
CO 6		H		H

EDSR0031: ETHICS AND SOCIAL RESPONSIBILITY IN EDUCATION (3-0-0)

COURSE OUTCOMES

Recognize the meaning, need, and components of ethics and value, identify the significance of values and morals along with types of ego, and meaning, need, role, and types of social responsibility.

(Remembering)

Understand the theoretical perspectives of ethics and social responsibility, relationship of educational ethics with gender and leadership, and significance of teaching profession. (Understanding)

Evaluate the strategies of social responsibility and role of ethics in a workplace. (Evaluation)

Apply the criteria of profession and UGC's code of conduct for teachers. (Application)

Analyze the influence of globalization on ethics and developmental activities and importance of code of conduct. (Analysis)

Mitigate the problems encountered in the process of delivering social responsibility. (Creation)

Module I: Educational Ethics (9 Lectures)

Concept of Ethics and educational ethics; Need of ethics in educational settings; Components of ethics; types of values, morals.

Module II: Theoretical Perspectives of ethics (12 Lectures)

Ethical theories: Utilitarianism, Kantian ethics, Natural rights theories; religious ethics; virtue ethics; Kantian vs utilitarian; gender and ethics; ethics and leadership. Concept of ego: psychological, ethical, rational. Moral philosophy.

Module III: Ethics and Social Responsibilities (12 Lectures)

Concept of social responsibility; Need of social responsibility; Types of social responsibility; Social responsibility of educators; Strategies of social responsibility.

Module IV: Professional Development (12 Lectures)

Concept of profession; Criteria for a profession; Teaching as a profession; Workplace and code of conduct, Technology and globalization in relation to professional ethics and developmental activities.

Suggested Readings

Hill, I. Curriculum Development and Ethics in International Education: Education for Disarmament, pp 49-58. Retrieved from Disarmament Forum.

Raina, R. Situating Ethics in Technology and Science, Economic and Political Weekly, June 5, (vol xlv no 23).

Roddick, A. Professionalism and Ethics. In Understanding Facilitation: Theory and Principles (pp 189 - 216). Christine Hogan. London: Kogan Page.

Sikand, Y. Deoband's Fatwas on Muslim Women, Economic and Political Weekly. May 22, (vol xlv no 21).

Sreekumar, N. Ethics, profession and developmental concerns, Economic and Political. Weekly June 26.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	H	
CO 2		H		M
CO 3			H	H
CO 4				H
CO 5				H
CO 6			H	

SPECIALIZATION: EDUCATIONAL PSYCHOLOGY**EDSP0032: COUNSELLING SKILLS FOR EDUCATIONAL PSYCHOLOGISTS (3-0-0)****COURSE OUTCOMES**

State the meaning, nature, objectives, scope, process, types, and approaches of counseling. (Remembering)

Explain various theories of counseling and understand the concept, need, and skills of educational psychologists. (Understanding)

Apply the theories and tools and techniques of counseling. (Application)

Assess the skills of counseling and role of teacher as a counselor. (Evaluation)

Analyze the theories of counseling and various types of guidance. (Analysis)

Create the tools and techniques to be used for student counseling and improvise teachers' role in counseling process. (Creation)

Module I: Introduction to Counselling (12 Lectures)

Meaning, nature, objectives and scope of counselling; counselling as a process: factors affecting counselling process, stages of counselling process; types: individual and group; approaches of counselling: Directive, Non-directive and Eclectic Counselling.

Module II: Theories of Counselling (12 Lectures)

Gestalt Counselling; Psychoanalytic Counselling; Cognitive Psychologists; Personality -Cattle's Truth Theory; Behavioral Counselling.

Module III: Introduction to Educational Psychologists (11 Lectures)

Concept of Educational psychologists; need of educational psychologists; educational psychology as a career; key skills for educational psychologists; concept of guidance, need and types of guidance; guidance and counselling services; tools and techniques to be used for student counselling process.

Module IV: Teacher as a Guide and Counsellor (10 Lectures)

Role of teacher as an educational psychologist; guidance worker and counsellor; Counselling skills: Building trust, Listening, Attending, Building rapport, Demonstrating Empathy, Observing; Difference between counsellors, educational psychologists, clinical psychologists.

Suggested Readings

Kinra, K. K. Guidance and Counselling, Pearson India (2008).
 Alam, Shah. Basics of Guidance and Counselling, Global Vision Publishing House (2008).
 Hansen, J. C. Counseling Process and Procedures. New York: Macmillan.(1982).
 Madhukar, I. Guidance and Counseling. Authors Press.(2000).
 NCERT. Guidance and Counseling. Module –I, NCERT, New Delhi (2009).
 NCERT. Guidance and Counseling, Module –II NCERT, New Delhi (2009).
 NCERT. Guidance and Counseling. Module –IX NCERT, New Delhi (2009).
 Oberoi, S.C. Guidance and Counseling. Paperback, R.Lall publishers (2016).
 Pandey, V.C. Educational Guidance and Counseling. Isha Books(2005).
 Rao, S.N. Counseling and Guidance, McGraw Hill Education (1993).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2		H	H	
CO 3		H	H	
CO 4				H
CO 5		H	H	
CO 6			H	H

EDCA0033: CHILD AND ADOLESCENT MENTAL HEALTH (3-0-0)**COURSE OUTCOMES**

Recognize the historical background of mental health, objectives, scope, and need of mental health, factors affecting mental health of children and adolescents, and the characteristics of a mentally healthy person. (Remembering)

Explain the factors affecting mental health in childhood, the features of adolescents, and the role of parents and teachers in these regards. (Understanding)

Apply solutions to various problems pertaining to mental health of child and adolescents. (Application)

Evaluate problem behaviours among children and adolescents. (Evaluation)

Analyze the status of mental health of school going children and adolescents and the best practices in mental health care. (Analysis)

Create awareness among the students about mental health of children and adolescents and develop preventive measures for mental health by designing a mental health system. (Creation)

Module I: Introduction to Mental Health (11 Lectures)

Concept of mental health: Historical background of mental health, objectives, scope, and need of mental health, factors affecting mental health; characteristics of a mentally healthy person; Mental health promotion, preventive intervention & treatment.

Module II: Mental Health as a Primary Health Concern among children (12 Lectures)

Childhood as critical stage of development: Child mental health as a primary health concern, factors affecting child mental health; Children with problem behaviours and developmental difficulties- language difficulties, Autism, Need for a comprehensive mental health system; Integrated approaches to early childhood mental health; Government policies and programs addressing childhood well-being.

Module III: Mental Health as a Concern among Adolescents (12 Lectures)

Concept of adolescents and adolescence, Adolescence as a period and its characteristics, Adolescence as period of stress and storm; Indicators of mental health development among adolescents, Introduction to problem behaviours among adolescents - delinquency, anxiety, conflict, stress, depression, drug abuse, substance abuse, alcoholism, adjustment mechanisms.

Module IV: Education and Mental Health (10 Lectures)

Mental health services in schools; child guidance clinic; Role of parents and teachers in fostering mental health among children and adolescents; promoting psychological well-being among children and adolescents; guidance and counseling.

Suggested Readings

Chauhan, S.S. (2010). Advanced Educational Psychology, Noida. Vikas Publishing House Pvt. Ltd.
 Goswamee, G. (2008) Child Development and Child Care. Guwahati: Arun Prakashan.
 Hadfield, J.A., (1952) Psychology and Mental Health, A Contribution to developmental Psychology, George Allen & Unwind.
 Kapur, M. (1995) Mental Health of Indian Children. New Delhi: Sage Publications.
 NCERT. (2009) Developing Mental Health and Coping Skills, Module 10, NCERT, New Delhi.
 Nayar, S. U. (2012) Child and Adolescent Mental Health. New Delhi: Sage Publications.
 Sharma, N. (1999) Understanding Adolescence. New Delhi. National Book Trust, India.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H			
CO 2	H		H	H
CO 3	H		H	H
CO 4		H	H	
CO 5	M		M	H
CO 6	H	H		

EDRM0034: RESEARCH METHODOLOGY IN EDUCATION (4-0-0)**COURSE OUTCOMES**

Describe the conceptual framework of Research process. (Understanding)
 Explain the methods and designs in Educational Research. (Analysis)
 Apply and interpret the tools and techniques of research. (Application)
 Examine the organization and analysis of data. (Remembering)
 Analyze the application of statistics in Educational research. (Application)
 Design and develop the synopsis and thesis writing. (Creation)

Module I: Introduction to Research in Education (13 Lectures)

Meaning and nature of research; Methods of Acquiring knowledge; Types of Research: Fundamental, applied, action research; Quantitative, Qualitative research; Principles and scope of Research in education; Scientific method and process of research; Preparation of synopsis for any research work in education; Ethics of Research.

Module II: Methods and Designs in Educational Research (14 Lectures)

General steps of research; review of related literature; Concept of Research Design and Types of designs; Methods of Educational Research: Historical, Survey, experimental, case study; Concept of hypotheses, Types and Testing hypotheses, Levels of significance, Fiduciary limits, Type I and Type II Errors.

Module III: Sampling and Tools of Research in Education (16 Lectures)

Concepts of Population and sample; Probability and Non-Probability sampling; Sample size and features of a good sample, Sampling Error; Tools of Research: Achievement Test, Intelligence Test, Observation, Interviews, Questionnaires, Attitude scale; Process of Development of tools; Nature of data and sources of data.

Module IV: Statistics in Educational Research (17 Lectures)

Concept, significance and functions of statistics; Measures of Central Tendency and measures of Variability; Coefficient of correlation: Product moment and rank difference method, Applications of z-test, t-test and f-test, Chi-square, median test, sign test, Report writing.

Suggested Readings

Check, J. and Schutt, R.K: Research methods in Education, Sage Publication, New Delhi (2014).
 Broota, K. D: Experimental Design in Behavioural Research, New Age International Publisher, New Delhi. (2010).
 Mohanti, B. & Misra, S.: Statistics For Behavioural and Social Science, Sage Publication, India Pvt Ltd, New Delhi. (2016).
 Ferguson, G. A Statistical Analysis in Psychology and Education, Mc Graw Mill, New York. (1981).
 Garrett, H. E. Statistics in Psychology and Education, Vikils, Feiffer and Semen's Ltd, Bombay (1998).
 Koul, L. Methodology of Research in Education, Vikash Publications, New Delhi (2009).
 Mangal, S.K and Mangal, S. Research Methodology in Behavioural Sciences, PHI Pvt, Ltd, Delhi (2013).
 Best, J.W. & Kahn, J. V: Research in Education, PrenticeHall of India, New Delhi. (2006).
 Edward, A. L. Techniques of Attitude scale construction, Appelton century crofts, Inc, New York (1957).
 Mangal, S.K: Statistics in Psychology and Education, Prentice Hall of India, New Delhi (2002).
 Cohen, L & Manion, L.: Research Methods in Education, London: Routledge. (1994).
 Guilford, J.P: Fundamental statistics in Psychology and Education, McGraw Hill Book co New York. (1995).

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H		
CO 2		H		H
CO 3	H		H	
CO 4			H	
CO 5				H
CO6				H

EDFE0035: PHILOSOPHICAL FOUNDATIONS OF EDUCATION (4-0-0)**COURSE OUTCOMES**

CO 1: To inculcate awareness about the nature of philosophy and educational philosophy among the students
 CO 2: To make the students well aware of the Indian philosophical thoughts in education
 CO 3: To make the students well aware of the Western philosophical thoughts in education
 CO 4: To make the students learn and understand the contribution of Indian and Western Thinkers in the field of education

Module I: Introduction to Philosophy and Educational Philosophy (15 lectures)

Philosophy: Definition, Concept, Branches of philosophy and its educational implications, Functions of philosophy, Knowledge: Concept, nature, types, theories; Education: Narrow and Wider Meaning, nature, Goals of Education in the 21st century, Relationship between philosophy and Education, Functions of Educational Philosophy.

National values as enshrined in the Indian constitution- socialism, secularism, justice, liberty, democracy, equality, freedom with special reference to education.

Module II: Indian Schools of Thought (15 lectures)

Astika and Nastika; Sankhya, Yoga, Vedanta, Buddhism, Jainism, with special reference to vidya; Dayanand Darshan. Islamic traditions: its educational aims and methods of acquiring valid knowledge.

Module III: Western Philosophical Thought (15 Lectures)

Some major schools; Naturalism, Idealism, Rationalism, Pragmatism, Realism, Existentialism, Marxism and - Their educational implications with special reference to epistemology, axiology and the process of education.

Module IV: Contribution of Thinkers to the development of Educational thought for Social Change (15 Lectures)

Indian: Vivekananda, Tagore, Gandhi, Aurobindo, J. Krishnamurty, and Savitribai Phule

Western: Paulo Freire, Nel Noddings and Wollstonecraft

Social Philosophy of Education – Freedom, Equality, Democracy and Education.

References

Bhayrappa, S.L.(1988): Values on Modern Indian Educational Thoughts, NCERT, New Delhi.

Brammel, D.T.(1971) : Patterns of Educational Philosophy, Runehart and Winston, New York.

Das, A & Das, A. J. (2021, June). Educational Contribution of Savitribai Phule in 21st Century India. International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, (4), pp.1281-1286, URL: www.ijtsrd.com/papers/ijtsrd42547.pdf

Delors, Jacques, et al; (1996). Learning: The Treasure within report of the international commission on education for 21st century, UNESCO.

Dupius, A.M (1972): Philosophy of Education in Historical Perspective, Thomson Press, New Delhi.

Freire, P. (1971). Pedagogy of the oppressed. New York: Herder And Herder.

Moore, T. W. (2010). Philosophy of Education: An introduction. Routledge, New York.

Radhakrishnan. S. (2008). Indian Philosophy. Vol. 1. 2nd edn. USA: Oxford University Press .

Radhakrishnan. S. (2008). Indian Philosophy. Vol. 2. 2nd edn. USA: Oxford University Press .

Shivendra, C. S. (2006). Philosophy of Education. Atlantic publishers and Distributers.

https://www.google.co.in/books/edition/Philosophy_of_Education/u6UQJ1sWrQoC?hl=en&qbpv=1&dq=functions+of+philosophy+of+education&printsec=frontcover

Wollstonecraft, M. (1792). A Vindication of the Rights of Women.

<https://www.gutenberg.org/ebooks/3420>

Mapping of COs to syllabus

COs	MODULE I	MODULE II	MODULE III	MODULE IV
CO1	H	M	M	M
CO2	M	H	M	M
CO3	M	M	H	M
CO4	M	M	M	H

EDEP0036: FUNDAMENTALS OF EDUCATIONAL PSYCHOLOGY (4-0-0)

COURSE OUTCOMES

CO 1: To make the students aware of the nature of educational psychology

CO 2: To learn about the nature of human development and personality as an important segment of any individual

CO 3: To create understanding about the conceptual framework of learning and intelligence

CO 4: To create awareness among the students about concepts of thinking process and creativity of individuals

Module I: Introduction to Educational Psychology (10 Hours)

Educational Psychology: concept, nature, concerns and scope, methods, and functions of educational psychology

Module II: Human Development and Personality (15 Hours)

Human growth and development: Concept, principle, factors influencing development and their relative role; Theories of growth and development; Piaget, Bruner, Erickson and Kohlberg – their educational implications.

Personality: Concept, Nature, Determinants, Theories: Freud, Carl Rogers, Gordon Allport, Max Wertheimer and Kurt Koffka; Assessment-Projective techniques

Module III: Learning and Intelligence (20 Hours)

Learning: Concept, Theories of Learning: trial and error, classical conditioning, operant conditioning Gagne's theory of learning, Carl Roger's theory of learning and field theory of learning; cognitive view point and information processing; Educational implications of the view points on learning;

Intelligence: Concept, Nature, Intelligence Quotient; Theories: Unitary theory, Two factor theory, SOI Model, Gardner's theory of multiple intelligence, Sternberg's Information Processing theory of intelligence; Assessment of Intelligence; Concept of Social Intelligence, Emotional Intelligence- Concept, Characteristics of an Emotionally intelligent person, Importance of Emotional Intelligence, Emotional Quotient.

Module IV: Problem solving, Thinking, Metacognition and Creativity (15 Hours)

Problem Solving: Meaning and Definition, Steps in Problem Solving, Factors affecting Problem Solving, and Strategies for Problem Solving.

Thinking: Definition and concept, nature, Theories, Tools, Types, Training for Development of thinking.

Metacognition: Concept, Strategies to develop students' Metacognition in the classroom

Creativity: Concept, Nature, Theories, The creative process, Assessment of creativity, Strategies to foster and develop creativity.

Suggested Readings

Bhatnagar, S. Advanced Educational Psychology, Agra: Bhargava Book House (2002).

Chand, T. Educational Psychology, Agra: Bhargava Book House (2002).

Cheng, E. C. K. (2021). Developing Metacognitive Teaching Strategies Through Lesson Study. Singapore, Springer.

https://www.google.co.in/books/edition/Developing_Metacognitive_Teaching_Strate/tNxFE-AAAQBAJ?hl=en&gbpv=0

Crow, R.B. and Crow, A. Educational Psychology, New Delhi: Eurasia Publishing House (1964).

Decece, J.P. The Psychology of Learning and Instruction, New Delhi: Prentice Hall (1970).

Dhir, R.N. Educational Psychology, Chandigarh: Abhishek Publication (2002).

Ewen R. B. An Introduction to the theories of personality, 7th Edition. New York: Psychology press (2010).

Guilford, J.P. The Nature of Human Intelligence, New York: McGraw Hill (1967).

Judd, C.H. Educational Psychology, Guwahati: Nivedita DK Distributions (2002).

Kuppuswamy, B. Advanced Educational Psychology, Jalandhar: Jalandhar University Publications (1963).

Mukunda, K. V. What did you ask at school today? A handbook of child learning. Noida, UP: HarperCollins, 371 (2009).

Rao, K.R., Parajpe, A.C. and Dalal, A.K. (Ed). . Handbook of Indian Psychology, New Delhi: Cambridge University Press India (2008).

Reynolds, W. M and Miller, G. E. . Current perspectives in Educational Psychology. In Handbook of Psychology Vol. VII (ed.) Irving B. Weiner. Canada: John Wiley and Sons, Inc (2003).

Rogers, C. Transition, self-regulation, independent learning and goal theory. Psychology of Education Review, 36(2), 26-31 (2012).

Sahoo, F.M. Psychology in Indian Context, Agra: Bhargava Book House (2002).

Sharma, R.N. Educational Psychology, Guwahati: DVS Publication (2002).

Sternberg, R.J. Contemporary Theories of Intelligence. In Handbook of Psychology Vol. VII (ed.)

Irving B. Weiner. Canada: John Wiley and Sons, Inc (2003).

Swiderski, S. M. Transforming Principles into Practice: Using Cognitive Active Learning Strategies in the High School Classroom. Clearing House (2011), 84(6), 239-243. doi:10.1080/000986 5.2011.590549.

Weinstein, C., Acee, T. W., and JaeHak, J. Self-regulation and learning strategies. New Directions For Teaching and Learning (2011), 2011(126), 45-53. doi:10.1002/tl.443.

Mapping of COs to syllabus

COs	M1	M2	M3	M4
CO1	H	M	M	M
CO2	M	H	M	M
CO3	M	M	H	M
CO4	M	M	M	H

EDPC0037: PEACE EDUCATION AND CONFLICT MANAGEMENT (3-0-0)

COURSE OUTCOMES

Describe the importance and relevance of peace education (Application)

Explain the concept of peace as held by different thinkers and other religious beliefs. (Analysis)

Discuss the awareness of the modes and methods for conflict management. (Application)

Compare the global issues and peace movements. (Evaluation)

Narrate the various methods of conflict Management. (Application)

Describe the theories of Peace. (Analysis)

Module I: Understanding peace as a dynamic social reality (16 lectures)

Basic concepts of Peace and Peace Education; nature, meaning, objectives. Theories of peace – democratic peace and active peace; Role of social organizations: Family, Religion, Mass Media, Community, School

Some thinkers on harmony: Dalai Lama, Gandhi, Mother Teresa; Concept of peace education; peace teacher, peace method and other enabling practices in an educational setting.

Module II: Conflict management and its methods (7 lectures)

Meaning, types, levels and factors for conflict; methods and modes of conflict resolution - mediation, negotiation, diplomacy, coercive methods; creative peace building, cross cultural methods.

Module III: Global issues and peace movements (7 lectures)

Human rights, population control, non-alignment movement, campaign for nuclear disarmament and role of world organizations in promoting peace.

Module IV: Practicum (30 lecture)

Any two activities to be conducted from the following

Field visit to place/organization-government/non-government working towards building peace

Exhibition on Peace related themes

Strategies to create peace building: Meditation, Yoga, Dramatization, Debate

Thematic analysis on documentary based on peace

Organise workshop on peace/ awareness programme on social marginalisation.

Suggested Readings

Dalai Lama. The joy of living and dying in peace. (ed.) Donald S. Lopez. Jr. Dharamsala: Tibetan and Archives (1998).

Diwaha, R. R. and Agarwal, M. (Ed). . Peace education. New Delhi: Gandhi Marg (1984).

Doyle, M. W. Liberal peace: Selected essays. London and New York: Routledge (2012).

- Duckworth, C. Teaching peace: a dialogue on the Montessori method. *Journal of Peace Education*(2006), 3(1), 39-53.
- Fountain, S. Peace education in UNICEF. New York: UNICEF (1999).
- Gat, A. The Democratic peace theory reframed: The impact of modernity. *World Politics* (2005), 58, pp. 73-100.
- Girard, K. Preparing teachers for conflict resolution in the schools. Washington, DC: ERIC Clearinghouse on Teaching and Teacher Education (1995).
- Hopper, B. Peace education and years 1to 10 studies of society and environment key learning Area. Queensland: Queensland School Curriculum Council.(2002).
- Johan, G. Peace by peaceful means. New Delhi: Sage Publication.(1996).
- Krishnamurti, J. (n.d). Education and Significance of life. Retrieved from <http://www.jkrishnamurti.org/krishnamurtiteachings/view-text.php?tid=51&chid=66876>.
- Layne, C. Kant or Cant: The Myth of the Democratic Peace. *International Security*, Vol. 19. Issue 2, pp. 5-49.(1994).
- Montessori, M. Peace and Education. India: The Theosophical Publishing House (1943).
- Morrison, M. L. Peace Education. Australia: McFarland(2003).
- Nair, G. Peace education and conflict Resolution in school. *Health Administrator* Vol. XVII, Number 1:38-42 (1997).
- Pant, D. and Gulati, S. Ways to peace: a resource book for teachers. New Delhi: National Council of Educational Research and Training (2014).
- Salomon, G., & Nevo, B. Peace Education: The Concept, Principles, and Practices around the World. London: Lawrence Erlbaum Associates(2002).
- Sheean, V. Mahatma Gandhi, a great life in brief. New Delhi: Random House.(1955).
- UNESCO. Peace Education: Framework for Teacher Education. New Delhi: UNESCO (2005).

Mapping of COs to Syllabus

	Module I	Module II	Module III	Module IV
CO 1	H	M	H	
CO 2	M	H		H
CO 3	H		H	
CO 4	H		H	
CO 5		H		H
CO 6	M			H

EDSF0038: SOCIOLOGICAL FOUNDATIONS OF EDUCATION (4-0-0)

COURSE OUTCOMES

- CO 1: To make the students aware of the nature of sociology of education and social institutions
- CO 2: To understand and summarize the contributions of different theoretical perspectives on better understanding of the society
- CO 3: To assess the various aspects of school as a social institution
- CO 4: To create awareness about the cross-national perspectives on the sociology of education and modern Indian society

MODULE I: SOCIOLOGY OF EDUCATION (15 lectures)

Concept and nature of sociology of education; Difference between sociology of education and educational sociology; Social institutions and their functions: Social Groups; Social Organization; Social Stratification; Social Change

MODULE II: THEORETICAL PERSPECTIVE OF EDUCATIONAL SOCIOLOGY (15 Lectures)

Theoretical approaches to educational sociology: Standpoint Theory, theory of social learning by Bandura, Conflict Theory, Structural Functionalism, Symbolic Interaction Theory, Theories of Social Movements- Relative Deprivation, Resource Mobilization, Political Process Theory

MODULE III: SCHOOL AS A SOCIAL INSTITUTION (15 Lectures)

School as a social institution; School as an organization; Social mobility by means of education; Organisational climate types, classroom climate and its impact; Social aspects of education; Role of schools in modern society; Role of modern mass communication media in education

MODULE IV: CROSS-NATIONAL PERSPECTIVES ON THE SOCIOLOGY OF EDUCATION AND MODERN INDIAN SOCIETY (15 Lectures)

Culture - Conceptual understanding of culture, Role of education in cultural context; Education and cultural change; Modern Indian Society: Globalization, Liberalization, Privatization, Modernization, Westernization; Constitutional Provisions; National Integration and International understanding

SUGGESTED READINGS

- Below, S. V., Powell, J. J., & Roberts, L. W. Educational Systems and Rising Inequality: Eastern Germany after Unification. *Sociology of Education*, 86 (4), 362-375. (2013)
- Binder, A. J. Sociology of Education's Cultural, Organizational, and Societal Turn. *Sociology of Education*, 86(4), 282-283. (2013)
- Bose, S. A Contextual Analysis of Gender Disparity in Education in India: Women's Status and Community. *Sociological Perspectives*, 55(1), 67-91. (2012)
- Brown, F.J. *Educational Sociology*, Prentice Hall of India, New Delhi.
- Clinard, M. B., & Elder, J. W. *Sociology in India: A Study in the Sociology of Knowledge*. *American Sociological Review*, 30(4), 581-587. (1965)
- Damle, Y. B. *Sociology in India: its teaching and status*. *International Social Science Journal*, 26(2), 343-348. (1974).
- Goel, S. K. Education, Training, and Rehabilitation of the Handicapped in India. *Retrospect and Prospect. Education & Society*, 8(1), 21-29. (1990)
- Harding, O. J. Rethinking the Cultural Context of Schooling Decisionism Disadvantaged Neighborhoods: From Deviant Subculture to Cultural Heterogeneity. *Sociology of Education*, 84(4), 322-339. (2011)
- Hodkinson, A., & Devarakonda, C. Conceptions of inclusion and inclusive education: A critical examination of the perspectives and practices of teachers in India, *Research in Education*, (82), 85-99. (2009)
- MacIver and Page- *Society: An Introductory Analysis*, Macmillan.
- Nakamura, T. Sociologization, Pedagogization, and Resocialization: Has the Post-war Japanese Sociology of Education Suffered from the Galapagos Syndrome? *International Journal of Japanese Sociology*, 22(1), 64-79. (2013)
- Sharma, C. L. Crisis of Character in India: The Need for Moral Education. *Education & Society*, 8(1), 64-73. (1990)
- Smith R. Eliot et al., *Social Psychology*. U.S.A.: Taylor and Francis. (2000)
- Von Below, Powell, J. W., & Roberts, L. W. Educational Systems and Rising Inequality: Eastern Germany after Unification. *Sociology of Education*, 86(4), 362-375. (2013)
- Wright, R. The Fourth Sociology and Music Education: Towards Sociology of Integration. *Action, Criticism, and Theory for Music Education*, 13(1), 12-39. (2014)

MAPPING OF COs TO SYLLABUS

	Module I	Module II	Module III	Module IV
CO 1	H		H	
CO 2		M		
CO 3			H	
CO 4			H	
CO 5				H
CO6				H

EDCI0039: CURRICULUM DEVELOPMENT AND INSTRUCTION (3-0-0)**COURSE OUTCOMES**

Explain the nature of curriculum. (Application)

Describe the basis of curriculum development. (Analysis)

Distinguish the approaches of curriculum development. (Evaluation)

Mention the process of curriculum development. (Application)

Frame about the assessment of curriculum. (Remembering)

Distinguish the Factors influencing curriculum implementation. (Understanding)

Module I: Understanding curriculum (6 lectures)

Contemporary definition of curriculum; curriculum criteria, curriculum goals and values, basic principles of curriculum and instruction Brainstorming session on the issues and trends of school/college curriculum

Module II: Philosophical underpinnings of curriculum (15 lectures)

Curriculum types and Models of teaching: Social, Information Processing, Personalist, and Behavioral, Child-Centered, Society-Centered, Knowledge-Centered, or Eclectic; Goals and Philosophies of Education across changing education paradigms - Idealism, Realism, Perennialism, Essentialism, Experimentalism, Existentialism, Constructivism and Reconstructivism

Analysis of the philosophical underpinnings of the present day curriculum

Module III: Approaches to curriculum development (10 lectures)

Tagore, Gandhi, Krishnamurthy, Plato, Dewey, Montessori, Don Bosco, Freire.

Detailed discussion on the pedagogical approach of one of the above thinkers

Module IV: Curriculum development frameworks in 21st Century (6 lectures)

NCTE Framework for 21st Century Curriculum and Assessment; UNESCO - A Futures Perspective in the Curriculum, Learning

Environment, Skills, Assessment, Professional Development; Curriculum and Future - Concepts from Social Sciences A review of the NCTE framework for 21st century Curriculum and Assessment

Module V: Curriculum development and assessment (8 lectures)

Developing a curriculum document: Approach and organization, stages of curriculum development, guidelines of statutory bodies with regard to curriculum development – UGC, NCTE, NCF; Curriculum integration: disciplines, media and technology; evaluating and assessing a curriculum; Models of curriculum; Curriculum implementation - Factors influencing curriculum implementation

Suggested Readings

Dottrens, R. The Meaning of the Terms Curriculum and Syllabus, in The Primary School Curriculum, (France: UNESCO) pp 79-89.

Dewey, J. The School and Society in Society and Education, Introduction by Philip W. Jackson (Chicago: The University of Chicago Press)

- Pring, R. Curriculum Integration in The Curriculum: Content, Design and Development (ed), (London Institute of Education Bulletin, Spring). pp- 4-8.
- Tyler Ralph, W. Basic Principles of Curriculum and Instruction. (University of Chicago Press).
- Vallance, E. Hiding the Hidden Curriculum in Curriculum Theory Network. Stanford University 4:1, pp 5-21 6.
- Kumar, Krishna. Origins of India's 'Textbook Culture from Comparative Education Review 32(4) pp 452-464.
- Bruner, J. Folk Pedagogies. In Leach, Jenny and Moon, Bob (eds) Learners and Pedagogy (pp4-20). London: Paul Chapman Publishing in Association with the Open University.
- Keddie, Nell. Classroom Knowledge in Young, M. F. D. (ed), Knowledge and Control. (London: Collier Macmillan) 9. Coleman, J. The Concept of Equality of Educational Opportunity in Equality and Achievement in Education. (Boulder: Westview Press)
- Winch, C. Constructing Worthwhile Curricula in Quality and Education (Oxford: Blackwell) pp45-56
- Akkari, A. Socialization, Learning and Basic Education in Islamic Contexts in Educational Theories and Practices from Majority World (ed), Sage, New Delhi, pp220-244.
- Bernstein, B. Class and Pedagogies: Visible and Invisible in Karabel and Hasley (ed) Power and Ideology in Education, Oxford University Press
- Hoare. Q and Smith G. N. On Education in Selection from The Prison Notebook of Antonio Gramsci (ed), India: Orient Longman Pvt Ltd
- Freire, P. chapter 2 Pedagogy of the Oppressed, New York: Seabury Press
- Education for Poor: Quality and Relevance? British Journal of Sociology of Education 13(4)
- Kohlberg, L and Meyer, R. Development as the Aim of Education Harvard Educational review 42(4)
- Tanner, Laurel N. The Meaning of Curriculum in Dewey's Laboratory School (1896-1904) Journal of Curriculum Studies, 23(2) 101-117
- Kumar, K. What is Worth Teaching? In What is Worth Teaching. Hyderabad, Orient Longman

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H		H	
CO 2	H	H	M	H
CO 3	H	H	M	
CO 4	H		H	H
CO 5	M	M	H	
CO 6	M		M	H

EDJG6002: JOURNALING - A TECHNIQUE FOR PERSONAL AND ACADEMIC GROWTH (1-0-2) – Practicum

COURSE OUTCOMES

- Recall one's life experiences. (Remembering)
- Explain clearly and specifically one's life experiences. (Understanding)
- Develop the skill of writing. (Application)
- Analyze life experiences at a conscious level and enhance reflective thinking. (Analysis)
- Synthesize one's thoughts in an organized manner and create a new piece of writing. (Creation)

Journaling is a strategy for making sense of experiences. The objective of journaling is to develop in students a reflection that can be described as an inner dialogue with oneself whereby a person calls forth his or her own experiences, beliefs, and perceptions about an idea; informing and transforming functions of knowledge; and a conscious and systematic mode of thought. This is to nurture in future educational leaders a sense of reflective practice.

Each student is required to maintain a reflective journal, using the Visible Thinking Routine (Harvard), as a critical structure for guiding their journal writing. The students are to submit the journal every Friday. Journaling has to be done six days of the week. At the end of the semester, the student will be awarded a grade/marks after assessing the learning.

Suggested Readings

Davies, M. (2011). Concept mapping, mind mapping and argument mapping: what are the differences and do they matter?. Higher education, 62(3), 279-301. Retrieved from <http://download.springer.com> on 19th July 2016.

Dhankar, Rohit (2013). Can reflective practice be taught? Teacher Plus 2013.

(<http://www.teacherplus.org/coverstory/can-reflective-practice-be-taught>).

Hubbs, D. L., and Brand, C. F. . The paper mirror: Understanding reflective journaling (2005). Journal of Experiential Education, 28(1), 60-71.

Liuolienė, A., and Metiūnienė, R. Students' Learning Through Reflective Journaling Coactivity / Santalka,(2009). 17(4), 32-37. doi:10.3846/1822-430X.2009.17.4.32-37.

Lowe, G. M., Prout, P., and Murcia, K. . I See, I Think I Wonder: An Evaluation of Journaling as a Critical Reflective Practice Tool for Aiding Teachers in Challenging or Confronting Contexts. Australian Journal Of Teacher Edu (2013).

Mapping of COs to Syllabus

Course Outcomes	M1
CO1	H
CO2	H
CO3	H
CO4	H
CO5	H

EDES6003: EDUCATIONAL SEMINAR I (0-0-2) – Practicum

COURSE OUTCOMES

Develop higher cognitive abilities to respond to new knowledge, critical thinking, and keen observation of research conducted. (Understanding & Evaluation)

Develop the abilities to seek clarification, defend the ideas of others, and present effectively. (Application & Creation)

Develop the feeling of tolerance, co-operation, and respect of the ideas and feelings of others. (Understanding)

Acquire good manners of putting questions and answering the questions of others effectively and develop emotional abilities. (Analysis & Application)

During the course of the programme, students are expected to present a series of seminars which will address fundamental intellectual, conceptual and practical issues in current educational philosophy and application. They may also deal with other relevant topics such as use of ICT in education, design of new and innovative curricula, methodological issues in education, etc. Students will be assisted through guest lectures, discussions, field work in education related institutions and active engagement with faculty members. During these interactions students will be provided with an opportunity to explore how best to bring new interdisciplinary scholarship, technology and critical thinking into the development of the chosen seminar area. They will also consider alternative pedagogic strategies, teaching techniques and technologies. Students will prepare and present a final paper based on these seminars. The course will be evaluated on the basis of the seminars and the final paper.

Mapping of COs to Syllabus

CO 1	H
CO 2	H
CO 3	H
CO 4	H

EDDI6005: DISSERTATION PHASE-I (0-0-2)**COURSE OUTCOMES**

Develop the skill to prepare the Research Proposal. (Application)

Apply the skill in collection of data in the field. (Application)

Develop the ability to analyze the data. (Analysis)

Ability to write the report in standard academic formats. (Creation)

Every student shall undertake a research project work under the supervision and guidance of a faculty member. The students are expected to complete the literature review and present a research proposal during the first phase. The dates, mode and components of evaluation and the weightages attached to them shall be published by the department at the beginning of the semester.

Mapping of COs to Syllabus

Course Outcomes	Phase-I
CO 1	H
CO 2	H
CO 3	H
CO 4	H

EDDI6007: DISSERTATION PHASE-II (0-0-4)**COURSE OUTCOMES**

Develop the skill to prepare the Research Proposal. (Application)

Apply the skill in collection of data in the field. (Application)

Develop the ability to analyze the data. (Analyzing)

Ability to write the report in standard academic formats. (Application)

The students of the final semester will have to compile their research study in the form of a dissertation. Each dissertation has to be systematically structured following proper methodology of educational research. To set the dissertations in a standardized pattern the supervisor should ensure that it follows proper sequence containing following aspects:

Preliminary section

Title page

Approval sheet

Acknowledgments

Table of contents

List of tables (if any)

List of figures (if any)

Main body

Introduction

Conceptual framework of the theme

Some relevant studies

Rationale/Justification of the study
 Statement of the problems
 Operational terms
 Statement of the study
 Objectives of the study
 Hypotheses
 Delimitation of the study
 Review of related literature
 Method and Procedure of the study
 Procedures used
 Methods of gathering data
 Description of data gathering tools
 Presentation and Analysis of Data
 Texts
 Tables
 Figures
 Statistical treatment
 Analysis of data gathered and interpretations
 Conclusion
 Brief restatement of problems and procedures
 Major findings and conclusion
 Educational implications
 Recommendations for further research

Reference section

References (APA sixth edition)

Appendix

The supervisor will help students to understand the detailed steps of writing a dissertation. He/ she will ensure that the dissertation is prepared keeping in view Of Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Phase I of the course is carried out in the 3rd semester where the students will work on research proposal, literature review and the first part of the data collection. In the 4th semester they will complete data collection, analysis, and preparation of a research report (Phase II). Students are required to make a presentation of the dissertation submitted to the department on the date set in the academic calendar for the same.

Mapping of COs to Syllabus

Course Outcomes	Phase-II
CO 1	H
CO 2	H
CO 3	H
CO 4	H

EDIN6008: INTERNSHIP (0-0-3)

COURSE OUTCOMES

To acquaint the students with the total environment of the school.(Remembering)

To learn about the functioning of the school.(Understanding)
 To observe the administrative and managerial activities.(Remembering)
 To observe the morning assembly and teaching work in the classroom for having an idea of teaching work.(Analysis)
 To prepare lesson plans and teaching aids for conducting classes.(Application)
 To observe and participate in the co-curricular activities and extracurricular activities. (Application)
 To organize the co-curricular and extracurricular activities. (Creation)
 To understand the behaviour of teachers, students, principal, headmaster and other supporting staff.
 (understanding)

Activities to be performed:

Organization/ observation of morning assembly.
 Classes to be taught during the day by preparing lesson plans.
 Unplanned classes to be taken during the day if some teachers are on leave. Observing the class of an effective/ good teacher.
 Participating/ organizing co-curricular activities. Participating/ organizing extracurricular activities. Any other specific events of the day.
 Undertaking action research or case study.
 On the basis of daily reports the students are to prepare the final report on the school Internship Programme.

EVALUATION:

	Stock of daily reports and Action research	30
	Preparation of final report	10
	Lesson plans	20
	Teaching aids developed	10
	Presentation of final report and viva voce	30
		100

Mapping of COs to Syllabus

CO 1	H
CO 2	H
CO 3	H
CO 4	H
CO 5	H
CO 6	H
CO 7	H
CO 8	H

EDES6009: EDUCATIONAL SEMINAR II (1-0-1) – Practicum

COURSE OUTCOMES

Develop higher cognitive abilities to respond to new knowledge, critical thinking, and keen observation of research conducted. (Understanding & Evaluation)
 Develop the abilities to seek clarification, defend the ideas of others, and present effectively.
 (Application & Creation)
 Develop the feeling of tolerance, co-operation, and respect of the ideas and feelings of others.
 (Understanding)
 Acquire good manners of putting questions and answering the questions of others effectively and develop emotional abilities.(Analysis & Application)

Following the previous course of Educational Seminar-I, in the present course of the programme the students are expected to present a series of seminars which will address fundamental intellectual, conceptual and practical issues in current educational philosophy and application. They may also deal with other relevant topics such as use of ICT in education, design of new and innovative curricula, methodological issues in education, etc. Students will be assisted through guest lectures, discussions, field work in education related institutions and active engagement with faculty members. During these interactions students will be provided with an opportunity to explore how best to bring new interdisciplinary scholarship, technology and critical thinking into the development of the chosen seminar area. They will also consider alternative pedagogic strategies, teaching techniques and technologies. Students will prepare and present a final paper based on these seminars. The course will be evaluated on the basis of the seminars and the final paper.

Mapping of COs to Syllabus

CO 1	H
CO 2	H
CO 3	H
CO 4	H

EDTP6010: TEACHING PRACTICE (1-0-1) - Practicum

COURSE OUTCOMES

Understand the concept and purpose of teaching practice (Understanding)

Develop skill of preparing lesson plan (Creating)

Practice various teaching skills in classroom situations (Application)

Module I: Concept of Teaching Practice (10 Lectures)

Introduction to Teaching Practice, Concept of teaching practice Objectives of teaching practice, Concept of Lesson Plan, significance of lesson plan, Approaches for preparing lesson plan, Format of lesson plan, Teaching skills and Micro Teaching

Module II: Preparation of Lesson Plan (20 Lectures)

Preparation of Lesson Plan and Presenting lesson plans, Preparing 10 lesson plans for Secondary / Senior Secondary / UG students Delivering four (4) Lesson Plans in Secondary / Senior Secondary / UG Classes One lesson plan for final practice teaching

Evaluation Scheme:

Internal Assessment	: 40Marks(Based on Test)
External Assessment	: 60 Marks
Record	: 20 Marks
Final Teaching practice	: 20 Marks
Viva	: 20 Marks

Suggested Readings

- Bloom, B.S. Taxonomy of Educational Objectives, New York (1956).
 Passi, B.K. Becoming Better Teacher: Microteaching Approach, Ahmedabad: Sahitya Mudranalaya(1976).
 Gage, N.S. "Theories of Teaching" in theories of learning and instruction, Chicago University Press (1968).
 Jangira, N.K. & Singh, A. Core Teaching Skills: The Microteaching Approach, NCERT, New Delhi (1983).
 Kapoor, K.C. et.al (Ed.): Teacher Education in the 21st century. Ambala Cantt.:The Associate Publisher (2008).
 Mangal, S.K & Mangal, U. Essentials of Educational Technology, PHI Learning Pvt. Ltd, Delhi (2014).
 Aggarwal, J.C. Essentials of Educational Technology, Innovation in Teaching-Learning, Vikas Publishing House Pvt. Ltd. New Delhi (2014).
 Freeberg, M.J & Drescoli, A. Universal Teaching Strategies, Boston: Allyn and Bacon (1992).
 Stone, Edgar & Morris, Sidney : Teaching Practice: Problems and Perspectives, London (1972).

Mapping of COs to Syllabus

Course Outcomes	M1	M2
CO 1	H	
CO 2		H
CO 3		H

EDEP6016: EXPERIMENTS IN EDUCATIONAL PSYCHOLOGY**(2 Credits- 60 hours) (L-T-P:0-0-3)****Course Objective:**

To help students gain experiential learning of the practical application of the theoretical concepts of psychology to understand human beings

Course outcomes:

CO1: Understand the concept and importance of experiments in educational psychology (Compression)

CO2: Apply the steps of psychological testing in administering the psychological tool. (Application)

CO3: Documenting the entire procedure and then writing the report. (Skill)

CO4: Use inferences drawn from data to make predictions about individuals and thereby improve the teaching learning process. (Analysis)

MODULE I: INTRODUCTION TO EXPERIMENTS IN EDUCATIONAL PSYCHOLOGY

Experimental psychology- concept and importance in the understanding of human behaviour

Steps to be followed while conducting an psychological experiment/ test

Writing and reporting

MODULE II:**PSYCHOLOGICAL EXPERIMENT (WITHOUT APPARATUS): ANY TWO**

Personality- Rorschach Ink blot test/ Thematic Apperception Test (TAT)

Intelligence- Cognitive ability test, Raven's progressive matrices

Individual differences- Differential ability test

PSYCHOLOGICAL EXPERIMENT (WITH APPARATUS): ANY TWO

Learning- Paired associate learning

Individual difference- Finger dexterity test

Intelligence- Matching familiar figure, Koh's pass along test

Creativity- Passi test of creativity

Scheme of Evaluation: (100 Marks)

Psychological Experiment with apparatus:	15 Marks
Psychological Experiment without apparatus:	15 Marks
Practical book:	10 Marks
Practical Examination, Reporting & Viva Voce:	60 Marks
Total	100 Marks

Full Marks: 50

Internal: 20 Practicum & Viva: 30

Suggested Readings

Woodworth, R. S. & Schlosberg, H. (1971). Experimental Psychology. New York: published by Holt, Rinehart and Winston.

Mohsin, S.M.(2016). Experiments in Psychology. Delhi; published by Motilal Banarsidass Publishers (P) Ltd.

Mapping of Cos

COURSE OUTCOME	MI	MII
1	H	
2	H	H
3	H	H
4		H

SWCA6010: COMPUTER APPLICATION FOR SOCIAL SCIENCES (1-0-1) - Practicum

COURSE OUTCOMES

Describe the application of the basics of Word Processing. (Applying)

Illustrate the basics of Excel Worksheet. (Applying)

Explain the basics of PowerPoint Presentation tools. (Analyzing)

Work out data analysis in research using Statistical Analysis Packages. (Applying)

Identify and describe the practical aspects of Computer Applications. (Evaluating)

Module I: Basics of Microsoft Office Word Processing (7 lectures)

Word Processing: Meaning, Features, advantages, Structure of a word Processor window, creating document, opening, saving document, Printing, Find and replace, Creating table, Mail Merge-Main document data source and merging.

Module II: Basics of Microsoft Office Excel Worksheet (8 lectures)

Worksheet Package: Cells, rows, columns, Range, Structure of a worksheet window, creating, opening and saving, Printing a worksheet document, creating tables, charts, data analysis using formulae in worksheet.

Module II: Basics of Microsoft Office PowerPoint Presentation (5 lectures)

Presentation Package; creating presentations in a presentation package, text tables, charts, Animation, running slide show, saving the slides, Printing the presentations.

Module IV: (Practicum) Using Statistical Packages for Data Analysis (10 lectures)

Qualitative Data Analysis, Quantitative Data Analysis. Statistical Packages for Data Analysis: Statistical Package for Social Sciences (SPSS), Analysis of moment structures (AMOS)

Suggested Readings

Foster, JJ. Data analysis using SPSS for Window, Sage Publication, Ltd., London, 1988.

Gaur, Ajai S., et al Statistical Methods and Practices in Research. Response Books, New Delhi, 2006.

Kelle, V., Computer Aided Qualitative Data Analysis: Theory, Methods and Practice, Sage Publication, Ltd., London, 1988.

Lincoln, Y.S. and N.K Danzin, Handbook of Qualitative Research, Sage Publication, California, 1994.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	H	H	H
CO 2	H	H	H	H
CO 3	H	H	H	H
CO 4	H	H	H	H
CO 5	H	H	H	H

EDSL0200: SERVICE LEARNING (A COMMUNITY-UNIVERSITY ENGAGEMENT PROGRAMME)**(1-0-1)****COURSE OUTCOMES**

Learn the concept of service learning and community engagement. (Remembering)

Understand the importance of service learning and community engagement for developing the skills of addressing real life issues in one's own community. (Understanding)

Develop the ethics of civic participation. (Applying)

Develop an understanding of the importance of communication skills in interacting with community members. (Understanding)

Be exposed to and empathize with people who are less fortunate than they are, economically, socially, academically, medically etc. (Applying)

Organize awareness programmes, rallies, campaigns, social service etc. (Analysing)

Develop the skills of problem solving and reflective thinking. (Analysing)

Realize one's potentiality to make a difference in the life of their community members. (Evaluating)

Understand and experience the system of inequality that exists in the Educational system. (Evaluating)

Applying the pedagogical concepts learned in class in the educational institutions of the community. (Creating)

Module I: Service Learning and Community- University Engagement

Concept of service learning and community-university engagement; History of service learning in the context of Indian Universities; Principles for an effective service learning; Principles of a good service learning pedagogy; Models of Service learning: Project Model, Charity Model, Social Justice Model.

Programs of Service learning: Community Engagement, Field Education, Volunteerism, Internship.

Benefits of Service learning: For Students, Academic enhancement, Personal/ Professional Growth, Understanding Diversity, Civic learning, Critical reflection, For the University, For the community.

Service learning: A means to Inclusive Education: Experiential Learning, Expo populations, Challenge to comfort zones, Reflection sure to diverse on Experiences, Personal growth, Professional growth.

Module II: Practices for Service Learning and Community- University Engagement

By collaborating with the Community Members, Village Panchayats, Parents, Educational Institutions (Heads, Teachers and Students), Anganwadis, Balwadis etc. and following the mentioned Models and Programs of Service Learning students can be engaged with the community welfare in the following ways: (Any....)

Creating awareness among community members regarding Early childhood care and nutrition.

Creating awareness among community members about parenting.

Self-participatory internship in a school of one's own choice.

Creating awareness among school children and community members and providing 5. training in developing one's life skills.

Providing teachers training in pedagogy.

Providing training to school teachers in the use of ICT for enhancing students' learning.

Providing training to teachers in the preparation of teaching aids by using available community resources.
 Creating awareness on Mental Health and strategies for its sustenance.
 Creating awareness on the importance of Physical health and ways of maintaining one's health.

Creating awareness on the importance of education and ways of creating a conducive environment for proper learning.

Creating awareness on AIDS.

Creating awareness on Population explosion- its effects and ways of population control.

Creating awareness on life skills and ways to develop one's life skills.

EVALUATION:

INTERNAL

Attendance	5
Non-Formal	5
Project presentation and Viva	10

EXTERNAL

Organization of activities and project report	30

Suggested Readings

Brown, Erin Marie Burke. (2015). Service-Learning Challenges and Strategies. Service-Learning Institute: Viginia Commonwealth University. Downloaded from

http://scholarscompass.vcu.edu/service_institute/servicelearning_2015/background_infomation/1

Centre for Community Engagement. (n.d.). Faculty Toolkit for Service Learning. Middlesex Community College Downloaded from https://www.uml.edu/docs/Faculty_Toolkit_MCC_tcm18-52567.pdf.

Cress, Christine M., Collier, Peter J., Reitenauer, Viki L. (2005). Learning Through Serving: A Student Guidebook for Service Across Disciplines. Sterling Virginia.

Lavery, S., Chambers, D. and Cain, G. (2018). Service Learning: Enhancing Inclusive Education. Emerald Publishing. United Kingdom.

Mittal, Pankaj. Fostering Social Responsibility by Higher Education: COVID-19 and Beyond. <https://youtu.be/4Yz1h0DtoBo>.

Narasimharao, B PanduRanga. (2010). Tertiary Education Institutions for Corporate Education, Need and Relevance of Corporate Education centres. Downloaded from <https://www.researchgate.net/publication/216686564>.

PRIA. (2014). Occasional Paper: Participatory Research in Asia Fostering Social Responsibility in Higher Education in India. New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6	H	H
CO7	H	H
CO 8	H	H
CO 9	H	H
CO 10	H	H

VALUE ADDED COURSES

EDES6011: EDUCATION FOR SUSTAINABLE DEVELOPMENT (1-0-1)

Objective:

To sensitize students about the growing issues surrounding the globe and make them aware of the most humanitarian and sustainable ways of addressing these issues

Course outcomes:

CO1: Awareness about the concept of Sustainable Development.

CO2: Justify the concept of Education for Sustainable Development and the role of Education in Sustainable Development.

CO3: Evaluate the utility and prevalence of sustainable development within self and in the community.

MODULE I: INTRODUCTION TO SUSTAINABLE DEVELOPMENT (4 hours)

Concept of Sustainable Development: Its 5 Ps (People, planet, prosperity, peace, and partnership)
Sustainable Development Goals (SDG)- 17

MODULE II: CURRICULAR FRAMEWORK FOR EDUCATION FOR SUSTAINABLE DEVELOPMENT (4 hours)

Concept of Education for Sustainable Development (ESD)
Importance of Education for Sustainable Development
Pedagogical approaches in ESD
Contribution of education in the achievement of SDGs

MODULE III: PRACTICAL IMPLICATIONS OF ESD (22 hours) (Any two)

Design posters and organize awareness rally on any one of the SDGs
Visiting neighboring areas to collect community related stories/ activities towards the realization of Sustainable Development Goals.
Surveying ADBU campus on its sustainability norms
Prepare a photo album on the issues of SDGs

Suggested Readings

UNESCO. (2012). *Education for Sustainable Development: Source Book*. Retrieved from <https://sustainabledevelopment.un.org/content/documents/926unesco9.pdf>

UNESCO. (2017). *Education for Sustainable Development Goals: Learning Objectives*. Retrieved from https://unesdoc.unesco.org/ark:/48223/pf0000247444?utm_sq=gj34xbfn94#:~:text=Target%204.7%20of%20the%20SDGs,peace%20and%20non%2D%20violence%2C%20global

UNESCO. (2018). *Issues and trends in Education for Sustainable Development*. Retrieved from

<https://www.ensi.org/global/downloads/Publications/433/Issues%20and%20trends%20in%20Education%20for%20Sustainable%20Development.pdf>

<https://www.plymouth.ac.uk/students-and-family/sustainability/sustainability-education/esd>

MAPPING OF COURSE OUTCOMES

CO	M1	M2	M3
Co1	H		
Co2		H	
Co3			H

EDTT6012: TEACHER AND TEACHING SKILLS (1-0-1)**COURSE OUTCOMES**

To create awareness among the students about conceptual framework of teaching skills. (Remembering)

To make the students well aware of the sources of teaching skills. (Understanding)

To create awareness about the approaches concerning teaching skills. (Applying)

Module I: Introduction to Teaching and Teacher

Concept of teaching; Structure of teaching; Levels and phases of teaching.

Module II: Concept of Teaching Skills

Meaning of teaching skill; Significance of teaching skills for a teacher; Sources and identification of teaching skills; Social skills for a teacher.

Module III: Micro teaching as an approach

Concept of Micro teaching; Need of micro teaching; Steps of micro teaching; Preparation of micro teaching lesson plan; Teaching practice for teaching skills through micro teaching lesson plans.

Suggested Readings

Abraham, P. P. (1974). Effectiveness of Micro Teaching in the development of questioning skill. M.Ed. Dissertation. M. S. University, Baroda.

Aggarwal, J.C (2014): Essentials of Educational Technology, Innovation in Teaching-Learning, Vikas Publishing House Pvt. Ltd. New Delhi

Allen, D. W. and Fortune, J. C. (1976): An analysis of micro teaching: A new procedure in teacher education. Stanford University, California.

Anupam and Kapoor, K. C. (2012). Micro teaching as an approach in Secondary School Teacher. International journal of Education and Research. 1 (5). ISSN 0975-7481.

Jangira, N.K. & Ajit Singh (1983): Core Teaching Skills: The Microteaching Approach, NCERT, New Delhi

Kapoor, K.C et. al. (Ed) (2008): Teacher Education in the 21st Century, The Associated Publishers, Ambala cantt.

Kapoor, K.C. (2020): Teaching of Geography for Secondary School Teachers. DVS Publishers, Guwahati.

Mangal, S.K & Mangal, U (2014): Essentials of Educational Technology, PHI Learning Pvt. Ltd, Delhi.

Passi, B.K. (1976): Becoming Better Teacher: Microteaching Approach, Ahmedabad: Sahitaya.

Mapping of COURSE OUTCOMES

Course Outcomes	Module I	Module II	Module III
CO1	L	H	H
CO2	L	H	L
CO3	L	M	M

EDHW6013: EDUCATION FOR HEALTH AND WELLNESS**Credits: 2**

Total Marks: 50 - Internal: 40 % (20 Marks) Total Hours: 30 External: 60% (30 Marks)

Course objectives

After completing the course, students will be able;

To acquire the knowledge, about health and physical education

To acquire the knowledge about health and safety education

To understand the nature of injuries and providing first aid

To develop the skills for organising games and sports in educational institution.

To acquire the knowledge about yoga

Module-I: concept of Health Education

Meaning, Definition, objectives of health education

Nutrition, Malnutrition, Personal Hygiene, Health education in schools, Health Services.

Food and Nutrition: Meaning, classification, constituents of food, vitamins and their deficiency, Balanced Diets, Diets for obesity and under Weight

Module-II Introduction to Physical & Yoga Education & Wellness Studies

Meaning, Definition, Objectives and scope of Physical education

Physical fitness: Meaning, definition, components, and benefits

Games and sports

First Aid: Road Accident, water accident, fire accident

Yoga Education: Meaning, Definition and uses of yoga for focussed mind.

Selected Asanas and Pranayama: Physical exercises

Dimensions of Wellness & Mindfulness.

Practicum:

Preparation of first aid kit

Health awareness programme

Demonstration of Asanas and Pranayama

Organizing games

Writing about the eminent performers in games and sports

Suggested Readings:

Nash, T.N. (2006). Health and Physical education. Hyderabad: Nilkamal publishers

Prasad, Y.V. (2006). Methods of teaching physical education. New Delhi: Discovering publishing house

Chandra, S.S & Krishanan, P. (2005). Health education and physical education. Delhi: Surjeet Publications

Mangal, S.K. (2005). Health and physical education. Ludhiana: Tandon Publication

EDFL6015: FAMILY LIFE EDUCATION

Credits: 2 (1-0-1); Hours: 30

Marks: 50 (Attendance-5, NF-5, Theory-20, Practical-20)

COURSE OUTCOMES:

CO 1: To develop understanding about the concept of Family life education and its core elements (Understanding)

CO 2: To practice abstinence from sex until marriage (Application)

CO 3: To develop the skills of positive parenting (Application)

CO 4: To recognize different types of child abuse and take steps towards its prevention (Analysis)

CO 5: To prepare pamphlets and organize awareness programmes in the community (Creation)

MODULE I: Family Life Education And Its Core Elements (15 Hours)

Family life education: Concept, principles, objectives and importance

Role of Individual, Family and Community in Family Life Education

The benefits of abstinence from sex until marriage

Positive parenting: building healthy relationship with your kids □ Child abuse and neglect

MODULE II: Practicum (30 Hours)

Prepare pamphlets related to family life education, child abuse, abstinence from sex until marriage

Organizing awareness in nearby schools through Role Play concerning to different issues of family life education

Suggested REadings

Aggarwal, J.C (2003): Population Education, Delhi: Shipra Publications

Kapoor, K.C & Kapoor, A. (2013): Population Education, Guwahati, EBH, Publications

National Center for Injury Prevention and Control (2021), Preventing Child Abuse & Neglect, Centers for Disease Control and Prevention; available at https://www.cdc.gov/violenceprevention/pdf/can/CAN-fact-sheet_508.pdf

Chacko, T. (n. d.). Importance of Family Life Education. Indira Gandhi National Open University; available at <https://www.egyankosh.ac.in/bitstream/123456789/80000/1/Unit-3.pdf>

NIH News in Health (Special Issue), A monthly newsletter from the National Institutes of Health, U.S. Department of Health and Human Services, page 1-6; available at <https://news-inhealth.nih.gov/sites/nihNIH/files/Special-Issues/Parenting.pdf>

Abstinence (2019), Alberta Health Services; available at https://teachingsexualhealth.ca/app/uploads/sites/4/Abstinence_Final-1.pdf

Maier, B. (n. d.). Why Wait: The benefits of abstinence until marriage, pages 1-14; available at <https://downloads.frc.org/EF/EF11B20.pdf>

What Is Child Abuse and Neglect? Recognizing the Signs and Symptoms (2019). Child Welfare Information Gateway. Children's Bureau/ACYF/ACF/HHS, pages 1-8; available at <https://www.childwelfare.gov/pub-pdfs/whatiscan.pdf>

Child Abuse. Indira Gandhi National Open University, pages 29-44; available at <https://egyankosh.ac.in/bitstream/123456789/31579/1/Unit-2.pdf>

Dahiya, A. (2018). Child Abuse: Forms, Factors Responsible, and Protection Issues, World Wide Journal of Multidisciplinary Research and Development, 4(2): 59-62, E-ISSN: 2454-6615; available at http://www.jmrd.com/upload/child-abuse-formsfactors-responsible-and-protection-issues_1518437447.pdf

MAPPING OF COs

	Module I	Module II
CO1	H	
CO2	H	H
CO3	H	H
CO4	H	H

EDWE6014: WOMEN EMPOWERMENT (2 CREDIT) 1-0-1

Course outcomes:

To familiarize students with the concept of women empowerment (R)

To make students aware on issues related to gender discrimination (U)

To analyze issues related to health conditions of Indian women.(An)

To organize/perform various activities related to women empowerment (Ap)

Module-1

Concept of Women's Empowerment (15 hrs)

Gender discrimination

Women's Rights

Health conditions and work related issues of women

Women empowerment through education

Practicum: (any two) (30 hrs)

Visiting women self - help groups.

Organizing flash mob, skits in neighboring areas.

Reporting on one stop Centre scheme by Government of India.

Releasing a magazine on status of women then and now.

Mapping of Cos to Syllabus

	CO1	CO2	CO3	CO4
Module 1	H	H	H	H
Module 2				H

Process of Evaluation: 50 Marks**Attendance- 5****Non-formal -5****Theory- 20(MCQ)****Practical-20****Suggested Readings**

Agrawal, S.P. 2001. Women Education in India, Guwahati: Eastern Book House.

Importance of education in empowerment of women in India. (n.d.). Retrieved November 18, 2022, from <https://www.motherhooduniversity.edu.in/pdf/Publications/2016/Khushboo%20Singh.pdf>*Ma [education] second semester EDCN 806E [English edition].* (n.d.). Retrieved November 18, 2022, from https://stage.tripurauniv.ac.in/Content/pdf/Distance%20Education%20Notice/Education%20for%20Em-powerment%20of%20Women%20_%20MAEducation%20_806E%20English_21072017.pdf*Role of education in the empowerment of women in India - eric.* (n.d.). Retrieved November 18, 2022, from <https://files.eric.ed.gov/fulltext/EJ1081705.pdf>

Seth, Mira. 2001. Women and Development. New Delhi: Sage Publication

EDAD6017: ADULT EDUCATION PRACTICES (2 credits)**COURSE OUTCOMES****CO1:** To create understanding about the concept and aims of adult education among the learners**CO2:** To make the learners well aware of the Programmes and Policies of Adult Education in India**CO3:** To enable the learners to understand the nature curriculum of adult education, its transaction and evaluation**Module-I: Nature and scope of Adult Education (8 Hours)**

Concept of adult education

Historical background of adult education with special reference to India

Need of adult education

Objectives of adult education

Scope of adult education

Module-II: Adult Education Policies and Programmes in India (7 Hours)

Adult Education and Five-year Plans in India

Adult Education and NPE-1986

Adult Education and Reports of Committees

Administrative and Resource structure of Adult Education

Module-III: Adult Education Practices (30 Hours) Practical

Curriculum of Adult Education

Pedagogy of Transacting the curriculum of Adult Education

Evaluation of adult learners

Adoption of the village

Scheme of Evaluation:

Internal:20 Marks

External:30 Marks

Total: 50 Marks 2 Credits

Suggested Readings

Colin, J Times (1987): Lifelong Education for Adult an International Handbook, Pergamon Press, New York, USA.

Chapra, Rita (1993): Adult Education, Himalaya Publishing House, Bombay

Govindappa, K (1988): Adult Education Impact of NLM, CosmoPublication, New Delhi.

Kundu, C.L. (1987): Adult Education Principles, Practice and Prospects, Sterling Problems Pvt Ltd, New Delhi.

Sura, P.P (1987): Adult Education, Asish Publication House, New Delhi

NPE (1986): Adult Literacy NCERT, New Delhi

NEP (2020): Foundational Literacy and Numeracy MHRD New Delhi

DEPARTMENT OF ENGLISH

VISION

To be a centre of excellence in learning, teaching and research in the areas of language and literature by imparting personalized education, inculcating human values and thereby contributing to nation building.

MISSION

To develop critical thinking, creative writing and interpretive ability

To foster professionalism to face the competitive world by developing language and communicative skills and by maintaining creative literary activity

To generate sensitivity to culture and ethical issues

To develop human potential to its fullest by mentoring and upholding human and spiritual values

To prepare individual to become responsible citizens of tomorrow

PROGRAMME OUTCOMES- MA ENGLISH

PO1: Critical Thinking: Apply theoretical knowledge to make a critical analysis, intervene using innovative frameworks and evaluate and follow up.

PO2: Effective Communication: Engage in inter and intra personal communications, behavioural change communication and proficiency in information Communication Technology.

PO3: Scientific Temper: To build essential skills of life including questioning, observing, testing, hypothesizing, analysing and communicating.

PO4: Effective Citizenship: Demonstrate empathetic social concern and engage in service learning and community engagement programmes for contributing towards achieving local, regional and national goals.

PO5: Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions and accept responsibility for them.

PO6: Environment and Sustainability: Participate and promote sustainable development goals.

PO7: Gender Sensitization and Social Commitment: To imbibe Gender sensitivity and the sense of social responsibility for self and community for the benefit of the society at large.

PO8: Self-directed and Life-long learning: Engage in continuous learning for professional growth and development.

PROGRAMME SPECIFIC OUTCOMES

PSO1: To critically analyse and evaluate the writers of English literature across different ages and continents, their theories, perspectives, models and methods.

PSO2: To enhance competence in critically analyzing scholarly work in the areas of English language teaching, literary research and translation.

PSO3: To develop the technical skills and ethical decision-making appropriate for the holistic professional development in the field.

LIST OF COURSES

1.1 Chaucer to Elizabethan Period - Poetry, Drama and Romance

1.2 Literary and Social History of England-Chaucer to Elizabethan Period

1.3 Shakespearean Drama I- Comedy and History Plays

1.4 Rhetoric and Prosody

1.5 T.S. Eliot

1.6 Thomas Hardy

- 1.7 Media Literacy
- 1.8 Leadership and Social responsibility
- 1.9 Gender Studies
- 1.10 English Language Teaching
- 1.11 Seminar and Presentation I
- 2.1 Restoration to Romantic Period-Poetry and Drama
- 2.2 Literary Criticism-Plato to F.R. Leavis
- 2.3 Shakespearean Drama II-Tragedy and Tragi-comedy
- 2.4 Approaches to Language and Literary Research
- 2.5 Classics in Translation
- 2.6 Indian Women Writers
- 2.7 Environment and Disaster Management
- 2.8 Peace Education and Conflict Management
- 2.9 Introduction to Social Psychology
- 2.10 North-East Indian Literature in English
- 2.11 Seminar and Presentation II
- 3.1 Victorian to Post-modern Period- Poetry, Drama and Fiction
- 3.2 Post-colonial Literature-Poetry, Drama and Fiction
- 3.3 American Literature-Poetry, Drama and Fiction
- 3.4 Literary and Critical Theory
- 3.5 Gender and Literature
- 3.6 Linguistics and Stylistics I
- 3.7 Introduction to Modern European Literature I
- 3.8 Colonial and Post-colonial African Literature I
- 3.9 Project Phase I
- 4.1 Indian Writing in English-Poetry, Drama and Fiction
- 4.2 South-Asian Literature
- 4.3 Linguistics and Stylistics II
- 4.4 Introduction to Modern European Literature II
- 4.5 Colonial and Post-colonial African Literature II
- 4.6 Project Phase II-Dissertation

MAPPING of COURSES to PO/PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
1.1									H		
1.2									H		
1.3									H		
1.4	L								H	M	
1.5	M								H	M	
1.6	M								H	M	
1.7		H		M	M					H	M
1.8				M	H		M	M		H	H
2.1					L				H		
2.2	H								H	H	L
2.3									H		
2.4		H						L	M	H	

2.5									H	M	
2.6	L						M		H		M
2.7						H			H	M	M
2.8				H	H			L	M	M	H
3.1									H		
3.2	M								H	L	M
3.3									H		
3.4	H								M	H	L
3.5	M				M		H		L	H	L
3.6		M								H	L
3.7									H		
3.8	M						M		H	M	
3.9	H		H					H	H	H	H
4.1									H		M
4.2									H		L
4.3		L							H	H	
4.4									H		
4.5	M						M		H	M	
4.6	H		H					H	H	H	H

DETAILED SYLLABUS - MA ENGLISH

EGEP0001: CHAUCER TO ELIZABETHAN PERIOD - POETRY, DRAMA AND ROMANCE (4-0-0) (CREDITS: 04)

Course Outcomes:

Define the fundamental concepts of the three genres of Poetry, Drama and Romance from the age of Chaucer to Elizabethan period (Remembering).

List the representative writers and their texts of the fourteenth century (Understanding).

Experiment the characteristic features and forms of Poetry, Drama and Romance from the age of Chaucer to Elizabethan period (Applying).

Categorize the socio-political background and factors that influenced and shaped the literary texts of the period (Analyzing).

Evaluate the given text critically in its literary context, use of various literary devices, thematic and symbolic significance and the use of Language and style (Evaluating).

Estimate the given texts as literary works of the corresponding age (Creating).

Module I: Selected Poetry (25 lectures)

Geoffrey Chaucer 's "Prologue" to The Canterbury Tales

Edmund Spenser 's The Faerie Queene (Book III)

William Shakespeare's Sonnets No. 18, 29,34

Philip Sidney's Astrophel and Stella

Module II: Selected Drama (20 lectures)

Christopher Marlowe's *The Jew of Malta*

Ben Jonson's *The Alchemist*

Module III: Selected Romance (15 lectures)

Sir Thomas More's *Utopia*

Suggested Readings

Texts of Selected Poetry, Drama and Romance.

Drabble, Margaret. ed. *The Oxford Companion to English Literature*. Oxford: OUP 3.

Ferguson, Margaret. et al. ed. *The Norton Anthology of Poetry*. New York: London.

Shakespeare, William. *William Shakespeare Sonnets*, Rupa Publishers

Tillyard, E. M. W. *Elizabethan World Picture*. Peregrine Books, 1970

Trevelyan, G.M. *English Social History: A Survey of Six Centuries, Chaucer to Queen Victoria*. Penguin, 1987

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6	H	H	H

EGLS0002: LITERARY AND SOCIAL HISTORY OF ENGLAND - CHAUCER TO ELIZABETHAN PERIOD (3-0-0) (CREDITS: 03)**Course Outcomes:**

Define the different Periods involved in the Literary and Social History of England from the Medieval to Elizabethan age (Remembering).

List the chronological changes that intervened in the history of England during fourteenth and early fifteenth century (Understanding).

Use the characteristic features, significant changes, development and modes indicating transition from the Medieval life, The Black Death to the Elizabethan theatre in the reading of the given texts (Applying).

Identify the various socio-political factors responsible for these developments and their influences in the shaping of the Literature of the period (Analyzing).

Explain the various literary and socio-political influences for the literature production at the various stages from the Medieval age to the coming of Elizabethan theatre (Evaluating).

Estimate the contextual background involved in the shaping up of various literary works (Creating).

Module I (15 lectures)

The Church and Medieval Life

Towns and Villages in Medieval England

Feudalism

The English Manorial System and Medieval Agriculture

Module II (15 lectures)

The Black Death and its Aftermath

Medieval English Theatre

Medieval Romance

Fabliau, Lyric, Dream Allegory and Ballad

Module III (15 lectures)

Caxton and the Printing Press

Renaissance and the Literature: The University Wits, the Elizabethan Prose, the Metaphysical Poetry, etc. c. Reformation
The Elizabethan Theatre

Suggested Readings

Abrams, M.H. *A Glossary of Literary Terms*. Prism India.
Ashok, Padmaja. *The Social History of England*. Orient Black Swan.
Choudhury, Bibhas. *English Social and Cultural History*. PHI, 2009.
Peck, John and Martin Coyle. *A Brief History of English Literature*. Palgrave.
Sanders, Andrew. *The Short Oxford History of English Literature*. Oxford: OUP.
Trevelyan, G.M. *English Social History: A Survey of Six Centuries, Chaucer to Queen Victoria*. Penguin, 1987

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	M	H
CO 2	H	H	H
CO 3		H	H
CO 4	H	H	
CO 5		H	H
CO 6	H	H	

EGET0007: ENGLISH LANGUAGE TEACHING (3-0-0) (CREDITS: 03)

Course Outcomes:

Define the vast body of Language teaching methodologies (Remembering)
Demonstrate the different approaches to teaching of English as a second language (Understanding)
Apply theoretical assumption as well as practical language teaching skills while dealing with second language learners in the classroom (Applying)
Analyse the specific issues such as the First and Second Language acquisition, Mother tongue interference in learning a foreign language, TG Grammar, Psychological and Sociological perspectives in Language learning, Role of technology in language learning (Analysing)
Compare and estimate the utility and feasibility of different language teaching methodologies and techniques in different language teaching- learning situations with proper forms of testing (Evaluating)
Design as well as adapt on the syllabuses of second language teaching and constructing lesson plans for dealing with language learners of different linguistic backgrounds (Creating)

Module I: Introduction to English Language Teaching (10 lectures)

Introduction, Fundamental concepts of Language Teaching, Historical Perspective of ELT, Language Pedagogy. Elements of the Structure of English Language.

Module II: Methods and Approaches of Teaching English (20 lectures)

Theoretical aspects of Language Acquisition and Learning; Language Skills assessment; Psychological approach to language teaching in a bilingual/ multilingual context; Use of Technology in Language Teaching; Educational Technology; Testing and Evaluation.

Module III: Grammar and Practical Language Skills (10 lectures)

Parts of Speech; Articles and Prepositions; Degrees of Comparison; Direct and Indirect Speech; Sentence patterns; Letter Writing; Report Writing; Reading Comprehension; Listening and Speaking; English Speech

Sounds – Vowels and Consonants, Stress and Intonation patterns; Language Games; Vocabulary Expansion; Telephonic Conversation; Teaching English for Academic and Business Purpose.

Module IV: Language through Literature (5 lectures)

Role of Literature in Language Learning; Teaching of Literature; Use of Language Model.

Suggested Readings

Ray Mackay, *A Basic Introduction to English Language Teaching*; Oxford, 2018.

Penny Ur, *A Course in English language Teaching*, CUP.2010.

Mapping of COs to Syllabus:

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H		
CO2	M	H	M	
CO3	H	H	M	M
CO4	H	H	M	M
CO5	M	H	H	M
CO6	H	H	H	H

EGRR0008: RESTORATION TO ROMANTIC PERIOD – POETRY AND DRAMA (4-0-0) (CREDITS: 04)

Course Outcomes:

Define various genres of literature, viz. poetry and drama and identify the recurrent themes of the Restoration and Romantic era. (Remembering)

Apply the historical onset while reading the texts. (Applying)

Analyse the themes critically and compare as well as contrast the different characters of the selected dramas. (Analysing)

Interpret the selected literary works and critically evaluate the plot, theme and character of the dramas and the theme and figures of speech in the poems. (Evaluating)

Assess and evaluate the selected dramas and poems vis-à-vis their context and socio-political and cultural background. (Evaluating)

Invent a new interpretation of the texts. (Creating)

Module I: Selected Poetry (25 lectures)

John Dryden: "Mac Flecknoe"

Lord Byron: "Love's Last Adieu"

William Wordsworth: "Composed on Westminster Bridge"

John Keats: "Ode to a Nightingale"

P. B. Shelley: "To a Skylark"

Module II: Selected Drama (35 lectures)

George Etherege: *The Man of Mode*

William Congreve: *The Double Dealer*

John Dryden: *All for Love*

Suggested Readings

Dryden, John. *Mac Flecknoe and Other Poems*.

Appelbaum, Stanley. *English Romantic Poetry: An Anthology*.

Selected Critical Texts (mentioned in the detailed course)

Fisk, Deborah Payne. *The Cambridge Companion to English Restoration Theatre*.

Perry, Henry Ten Eyck. *The Comic Spirit in Restoration Drama: Studies in the Comedy of Etherege*,

Wycherley, Congreve, Van Brugh and Farquhar.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	H
CO2	H	H
CO3	H	H
CO4	H	H
CO5	H	H
CO6	H	H

EGEP0001: CHAUCER TO ELIZABETHAN PERIOD - POETRY, DRAMA AND ROMANCE (4-0-0) (CREDITS: 04)

Course Outcomes

Define the literary form of drama, especially tragedy and tragi-comedy. (Remembering)

Interpret the selected literary works, i.e. the Shakespearean tragedy and tragi-comedy and they are able to explain the plot, theme and character of the dramas. (Understanding)

Apply critical reading skills to the two very distinct forms of Shakespeare's drama. (Applying)

Analyse selected texts for a better understanding of the genius of William Shakespeare. (Analysing)

Assess and critically appreciate the selected dramas. (Evaluating)

Negotiate with the complexity of ideas winded around plot, theme and character of the selected dramas. (Creating)

Module I: Tragedy (30 lectures)

William Shakeaspear: *Macbeth*

William Shakespeare: *King Lear*

Module II: Tragi-Comedy (30 lectures)

William Shakespeare: *The Merchant of Venice*

William Shakespeare: *The Winter 's Tale*

Suggested Readings

Shakespearean Tragedy: Lectures on Hamlet, Othello, King Lear and Macbeth, latest edition, Bradley, A.C, 2017, Pinnacle Press.

The Oxford Shakespeare: The Complete Works, 2nd Edition, Wells, Stanley and others, 2005, OUP.

The New Cambridge Companion to Shakespeare, 2nd Edition, De Grazia and Wells Stanley, 2010, CUP.

English Drama 1586 – 1642: The Age of Shakespeare, Latest Edition, Hunter, G.K, 1997, OUP.

Johnson, Samuel. "Preface to Shakespeare." 131-61, *Indian Edition*, D.J. Enright and Ernst De Chickera ed. *English Critical Texts*: 1975, Oxford

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6	H	H

EGAL0011: APPROACHES TO LANGUAGE AND LITERARY RESEARCH (3-0-0) (CREDITS: 03)**Course Outcomes**

Explain basic concepts of research and its methodologies. (Understanding)

Identify research topics and select and define appropriate research problems and parameters.

(Remembering)

Organize and conduct research in an appropriate manner. (Applying)

Analyse literary works from various genres by applying various theories and approaches. (Analysing)

Assess and evaluate the various works of literature to write research reports and papers. (Evaluating)

Discuss, summarize and critically appreciate the various approaches to language and literary research.

(Creating)

Module I: Introduction (10 lectures)

Meaning of Research; Objectives of Research; Motivation in Research; Different types of Research Methods; Research Methods Vs Research Methodology; Difference between Methods and Techniques; Ethics in Research; Review of Literature

Module II: Hypothesis and Data Collection (10 lectures)

Formulation of Hypothesis; Types of Hypothesis; Methods of Testing Hypothesis; Determining Sample design; Methods of Sampling; Methods of Collection of Data (Primary Data and Secondary Data); Processing and Analysis of Data; Types of Analysis

Module III: Critical Approaches to Literature (15 lectures)

Russian Formalism and New Criticism; Feminism and Gay and Lesbian Studies; Psychoanalysis; Marxism; Archetypal Criticism; Narratology; Race Ethnicity and Postcolonial Studies; Structuralism; Post-structuralism; Deconstruction; Ecocriticism; Cultural Studies.

Module IV: Analysis and Report-Writing (10 lectures)

Testing of Hypothesis; Interpretation; Different techniques of Interpretation; Citation and Bibliography; Writing and Presentation of Report

Suggested Readings

The Art of Literary Research, 4th Edition, Altick, Richard D. & Fenstermaker, John J, 1992, W.W Norton & Company.

Correa, Delia Da Souza & Owens, W.R. *The Handbook to Literary Research*, 2nd Edition, 2009, Routledge. *Literary Theory*, 3rd Edition, Eagleton, Terry, 2008, University of Minnesota Press.

Research Methodology: Methods and Techniques, 3rd Edition, Kothari, C. R. & Gaurav Garg, 2013, New Age International.

MLA Handbook for Writers of Research Papers.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H		H
CO 2	H	H		H
CO 3	H	H	H	H
CO 4			H	
CO 5			H	H
CO 6			H	

EGTR0012: CLASSICS IN TRANSLATION (3-0-0) (CREDITS: 03)**Course Outcomes**

At the end of this course students will be able to:

Define the history, theories, and methodologies in Translation Studies. (Remembering)

Illustrate fundamental questions related to translation of the major poets of classical literatures of Roman, Greek and Sanskrit. (Understanding)

Apply various theories and methods of translation. (Applying)

Examine critically the translated literary texts, critically analyse the themes and the style of literary expression in the selected texts. (Analysing)

Evaluate the high intrinsic quality of the classics and their fundamental importance in shaping ancient literary standards and cultural ideals. (Evaluating)

Discuss, summarize and critically appreciate the selected classics in translation. (Creating)

Module I: Introduction to Translation Studies (20 lectures)

Introducing Translation; History of Translation Theories; Significance of Translation in a Multi- Linguistic and Multi-Cultural Society/World; Different Types/Modes of Translation (Semantic, Literal, Literary, Functional, Communicative, Technical); Understanding the dynamics and challenges in Translation.

Module II: Selected Texts (25 lectures)

Ovid: *Metamorphoses*- Book I “Creation”, Book III “Tiresias”, Book IV “Persius and Andromeda”, Book VI “Procne and Philomela”, Book VIII “Daedalus and Icarus”, Book IX “Hercules”, Book X “Orpheus and Eurydice”, Book XI “Troy”, Book XII “Achilles”, Book XIII “Ulysses”

Homer: *Odyssey*

Kalidasa: *Abhijnana Shakuntalam*

Suggested Reading:

Translation Studies, 4th Edition, Bassnett, Susan. 2014, Routledge.

The Theory and Practice of Translation. New Edition, Nida, E, 1998, Brill.

Introducing Translation Studies, 3rd Edition, Munday, Jeremy, 2012, Routledge.

Classics in Translation: from Homer to Juvenal, 1st Edition, Jones, Peter V, 1998, Duckworth.

Tr. *Metamorphoses of Ovid*, 1st Edition, Innes, Mary M, 1975, Penguin.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	H
CO 3	H	
CO 4		H
CO 5	H	
CO 6		H

EGNE0014: NORTH-EAST INDIAN LITERATURE IN ENGLISH (3-0-0) (CREDITS: 03)**Course Outcomes**

Define the vast body of writings in English from Northeast of India. (Remembering)

Interpret the emerging trends of literature from northeast of India in its different genres- poetry, fiction and translation (Understanding)

Apply theoretical assumption as well as critical reading skills to the study of vibrant areas of Northeast literature. (Applying)

Examine the most significant topics like colonialism, identity and unity, cultural loss, ethnic conflicts, universality in the literature of Northeast region before and after British Colonial Period (Analysing)

Explain different literary themes and recurrent issues reflected in the vast body of Northeast writings in English. (Evaluating)

Elaborate on the existing critical views on Northeast India's literary texts with reference to the Modern and Postmodern Theories on Literature. (Creating)

Module I: Selected Poetry (15 lectures)

Easterine Kire: "Riddu Riddu" & "Narcissus"

Robin Ngangom: "My Invented Land"

Nongkynrih Mona Zote: "Rez"

Module II: Selected Fiction/Non-Fiction Writers (30 lectures)

a. Mamang Dai: *The Legends of Pensam*

b. Mitra Phukan: *The Collector's Wife*

Suggested Readings

The Oxford Anthology of Writings from North East India: Poetry and Essays, Indian Edition, Misra, Tillotama, 2010, OUP.

Emerging Literatures from North East India: The Dynamics of Culture, Society and Identity, 1st Edition, Zama, Magarat Ch, 1900, SAGE publications.

Dancing Earth: An Anthology of Poetry from North-east India, 1st Edition, Ngangom, Robin S. & Nongkynrih, Kynpham Singh, 2009, Penguin.

Exploring North-East Indian Writings in English: 2 volumes, 1st Edition, Swami, Indu, 2010, VDM Verlag.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6	H	H

EGVP0015: VICTORIAN TO POST-MODERN PERIOD-- POETRY, DRAMA & FICTION (4-0-0)

(CREDITS: 04)

Course Outcomes

Define the socio-cultural set up of England from Victorian to Post-Modern era. (Remembering)

Illustrate the Victorian, Modern and Post-modern elements and themes prominent in the prescribed texts. (Understanding)

Develop and apply theoretical interpretations of the prescribed texts. (Applying)

Analyse the various prominent genres of the era, background of the texts and the authors. (Analysing)

Assess and evaluate the plot, theme, characters and context of the texts under study. (Evaluating)

Construct a critical reading based on historic aspects evident in the texts. (Creating)

Module I: Victorian Period: Poetry, Fiction, and Drama (20 lectures)

"Ulysses": Alfred Lord Tennyson

Wuthering Heights: Emile Bronte.

Playboy of the Western World: J.M. Synge

Module II: Modern Period: Poetry, Fiction, and Drama (20 lectures)

“Wreck of the Deutschland”: G. M. Hopkins

Heart of Darkness: Joseph Conrad

Pygmalion: G. B. Shaw

Module III: Post-Modern Period: Poetry, Fiction, and Drama (20 lectures)

a. “Digging”: Seamus Heaney

The French Lieutenant’s Woman: John Fowles

Waiting for Godot: Samuel Beckett

Suggested Readings

David, Deirdre. *The Victorian Novel*. Cambridge University Press, 2012.

Bradbury, Malcolm and James Mc Farlane. *Modernism: A Guide to European Literature*. Penguin Publication, 1978.

Hutcheon, Linda. *The Poetics of Postmodernism*. Routledge Publication, 1988.

Waugh, Patricia. *Metafiction: The Theory and Practice of Self-Conscious Fiction*. Routledge Publication, 1988.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6	H	H	H

EGPL0016: POST-COLONIAL LITERATURE-- POETRY, DRAMA & FICTION (3-0-0)

(CREDITS: 03)

Course Outcomes

Recall the various critical elements in adherence to the Post-colonial literature. (Remembering)

Illustrate the historical context of Post-colonial literature and the use of racist and colonial undertones in the texts under study. (Understanding)

Identify the texts on the basis of the historical background, socio-political conditions of the respective time period and establish a connectedness across the commonalities of the theme and structure of the texts under study. (Applying)

Analyse the various postcolonial theories and literary concepts from texts written in corresponding time frames and by authors coming from varied socio-linguistic milieu. (Analysing)

Evaluate the significance of Post-colonial literature from the historical, socio-political and literary perspective and its evolution within a relevant theoretical framework along with the writer’s psyche and contribution towards it. (Evaluating)

Formulate the understanding of world literatures from the postcolonial perspective. (Creating)

Module I: Introduction to Post-colonial Studies (8 lectures)

Historical background of Post-colonial Studies, Post-colonial theory, Decolonization, Globalization, Hybridization, identity, culture, ‘othering’.

Module II: Selected Texts (10 lectures)*Orientalism*: Edward Said (Selections)*Nation and Narration*: Homi K. Bhabha**Module III: Selected Novels (12 lectures)***The Shadow Lines*: Amitav Ghosh*Foe*: J. M. Coetzee**Module IV: Selected Drama and Poetry (15 lectures)**a. *A Dance of the Forests*: Wole Soyinka

“Vultures”: Chinua Achebe

“Phenomenal Woman”: Maya Angelou

Suggested Readings

“The Danger of a Single Story” (Transcript) by Chimamanda Adichie.

Benson, Eugene and L. Conolly (Eds). *Encyclopaedia of Postcolonial Literatures in English*. Routledge, 2005Moore-Gilbert, Bart et al (Eds.) *Postcolonial Theory: Contexts, Practices, Politics*. Routledge, 1997Mongia, Padmini. *Postcolonial Theory*. Oxford, 1996Mukherjee, Meenakshi and Harish Trivedi (Eds.) *Interrogating Postcolonialism*. Indian Institute of Advanced Studies, 1996.Ashcroft, Bill et al. *The Empire Writes Back*. Routledge, 2002.Nayar, Pramod K. *Postcolonial Literature: An Introduction*. Pearson Education India, 2008.Young, Robert J.C. *Postcolonialism: A Very Short Introduction*. Oxford UP, 2003.**Mapping of COs to Syllabus**

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	H	M	M	M
CO 3		H	H	H
CO 4	M	H	H	H
CO 5		H	H	H
CO 6	M	H	H	H

EGAL0017: AMERICAN LITERATURE – POETRY, DRAMA & FICTION (3-0-0) (CREDITS: 03)**Course Outcomes**

Define intricacies of American literature. (Remembering)

Explain diversified range of subjects portrayed in American literature. (Understanding)

Organize a comparative study between literature from the conventional European colonial powers and a colonised yet culturally and politically dominant nation like America. (Applying)

Discover the colonial experience of America and its post-colonial recuperation (Analysing)

Interpret the complexities of race and identity as expressed through the indigenous cultures of the American society in the post-colonial context (Evaluating)

Develop a critical perspective towards the contemporary reading of a colonial text (Creating)

Module I: Introduction (10 lectures)

The Colonial Period (“Declaration of Independence”, 1776), American Nationalism, Romanticism, Transcendentalism (Selections from Emerson), Selections from *Studies in American Indian Literature* by Paula Gunn Allen

Module II: Drama (10 lectures)*Who is Afraid of Virginia Woolf*: Edward Albee*Death of a Salesman*: Arthur Miller**Module III: Novels (15 lectures)***Moby Dick*: Herman V Melville.*The Scarlet Letter*: Nathaniel Hawthorne**Module IV: Poems (10 lectures)**

"When Lilacs Last in the Dooryard Bloom'd": Walt Whitman

"The Raven": Edgar Allan Poe

"The Red Part": Linda Hogan

Suggested ReadingsEllmann, Richard (Ed.). *The New Oxford Book of American Verse*. Oxford University Press, 2001.Horton, R W and H.E. Edwards (Eds.). *Backgrounds of America Literary Thought*. Prentice Hall, 1974.Spiller, Robert E. *The Cycle of American Literature*. Macmillan, 1961.Gray, Richard. *History of American Literature*. Blackwell, 2008.Chase, Richard. *The American Novel and its Tradition*. Johns Hopkins Press, 1990.Krasner, David. (Ed.) *A Companion to Twentieth Century American Drama*. Blackwell, 2005.**Mapping of COs to Syllabus**

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	M	M
CO 2	H	H	H	H
CO 3	H	M	M	M
CO 4	H	M	H	M
CO 5	H	H	H	H
CO 6	H	M	M	M

EGLT0018: LITERARY AND CRITICAL THEORY (4-0-0) (CREDITS: 04)**Course Outcomes**

Define contemporary critical theories. (Remembering)

Explain the genesis and growth of the modern critical theories in the context of literary texts.

(Understanding)

Construct awareness of contemporary as well as Indian theories of literary aesthetics and utilize the theories to generate new approaches of looking at literary texts. (Applying)

Examine texts on the basis of their understanding of critical theoretical paradigms related to literature

(Analysing)

Evaluate the texts in terms of their political, social, psychoanalytical, feministic and economic implications.

(Evaluating)

Develop a more profound critical approach after the study of these theories. (Creating)

Module I: Canonical literary theories and theorists (20 lectures)

Deconstruction with reference to "Structure, Sign and Play in the Discourse of the Human Sciences": Jacques Derrida

Post- modernism with reference to "The Death of the Author": Roland Barthes

Marxist literary theory with reference to *Ideology and the State Apparatuses* (extract): Louis AlthusserPost- structuralism with reference to *The Order of Discourse* (extract) : Michel Foucault

Module II: Important texts (10 lectures)

"Myth, Fiction and Displacement": Northrop Frye

Selections from *Seven Types of Ambiguity*: William Empson

Selections from *Culture and Society, 1780-1950*: Raymond Williams

Module III: Critical essays and concepts (30 lectures)

a. "Castration or Decapitation?": Hélène Cixous

"Discourse in the Novel" from *The Dialogic Imagination*: M. M. Bakhtin

Selections from *Practicing New-historicism*: Stephen Greenblatt

"What Makes an Interpretation Acceptable": Stanley Fish

"Trans-corporeal Feminisms and the Ethical Space of Nature": Stacy Alaimo

Excerpts from *The Natyashastra*: Bharata Muni

Suggested Readings

Cuddon, J.A. *A Dictionary of Literary terms and Theories*. Penguin, 1997.

Wimsatt, William K and Cleanth Brooks (Eds.). *Literary Criticism: A Short History*. Routledge, 1957. 3.

Selden, Raman and Peter Widdowson, *A Reader's Guide to Contemporary Literary Theory*. 5th Edition, University Press of Kentucky, 1993.

Alaimo, Stacy and Susan Hekman. *Material Feminisms*. Indiana University Press, 2008. Project MUSE

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	M	H
CO 2	H	H	H
CO 3	M		H
CO 4	H		H
CO 5	H	H	H
CO 6	H	H	H

EGGN0019: GENDER AND LITERATURE (2-0-0) (CREDITS: 02)**Course Outcomes**

Define the various thoughts and theories pertaining to feminist writings and feminism. (Remembering)

Explain the themes and topics and relate it to real life situations. (Understanding)

Develop new ideas by connecting the various topics taught. (Applying)

Analyse the various movements related to gender issues and new developments in gender studies in literature. (Analysing)

Evaluate the interdisciplinary aspect in various texts. (Evaluating)

Discuss the meanings, ideas and thoughts regarding gender and its connection with literature. (Creating)

Module I: Selected Feminist Writings (12 Lectures)

"Vindication of the Rights of Woman": Mary Wollstonecraft (Excerpts)

"The Laugh of the Medusa": Helene Cixous

The Second Sex: Simone de Beauvoir (Selections)

The Gender Trouble: Judith Butler (Selections)

Module II: Selected Fiction (12 Lectures)

Funny Boy: Shyam Selvadurai

Sunlight on a Broken Column: Attia Hussain

Module III: Selected Short Story and Poetry (6 Lectures)

"The Wife's Letter": Rabindranath Tagore

"Purdah": Imtiaz Dharker

Suggested Readings

De Souza, Eunice (Ed.) *Nine Indian Woman Poets*. Oxford University Press, 1997.

Butler, Judith. *Gender Trouble: Feminism and Subversion of Identity*. Routledge, 1990.

Chaudhari, Sukanta (Ed.). *Rabindranath Tagore: Selected Short Stories*. Oxford, 2000.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2	H	M	M
CO 3	H	M	M
CO 4	H	M	M
CO 5		H	H
CO 6	M	H	H

.....: Linguistics and Stylistics I

Total Credits: 4 credits (45 Hours)

Course Outcome:

1. Define the key concepts related to language and society. (Remembering)
2. *Identify* the relationship between linguistics and stylistics. (Applying)
3. Identify linguistic changes in both written and spoken forms. (Evaluating)
4. Discuss stylistics as an interdisciplinary area of study. (Creating)

Module I: Language and Society (35 HOURS)

Language and Society, Dialect and Idiolect, Language variation- Standard Language, Register and Style, Bilingualism and Multilingualism, Pidgin and Creole, Code-switching and code-mixing, Language maintenance, Language Shift and Language Death

Linguistics categories- kinship terms, time concepts; Linguistic Relativity; Cognitive categories- Classifiers and Class Terms; Social categories and gender- gendered words, gendered structures, gendered speech Language Families; Language change; Sound change- Metathesis, epenthesis, prothesis; Syntactic Change- loss of inflections.

Module II: Introduction to Stylistics (10 HOURS)

Definition, Nature and Scope of Stylistics, Stylistics, Major Thinkers in Stylistics: Roman Jakobson, I.A. Richards, William Empson, David Crystal, Nils Erik Enkvist, Roger Fowler, Objectives of this discipline, Stylistics and levels of language, Stylistics and Style, Different branches of Stylistics- Linguistic Stylistics, Literary Stylistics and Pedagogical Stylistics, Stylistics as an interdisciplinary field

Suggested Readings:

1. Bradford, Richard. *Stylistics*. Routledge, 1997.
2. Carter, Ronald and Paul Simpson. *Language, Discourse and Literature: An Introductory Reader in Discourse Stylistics*. Routledge, 1998.
3. Fromkin, Victoria, Robert Rodman, and Nina M. Hyams. *An Introduction to Language*. 7th ed., Thomson/Heinle, 2003.
3. Simpson, Paul. *Stylistics*. Routledge, 2014. Lyons, John. *Language and Linguistics*. Cambridge University Press, 1981.

4. Toolan, Michael. *Language in Literature: An Introduction to Stylistics*. Routledge, 1998.
5. Trudgill, Peter. *Sociolinguistics*. Penguin, 1990.
6. Glottolog. Max Planck Institute for Evolutionary Anthropology, glottolog.org.
7. Kaipuleohone: The University of Hawai'i Digital Ethnographic Archive. University of Hawai'i, scholarspace.manoa.hawaii.edu/handle/10125/1.

Mapping of COs to Syllabus:

Course Outcome	Module I	Module II
CO1	H	
CO2	H	H
CO3	H	H
CO4		H

EGIW0023: INDIAN WRITING IN ENGLISH – POETRY, DRAMA & FICTION (4-0-0) (CREDITS: 04)**Course Outcomes**

- Define the literature produced in India in English. (Remembering)
- Illustrate and comment on poetry, drama, short stories and novels produced in India in their various socio-cultural contexts. (Understanding)
- Identify and explain the various critical theories involved in the production of various indigenous texts. (Applying)
- Analyse the techniques, style of writing and contribution of various writers to the Indian English literary tradition. (Analysing)
- Evaluate the Indian writings in English and their representation of the Indian ethos on a global forum and critically interpret the evolution of English language in India (Evaluating)
- Discuss the selected literary works and find out the commonalities in terms of themes and issues. (Creating)

Module I: Selected Poetry (10 lectures)

- "Philosophy": Nissim Ezekiel
- "The Looking Glass": Kamala Das
- "A River": A.K. Ramanujan
- "A Poem for Mother": Robin Ngangom
- "Indian Summer": Jayanta Mohapatra

Module II: Selected Drama & Short Story (15 lectures)

- Dance Like a Man*: Mahesh Dattani
- "The Road to Salvation": Munshi Premchand

Module III: Selected Fiction (20 lectures)

- Coolie*: Mulk Raj Anand
- Palace of Illusions*: Chitra Banerjee Divakaruni

Module IV: Selected Travel Writing and Non-fiction (15 lectures)

- a. *In an Antique Land*: Amitav Ghosh
- b. "Language and Spirit" Foreword to *Kanthapura*: Raja Rao

Suggested Readings

George, K.M.(Ed), *Contemporary Indian Short Stories in English and Modern Indian Literature*. Sahitya Akademi, 1992.

Deshpande, G.P. (Ed.) *Modern Indian Drama: An Anthology*. Goodreads, 2000.

Naik, M.K. *A History of Indian English Literature*. Sahitya Akademi, 1982.

Dattani, Mahesh. *Dance Like a Man*. Penguin, 2006

Divakaruni, Chitra Banerje. *Palace of Illusions*, Doubleday, 2008

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	M	M	H
CO 2	H	H	H	
CO 3	M	M	M	H
CO 4	H	H	H	H
CO 5	H	H	H	H
CO 6	H	H	H	H

EGSA0024: SOUTH-ASIAN LITERATURE (4-0-0) (CREDITS: 04)

Course Outcomes

Define the South Asian literary milieu. (Remembering)

Outline the literary, social, political and cultural dynamics of these texts. (Understanding)

Apply the knowledge from these texts to assess the socio-cultural aspect of these areas. (Applying)

Examine the texts with reference to the classic literary texts that they have studied earlier. (Analysing)

Evaluate the overall political and social implications of the area as suggestive in these texts. (Evaluating)

Discuss the emotions and aspirations of the writers from South Asia reflected in their writings. (Creating)

Module I: Introduction (20 lectures)

Geo-political conditions, Historical background of South Asian Literature, Imperialism, Colonialism, Nationalism, Orientalism, Decolonization, Specific issues with reference to history, politics and linguistic inventiveness in the literature of South-Asian countries.

Module II: Selected Poetry (10 lectures)

a. 'Love', 'Marriage', 'Children', 'Work', 'Joy and Sorrow' and 'Houses' from *The Prophet*: Khalil Gibran
b. Selected poems from 'Masnavi': Rumi

Module III: Selected Fiction (30 lectures)

Ice Candy Man: Bapsi Sidhwa

The Kite Runner: Khaled Hosseini

The Bones of Grace: Tahmima Anam

Suggested Readings

Mukherjee, Surjit. *Translation as Recovery*. Orient Longman, 2018.

Narasimhaiah, C.D. *East and West Poetics at Work*. Sahitya Academy, 1994.

Walsh, W. *Commonwealth Literature*. Oxford University Press, 1973.

Ashcroft, Bill et al. (Eds.) *The Empire Writes Back*. Routledge, 2002.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		

CO 2	M	H	H
CO 3		H	H
CO 4		H	H
CO 5	H	H	H
CO 6		H	H

.....: **Linguistics and Stylistics II**

Total Credits: 4 credits (45 Hours)

Course Outcomes

1. Apply pragmatic analysis to study language and its functions. (Applying)
2. Analyse the structure of a word or sentence linguistically and stylistically and read the various genres critically. (Analysing)
3. Assess and evaluate the structure of language using linguistic and stylistic tools. (Evaluating)
4. Discuss the importance of form and style. (Creating)

Module I: Analysing Structure and its meaning (30 Hours)

Syntactic Structure of English language; Deep structure and Surface Structure; Immediate Constituent Analysis; Phrase Structure rules.

Semantic level of language: Understanding semantic roles- agent, theme, experiencer, location, source and goal; Word-Meaning relations: Synonymy, antonymy, homonymy, hyponymy, metonymy and polysemy.

Pragmatics: Reference- inference and anaphora; presupposition and Entailment; Pragmatic markers; Politeness; Speech acts

Module II: Reading in Stylistics (15 Hours)

Sentence styles: development and illustration, Interpreting patterns of sound, Techniques of speech and through presentation.

Discourse analysis: Interpreting discourse, Cohesion and Coherence, A sociolinguistic model of narrative, Exploring metaphors in literary texts

Style variations: Free variation, Stylistic incongruity, Stylistic appreciation of poetry/prose

Suggested Readings:

1. Balasubramanian, T. A. Textbook of English Phonetics for Indian Students. Macmillan, 1981.
2. Crystal, David. Linguistics. Penguin, 1990. Hudson, R.A. Sociolinguistics. Cambridge UP, 1980.
3. Fromkin, Victoria, Robert Rodman, and Nina M. Hyams. *An Introduction to Language*. 7th ed., Thomson/Heinle, 2003.
4. Lyons, John. Language and Linguistics: An Introduction. Cambridge UP, 1981.
5. Simpson, P. Stylistics: A Resource Book for Students. Routledge, 2004.
6. Schneider, Klaus P. "Referring to Speech Acts in Communication: Exploring Meta-Illocutionary Expressions in ICE-Ireland." *Corpus Pragmatics*, vol. 6, no. 2, 2022, pp. 155–174.
7. Alhadi Ali Ahmed, F., et al. "An in-depth analysis of the representation of speech acts and language functions in Libyan public high school English textbooks." *Frontiers in Psychology*, vol. 13, 2023.

Mapping of COs to Syllabus:

Course Outcome	Module I	Module II
CO1	H	H
CO2	H	H
CO3	H	H
CO4		H

EGLC0028: LITERARY CRITICISM: PLATO TO F.R. LEAVIS AND SELECT TWENTIETH CENTURY PERSPECTIVES (4-0-0) (CREDITS: 04)
Course Outcomes:

List out the characteristics of a tragic hero according to Aristotle. (Remembering)
 Compare between Plato and Aristotle's theory of mimesis. (Understanding)
 Apply the twentieth century perspectives in literary research (Applying)
 Analyse critically a selected text in the field of Literary Criticism. (Analysing)
 Explain Coleridge's theory of Imagination. (Evaluating)
 Discuss the contributions of I A Richards in the field of Literary Criticism. (Creating)

Module I: Literary Criticism: Key Ideas and Concepts – Plato to Dryden (10 lectures)

Plato: Views on Poetry, Theory of Mimesis; Horace: Observations on drama; Longinus: Ideas On the Sublime, Sources of Sublimity in Literature; Philip Sidney: Ideas on "An Apology for Poetry"; John Dryden: ideas (classical, modern, French and English drama) from "An Essay on Dramatic Poesy"

Module II: Literary Criticism and Theory: Key Ideas and Concepts – Johnson to F. R. Leavis and Select Twentieth Century Perspectives (20 lectures)

Samuel Johnson: Views on Shakespeare;; William Wordsworth: Views on Poetry, Poetic Diction;; John Keats: Negative Capability, Egotistical Sublime; Matthew Arnold: The Touchstone Method, High Seriousness, Grand Style; I. A. Richards: The Referential and Emotive Uses of Language, Statement and Pseudo-Statement; Tenor and Vehicle, Stock Response; F.R. Leavis: Enactment, Literary Criticism and Philosophy; Russian Formalism, New Criticism, Marxism and Psychoanalysis

Module III: Selected Critical Texts (30 lectures) a. *Poetics* : Aristotle

Biographia Literaria (Chapter 13) : Samuel Taylor Coleridge

"Tradition and the Individual Talent": T. S. Eliot

Suggested Readings

Culler, Jonathan. *Literary Theory: A Very Short Introduction*.
 Abrams, M.H. *A Glossary of Literary Terms*.
 Cuddon, J.A. *The Penguin Dictionary of Literary Terms and Literary Theory*.
 Habib, M.A.R. *A History of Literary Criticism: From Plato to the Present*.
 Enright, D. J, Ernst De Chickera ed. *English Critical Texts: Indian Edition*. Oxford,1975

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1			H
CO 2	H		H
CO 3		H	
CO 4			H
CO 5			H
CO 6		H	

EGSD0029: SHAKESPEAREAN DRAMA (4-0-0)
Course Outcomes

Define drama as a literary genre (Remembering).

Explain the significant stages in the making of Shakespearean plays-tragedy, comedy, tragic-comedy and history plays (Understanding).

Apply the substance of the given criticism in the given plays (Applying).

Analyse the content of the given critical readings and their applicability in the given plays (Analysing).

Evaluate the theme, plot, literary techniques, characteristic features and creative energy of Shakespeare through the given plays (Evaluating).

Compile the content, style and the literary aspects of the given Shakespearean texts (Creating).

Module I: Tragedy and Tragi-comedy (25 lectures)

a) *Hamlet*

b) *Winter's Tale*

Module II: Comedy and History Plays (25 lectures)

a) *The Tempest*

b) *Julius Caesar*

Module III: Shakespearean Criticism (10 lectures)

Dollimore, Jonathan. "Introduction: Shakespeare, Cultural Materialism and New Historicism." *Political Shakespeare: Essays in Cultural Materialism*, edited by Jonnathan Dollimore and Alan Sinfield, Manchester University Press, 1994

Neill, Michael. "Post-colonial Shakespeare? Writing Away from the Centre." *Post-Colonial Shakespeare*, edited by Ania Loomba and Martin Orkin, Routledge, 2002

Suggested Readings List:

Texts prescribed in the Course.

Bloom, Harold, *Elizabethan Drama*. Infobase Publishing, New York.

Dutton, Richard and Howard, Jean. *A Companion to Shakespeare's Works*, Vol.II. Blackwell, Oxford.

Greenblatt, Stephen. *Tyrant: Shakespeare on Power*. Vintage, 2019.

Haris, Jonathan Gil. *Shakespeare and Literary Theory*. Oxford University Press, 2012.

Legatt, Alexander. *Shakespeare's Political Drama*. Rout ledge, London.

CO Mapping:

COs	Module I	Module II	Module III
CO1	H	H	L
CO2	H	H	L
CO3	M	M	H
CO4	M	M	H
CO5	H	H	M
CO6	H	H	M

EGIL0030: INTRODUCTION TO LINGUISTICS (4-0-0)

Objectives:

The aim of this paper is to introduce the students to the different branches of linguistics and its scope. The course will enable the students to have a better understanding of the philosophical and theoretical perspectives governing the studies in languages.

Course Outcomes:

CO 1: Define the basic concepts of linguistics. (Remembering)

CO 2: Understand the theoretical perspectives governing linguistic studies. (Understanding)

CO 3: Identify the levels of language structure. (Applying)

CO 4: Analyse the course of development of language with reference to traditional grammar approaches. (Analysing)

CO 5: Examine the basic phonological and morphological patterns of languages. (Evaluating)

CO 6: Summarize the course of development of language studies. (Creating)

Module I: Theoretical perspectives (30 Hours)

Origins of language; the nature of human language; language and cognitive development- the critical period; Language acquisition- Behaviourist Approach, Innateness Hypothesis, Stages in Language acquisition; Sapir-Whorf Hypothesis.

Structuralism- the influence of Prague School; American Structuralism; key concepts of structural linguistics- Sign, signifier and signified, langue and parole, synchrony and diachrony, paradigmatic and syntagmatic relations.

Historicism; Functionalism; Generativist approach and Universal Grammar; Cognitive approach and Usage-based theories in linguistics.

Module II: Branches of Linguistics and its key concepts (30 Hours)

The branches of linguistics and its scope; the development of grammar- descriptive and prescriptive grammars; language universals.

Phonetics and Phonology: The organs of speech, articulatory phonetics, phonemes (IPA) and allophones, phonetic and phonemic transcription; distinctive features and suprasegmental phonology, phonological structure.

Morphology: Free and bound morphemes- prefix, suffix, infix and circumfix; content words and function words; inflectional and derivational morphology; word formation processes.

Suggested Readings List:

Balasubramanian, T. *A Textbook for English Phonetics for Indian Students*, Macmillan, New Delhi. 2000.

Wood, F. T. *An outline history of the English language*, Macmillan, New Delhi. 1941.

Yule, George. *The Study of Language*, 4th edition, Cambridge University Press. New Delhi. 2010

Fromkin, Victoria. *Introduction to Language*. 7th Edition. Wadsworth Publication. 2003

Lyons, John. *Language and Linguistics: An Introduction*. 19th Edition. Cambridge University Press. 2009

CO Mapping:

COs	Module I	Module II
CO1		H
CO2	H	H
CO3	H	H
CO4	H	
CO5		H
CO6	H	H

EGIM0031: MODERN EUROPEAN LITERATURE I (3-0-0) (CREDITS: 03)

Course Outcomes

Analyse the specific issues such as the double challenge of truth and liberty, of identity and unity, of cultural loss and recovery, of ethnic specificity and aesthetic universality in the writings of contemporary European writers. (Analysing)

Evaluate the core issues as depicted in the literature of Modern Europe. (Evaluating)

Develop critical understanding of various texts. (Creating)

Module I: Major Aesthetic Developments (10 lectures)

Constructivism, Realism, Symbolism, Naturalism, Aestheticism, Futurism, Vorticism, Imagism, Expressionism, Dadaism, Surrealism, Cynicism, Skepticism, Resistance, Despair and Alienation

Module II: Selected Modern European Poetry (10 lectures)

"The Albatross": Charles Baudelaire

"The Apple Orchard": Rainer Maria Rilke

Module III: Modern European Fiction (25lectures)

a. *Crime and Punishment*: Fyodor Dostoevsky

b. *The Castle*: Franz Kafka

Suggested Readings

Abrams, M.H. and, Geoffrey Galt Harpham. *A Glossary of Literary Terms*. Cengage Learning, 2015.

Bloom, Harold. *The Western Canon: The Books and School of the Ages*. Harcourt, 1994.

Bradbury, Malcolm and James Mac Farlane (Eds) *Modernism: A Guide to European Literature, 1890-1930*. Penguin, 1976.

Cohen, Walter. *A History of European Literature*. Oxford University Press, 2017.

Cohen, J.M. *A History of Western Literature*. Transaction Publishing, 2007.

Hamburger, Michael. *The Truth of Poetry: Modernist Poetry Since Baudelaire*. Anvil Press Poetry, 2004.

Moretti, Franco(Ed.). *The Novel*. Princeton UP, 2006.

Nicoll, Allardyce. *British Drama*. Barnes & Noble, 1961.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	H	H
CO 2	H	M	M
CO 3		H	H

EGEL0032: MODERN EUROPEAN LITERATURE II (3-0-0) (CREDITS: 03)**Course Outcomes**

Analyse the modernist issues such as humanism, individualism, meaninglessness of life, liberty and identity, cultural loss and recovery and aesthetic universality in the literature from different nations of Europe.

(Analysing)

Evaluate the overall Western modern philosophy in the works of the various writers of the area. (Evaluating)

Discuss the changing trends and movements of literature as reflected in the selected texts. (Creating)

Module I: Selected Modern European Poetry (20 lectures)

a. "Lament for a Bullfighter": Federico Garcia Lorca

b. "To his Own Beloved Self": Vladimir Mayakovsky

Module II: Selected Modern European Drama (15 lectures)

a. Accidental Death of an Anarchist: Dario Fo (Italy).

b. The Chairs: Eugene Ionesco (Romania)

Module III: Modern European Fiction (10 lectures)

The Stranger: Albert Camus

The Tin Drum: Gunter Grass

Suggested Readings

Abrams, M.H. and Geoffrey Galt Harpham. *A Glossary of Literary Terms*. Cengage Learning, 2015.

Bloom, Harold. *The Western Canon: The Books and School of the Ages*, Harcourt, 1994.
 Bradbury, Malcolm and James MacFarlane (Eds). *Modernism: A Guide to European Literature, 1890-1930*. Penguin, 1976.
 Cohen, Walter. *A History of European Literature*. Oxford University Press, 2017.
 Cohen, J.M. *A History of Western Literature*. Transaction Publishing, 2007.
 Hamburger, Michael. *The Truth of Poetry: Modernist Poetry since Baudelaire*. Anvil Press Poetry, 2004.
 Moretti, Franco(Ed.). *The Novel*. Princeton UP, 2006.
 Nicoll, Allardyce. *British Drama*. Barnes & Noble, 1961.

Mapping of COs to Syllabus

Course Out-comes	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H

EGWL0033: WORLD LITERATURE SINCE 20TH CENTURY

Credits: 02 (2-0-0)

Objective: The course aims to introduce the students to literature across the world. The students are expected to develop an understanding of cultural exchange processes as represented through literature from different parts of the world, along with the ability to relate the ideas and contexts of socio-economic development to the historic development of the nations through various literary texts.

Course Outcomes:

To *acquaint* with the major literary concepts/movements to comprehend and interpret the prescribed texts of World Literature.

To *develop* a consciousness of the illusions pertaining to national identity and the status of an individual in a given geographical area.

To *construct* ideas on multiculturalism, disconnect from native land and the challenges face by people in various diaspora contexts.

Module 1: Conceptual background (5 hours)

David Damrosch. "What is World Literature?" in *World Literature Today*.

Module 2: 20th Century World Literature (12 hours)

Fiction:

Maxim Gorky: *Mother* (Chapter 1 and 2)

Gabriel Garcia Marquez: "A Very Old Man with Enormous Wings"

Kunzang Choden: "The Woman Who Lost Her Senses"

Poetry:

1. Yehuda Amichai: "Half the People in the World"

Module 3: Contemporary World Literature (13 hours)

Fiction:

Haruki Murakami: *Kafka on the Shore* (Chapter 1-4)

Jhumpa Lahiri: "Hell-heaven"

Ama Ata Aidoo: "Diplomatic Pounds"

Poetry:

1. Khairani Borokka: "Money for Your English"

Suggested Readings:

Damrosch, David. "What Is World Literature?". *World Literature Today*, Vol. 77, No. 1, 2003, pp. 9-14. :

<https://www.jstor.org/stable/40157771>

Barnes, John R. "World-Literature." *The English Journal*, Vol. 26, No. 9, 1937, pp. 734-739.

<https://www.jstor.org/stable/804286>

Gorky, Maxim. *Mother*, Maple Press, 2015

Marquez, Gabriel Garcia, *A Very Old Man With Enormous Wings*, Penguin, 2014.

Choden, Kunzang. *Tales in Colour and Other Stories*, Zubaan, 2009

Murakami, Haruki. *Kafka on the Shore*, Vintage Books, 2006

Aidoo, Ama Ata. *Diplomatic Pounds and Other Stories*, Ayebia Clarke, 2012

Lahiri, Jhumpa. *Unaccustomed Earth*, Random House, 2013

Almond, Ian. *World Literature Decentered*, Taylor and Francis, 2021

Ganguly, Debjani. *Cambridge History of World Literature*, CUP, 2021

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	M	M	H
CO 3	M	H	H

EGAA0034: ARTS AND AESTHETICS

3 credits: 3-0-0

Course Objectives

The objective of this course is to make the students understand the aesthetic concepts from various Western and Indian Philosophies along with their contextual relevance. A philosophical exploration is expected to enhance our understanding of the significance of art and aesthetics in the global culture.

Course Outcomes

CO1: *Remembering* the historical understanding on Western and Indian Aesthetics

CO2: *Understanding* the aesthetic concepts from various Western and Indian philosophers

CO3: *Analyzing* the contextual relevance of aesthetic theories

Module I: Nature of Aesthetics (10 hours)

Definitions of art

Art as Expression

Art and Society

Art and Aesthetics

Module II: Art and Aesthetic Experience (15 hours)

Introduction to Western and Eastern Aesthetics

Immanuel Kant on "Disinterested Delight"

Bharata Muni's "Rasa Theory"

Abhinavagupta on “Rasa”

Module III: Aesthetics and Philosophical Aesthetics (15 hours)

Arindam Chakrabarti: Introduction to *The Bloomsbury Research Handbook of Indian Aesthetics and the Philosophy of Art*, Bloomsbury, 2016.

Renaissance art and Humanism- A study on the works of Albrecht Durer and Leonardo Da Vinci

Suggested Readings

Chen, Jingran. “An Analysis of the Multiple Meanings of Art During the Renaissance.” *Journal of Education, Humanities and Social Sciences*, 2009.

Guo, Zhaodi, and Lin Zhang. “Wisdom and Knowledge: The Outline of Eastern and Western Aesthetic Spirits.” *Frontiers of Philosophy in China*, vol. 7, no. 1, 2012, pp. 90–111. JSTOR, <http://www.jstor.org/stable/44259373>.

Kant, Immanuel. *The Critique of Judgment (Theory of the Aesthetic Judgment & Theory of the Teleological Judgment)*.

Czechia Good Press, 2024.

Nanay, Bence. *Aesthetics: A Very Short Introduction*. Oxford UP, 2019.

Pande, Suresh Chandra. *The Concept of Rasa With Special Reference to Abhinava Gupta*. Indian Institute of Advanced Study, 2018.

Price, David. *Albrecht Durer's Renaissance Humanism, Reformation and the Art of Faith*. University of Michigan Press, 2003.

Vatsyayan, Kapila. *Bharata - the Natyashastra*. Sahitya Akademi, 1970.

Mapping of COs to Modules

Cos	Module I	Module II	Module III
CO1	H	H	H
CO2	M	H	H
CO3	M	H	H

EGCS0035: CULTURAL STUDIES

Credit: 3-0-0

Objectives: The course will introduce the students to the basic ideas and theoretical developments under the broader research area of Cultural studies, adding critical perspectives to their understanding. The course will introduce the key ideas, theories and methodologies for practical application of the ideas within popular sites of culture production.

Course Outcomes:

To *familiarize* the student to the multi-faceted dynamics of culture, the process of culture production and cultural products

To *identify* the core debates within cultural studies.

To *develop* habits of independent learning through critical analysis.

Module 1: Origins, Aims and Scope of Cultural Studies (17 hours)

Culture: Definition, Popular culture, culture and power, sites of culture production, product and spaces of culture consumption **Origins of Cultural studies:** Early trends, Birmingham Centre for Contemporary Cultural Studies, Stuart Hall's ideas and contribution, Scopes

Module 2: Methods and Methodologies of Cultural Studies (18 hours)

Methods: 'Circuit of Culture' (Representation, Identity, Production, Consumption, Regulation), Language and Discourse, Cultural Materialism, Postcolonialism and Cultural Studies, Media culture and cultural studies.

Module 3: Critical Text (10 hours)

Hall, Stuart. "Encoding/Decoding"

Suggested Readings

Nayar, Pramod K. *An Introduction to Cultural Studies*, Second Edition, Viva Books, 2023

Williams, Raymond. *Culture and Society 1780-1950*, Anchor Books, 1960

Amin, Ash and Nigel Thrift. *Cities: Reimagining the Urban*, London Polity, 2002.

Beck, Ulrich. *Risk Society: Towards a New Modernity*, Tr. Mark Ritter, Sage, 1992.

Bhaba, Homi K. *The Location of Culture*, Routledge, 1995.

Hall, Stuart. "Encoding/decoding." In Stuart Hall, Dorothy Hobson, Andrew Love, and Paul Willis (eds.), *Culture, Media, Language*, pp. 128–38. London: Hutchinson, 1980.

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3
CO 1	H	M	L
CO 2	L	H	H
CO 3	M	H	H

EGFS0036: FILM STUDIES (3-0-0)

Objectives: This paper enables students to gain skills in the field of cinema via the appreciation of its features as a medium. The course is practically oriented to encourage students to acquire the competence necessary to become engaged viewers/critics/reviewers.

Course/Learning Outcomes

At the end of the course students will be able to:

CO1: *Define* the specific features of composition that help create films. (Remembering)

CO2: *Explain* the different methodologies of film analysis. (Understanding)

CO3: *Write* film reviews to generate a repertoire of analyses and interpretations. (Application)

Module I: Introduction to Film Studies (15 Hours)

History of world cinema; Western cinema; Non-western cinema; Art and Technique of film; Script writing; Language of Cinema; Mise en scene; Cinematography; Editing; Sound; Types of cinemas; Different movements of cinema

Module II: Film Genres (15 Hours)

Analysis of film scripts; Definition of various film genres; Taxonomies of film genre; Story Idea; Theme; Structure; Film genre as economic strategy; Film genre as Cognition; Rethinking film genres

Module III: Film Criticism (15 Hours)

Critical analysis of films; Different film theories; Classical Film Theories; Post-classical film theories Tools of film criticism;

Semiotic approaches; Structuralist approaches, Contextual approaches; Film reviews

Suggested Readings

Corrigan, Timothy. *A Short Guide to Writing About Film*. Pearson, 2014.
 Dix, Andrew. *Beginning Film Studies*. Viva, 2010, pp. 9-100. New Delhi.
 Nelmes, Jill, editor. *An Introduction to Film Studies*. Routledge, 2003, pp. 152-69. London.
 Richardson, Michael. "Film Criticism." *The International Encyclopaedia of Surrealism*, 2020.
 Raghavendra, M. K. *Locating World Cinema: Interpretations of Film as Culture*. Bloomsbury Publishing, 2020. India.
The Language and Style of Film Criticism. Taylor & Francis, 2011. United Kingdom.

Suggested Films

Aamis: Ravening. Directed by Bhaskar Hazarika, 2019.
 Enemy. Directed by Denis Villeneuve, 2013.
 In the Mood for Love. Directed by Wong Kar-wai, 2000.
 No Smoking. Directed by Anurag Kashyap, 2007.

Mapping of COs to Syllabus:

Cos	Module I	Module II	Module III
CO1	H	L	M
CO2	M	H	L
CO3	H	M	L

EGNE0037: NORTH-EAST INDIAN LITERATURE IN ENGLISH (3-0-0)**(Credits: Theory 03)**

Objectives: The objective of the course is to introduce learners to the vast body of writings in English from Northeast of India so that they develop an ability to critically interpret different literary themes and recurrent issues reflected in Northeast Indian literature in English.

Course Outcomes

Interpret the emerging trends of literature from northeast of India in its different genres- prose, poetry, fiction and short-fiction. (Understanding)

Apply critical theoretical assumption as well as critical reading skills to evaluate vibrant areas of Northeast literature. (Applying)

Examine the most significant topics like colonialism, identity and unity, cultural loss, ethnic conflicts, universality in the literature of Northeast region before and after British Colonial Period (Analysing)

Module I: Selected Poetry (12 hours)

a) Easterine Kire: "Riddu Riddu"
 Robin Ngangom: "My Invented Land"
 Nini Lungalang – "Going Home"
 Rajendra Bhandari – "I.D. Card of an Unemployed Youth"

Module II: Selected Fiction (20 hours)

Mamang Dai: *The Legends of Pensam*
 Mitra Phukan: *The Collector's Wife*

Module III: Selected Short Stories (13 hours)

Janice Pariat – "Boats on Land" (Title Story)

Temsula Ao - "The Curfew Man" (from *These Hills Called Home*)

Suggested Readings

The Oxford Anthology of Writings from North East India: Poetry and Essays, Indian Edition, Misra, Tillotama, 2010, OUP.

Emerging Literatures from North East India: The Dynamics of Culture, Society and Identity, 1st Edition, Zama, Magarat Ch, 1900, SAGE publications.

Dancing Earth: An Anthology of Poetry from North-east India, 1st Edition, Ngangom, Robin S. & Nongkynrih, Kynpham Singh, 2009, Penguin.

Exploring North-East Indian Writings in English: 2 volumes, 1st Edition, Swami, Indu, 2010, VDM Verlag. Swami, Indu. *Exploring North East Indian Writings in English* (2 Volumes)

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3
1	H	H	H
2	M	H	H
3	H	H	H

EGWR0038: WOMEN'S WRITINGS

Credits: 03 (3-0-0)

Course Objectives: The course intends to equip the student with the ability to acknowledge the diverse experiences of women across time, nations and cultures understand the importance of context for interpreting women's experience.

Course Outcomes

Define and explain the various thoughts and theories pertaining to feminist writings and feminism.

(Remembering)

Analyse the various movements related to gender and the progress in gender and literature. (Analyzing)

Evaluate the interdisciplinary aspect in the various texts prescribed. (Evaluating)

Module I: Selected Poetry (12 hours)

Sylvia Plath: 'Daddy'

Anjum Hassan: 'Distant God'

Adrienne Rich: 'Snapshots of a Daughter-in-law'

Amrita Pritam: 'Meeting The Self'

Module II: Selected Fiction (18 hours)

Alice Walker: *The Color Purple*

Monica Ali: *Brick Lane*

Module III: Selected Non-fiction (15 hours)

Mary Wollstonecraft- *A Vindication of the Rights of Woman* (New York: Norton, 1988) chapter.1

Judith Butler: *Gender Trouble: Feminism and the Subversion of Identity* (New York and London: Routledge, 1990) Chapter 1 Elaine Showalter. *A Literature of their Own*, Princeton: Princeton UP, 1977 (excerpt)

Suggested Readings

- Wollstonecraft, Mary. *A Vindication of the Rights of Woman*. Norton, 1988.
- Woolf, Virginia. *A Room of One's Own* (chaps.1 and 6.). Harcourt, 1957.
- Beauvoir, Simone de. 'Introduction', in *The Second Sex*, tr. Constance Borde and Shiela Malovany-Chevallier. Vintage, 2010, pp.3–18.
- Sangari, Kumkum and Sudesh Vaid, ed. 'Introduction', in *Recasting Women: Essays in Colonial History*. Kali for Women, 1989, pp. 1–25.
- Wittig, Monique. *The Straight Mind and Other Essays*. Beacon P, 1992.
- Vanita, Ruth and Saleem Kidwai, ed. *Same-sex Love in India: Readings from Literature and History*. St Martin's P, 2000.
- Mohanty, Chandra Talapade. 'Under Western Eyes: Feminist Scholarship and Colonial Discourses', in *Contemporary Postcolonial Theory: A Reader*, ed. Padmini Mongia. Arnold, 1996, pp. 172–97.

COs Mapping

CO	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H

EGAL0039: COLONIAL AND POST-COLONIAL AFRICAN LITERATURE I (3-0-0) (CREDITS: 03)**Course Outcomes**

- Analyze* the critical background of the formation of the postcolonial African literature
- Evaluate* the various issues such as colonialism, identity, cultural loss, dislocation, displacement, mimicry in the literature of Africa in the post-colonial socio-cultural context. (Evaluating)
- Discuss* selected African literary texts from the postcolonial critical perspective to explore their postcolonial socio-cultural implications. (Creating)

Module I: Conceptual Background : Critical Terms (10 lectures)

"Post-colonialism / Postcolonialism, Colonial and Postcolonial Periods in Africa, Negritude, African Feminism, Afrofuturism, Negofeminism, Motherism, Stiwanism, negraille

Module II: Fiction (20 lectures)

- No Longer at Ease*: Chinua Achebe
- Purple Hibiscus*: Chimamanda Ngozi Adichie
- A Far Cry from Africa*: Derek Walcott

Module III: Drama (15 lectures)

- The Lion and the Jewel*: Wole Soyinka
- The Dilemma of a Ghost*: Ama Ata Aidoo

Suggested Readings

- Achebe, Chinua. *Arrow of God*. William Heinemann Ltd, 1958.
- Adichie, Chimamanda Ngozi. *Purple Hibiscus*. Algonquin Books, 2003.
- Aidoo, Ama Ata. *The Dilemma of a Ghost*. Longman, 1995.
- Bell, Bernard W. *The Afro-American Novel and Its Tradition*. University of Massachusetts Press, 1989.
- Dathorne, O.R. *The Black Mind: A History of African Literature*. University of Minnesota Press, 1974.
- King, Lovelace et al. *Contemporary African American Literature: The Living Canon*. Indiana University Press, 2013.

Ngugi, MukomaWa. *The Rise of the African Novel*. University of Michigan Press, 2018

Soyinka, Wole. *The Lion and the Jewel*. Oxford UP, 1962.

The prescribed texts

Mapping of COs to Syllabus

COs	Module 1	Module 2	Module 3
1	H	M	M
2	M	H	H
3	M	H	H

EGPC0040: COLONIAL AND POST-COLONIAL AFRICAN LITERATURE II (3-0-0) (CREDITS: 03)

Course Outcomes

Analyze the additional critical background of the formation of the postcolonial African literature

Evaluate the issues such as colonialism, identity, cultural loss, dislocation, displacement, mimicry in the literature of Africa in the post-colonial socio-cultural context. (Evaluating)

Discuss selected African literary texts from the postcolonial critical perspective to explore and map their theoretical background and the body of colonial and post-colonial African literature.

Module I: Conceptual Background: Essays (10 lectures)

a. Leopold Sedar Senghor. "Negritude"

b. Mark Dery. "Afrofuturism"

Module II: Selected Fiction and Poetry (20 lectures)

By the Sea : Abdulrajak Gurnah

July's People: Nadine Gordimer

Bound to Violence : Yambo Ouologuem

"On Being Brought from Africa to America": Phillis Wheatley

Module III: Selected Non-Fiction (15 lectures)

"On Abolition of the English Department": Ngugi wa' Thiong'o

"The African Writer and the English Language": Chinua Achebe.

Suggested Readings

Achebe, Chinua. *Hopes and Impediments*. PenguinBooks,1990.

Ngugi, MukomaWa. *The Rise of the African Novel*, University of MichiganPress. 2018.

Fanon, Frantz. *The Wretched of the Earth*. Translated by Constance Farrington. Penguin Books, 1963.

Senghor, Leopold Sedar. "Negritude." *Indian Literature* Vol. 17, No.1/2, 1974, pp. 269-

273. <https://www.jstor.org/stable/23329885>.

Dery, Mark. "Black to the Future: Interviews with Samuel R. Delany, Greg Tate, and Tricia Rose" in Mark Dery ed. *Flame Wars: The Discourse of Cyberculture*, Duke University Press, 1994.

Thiong'o, Ngugi wa. *Decolonising the Mind*, East African Educational Publishers, 1986.

Gurnah, Abdulrajak : *By The Sea* , Bloomsbury Publishing , 2021

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	M

CO 2	M	H	H
CO 3	M	H	H

EGSL0200: SERVICE LEARNING- LANGUAGE COMMUNICATION (2-0-0) (CREDIT: 02)

Course Outcomes

Describe the nature of Service Learning and the principles of Community University Engagement (Remembering)

Understand the importance of engagement with nearby communities and develop a mutual partnership in terms of the sharing of knowledge with the local communities (Understanding)

Apply the principles of Community University Engagement in the linguistic study of local communities in terms of spoken English and study of speech expressions (Applying)

Analyze the linguistic expressions of the communities and the gap of communication in terms of English language. (Analyzing)

Evaluate the expressions of the communities and summarize the socio-cultural constructs behind the expressions under Service-learning study. (Evaluating)

Design a project report on their understanding of Service learning and involvement with the communities. (Creating)

Module I: Understanding Service Learning (15 lectures)

Introduction to Service Learning; Understanding Community University Engagement; Historical Overview of Community University Engagement in India; Principles of Community University Engagement; Forms of Community University Engagement; Community Based Participatory Research; Social Responsibility of Higher Education Institutions of India

Module II: Interaction with Communities (15 lectures)

Foundations of English grammar; English phonetic symbols (vowels and consonants); Common idioms and phrases in English; Understanding the Key concepts of languages: the socio-cultural context; Exploring different speech communities; Learning unique linguistic expressions; Exploring idioms and phrases: the socio-cultural construct that binds them; Basics of translation; Field Visit; Assessment: Assignment writing and Submission

Suggested Readings

Abbi, Anvita. *A Manual of Linguistic Fieldwork and Structures of Indian Languages*. Lincom Europa.2001

Colina, Sonia. *Fundamentals of Translation*.CUP. 2015

Hall Budd. et al. *Strengthening Community University Research Partnerships: Global Perspectives*.

University of Victoria,2015

Kaye, Berger Catheryn. *A Complete Guide to Service Learning*. Free Spirit Publishing, 2004

Rastogi, Pratap. *Art of English Translation*. Ramesh Publishing House,2016

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO 1	H	
CO 2	H	
CO 3	H	
CO 4		H
CO 5		H
CO 6		H

EGPP6003: PROJECT PHASE I (1-0-1) (CREDITS: 02)**Course Outcomes**

Define academic writing, research paper and publication. (Remembering)

Identify research topics for sustained and rigorous investigation so that original write-ups can be developed. (Understanding)

Estimate and expand their abilities to absorb, synthesize and construct arguments in a close-knit community. (Applying)

Analyse the various works of literature to write research reports and papers. (Analysing)

Evaluate critically through reading, research, discussion and composition around a particular topic/ theme or subject. (Evaluating)

Compose write-ups for scholarly journals by doing analysis of textual evidence. (Creating)

Module I: Conceptualizing, Planning and Preparing a Research Paper (15 lectures)

Introduction to academic/ research writing

Avoiding Plagiarism in research

Selection of a research topic

Developing an outline of the research paper

Choosing an appropriate title for the research paper

Writing an abstract

Review of Literature

Developing an argument

Bringing a critical interpretation into writing

Drawing inferences/ framing a conclusion

MLA Handbook 8th Edition

Referencing and Citation

Bibliography

Module II: Practical- Writing and editing a Research Paper (15 Lectures)

□ Draft of the abstract

Draft of the literature review

First draft of the research paper

Second draft of the research paper

The final research work

Suggested Reading

1. Correa, Delia Da Souza & Owens, W.R. *The Handbook to Literary Research*. Routledge. 2009
2. Kothari, C. R. & Gaurav Garg. *Research Methodology: Methods and Techniques*. New Age. 2019
3. *MLA Handbook for Writers of Research Papers*, Eighth Edition. MLA. 2016.

Mapping of Course Outcomes

Course Outcomes	Module 1	Module 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6		H

EGPP6004: PROJECT PHASE II (2-0-6) (CREDITS: 08)**Course Outcomes**

Define academic writing, dissertation and publication. (Remembering)

Identify research topics for sustained and rigorous investigation so that original write-ups can be developed. (Understanding)

Estimate and expand their abilities to absorb, synthesize and construct arguments in a close-knit community. (Applying)

Analyse the various works of literature to conduct detailed analytical research. (Analysing)

Evaluate critically through reading, research, discussion and composition around a particular topic/ theme or subject. (Evaluating)

Compose scholarly write-ups by conducting detailed, in-depth analysis of a research area. (Creating)

Module I: Conceptualizing, Planning and Preparing a Research Topic (30 lectures)

Introduction to Project work and Dissertation writing

Topic and Proposal

Literature review

Perspective/ Theoretical framework

Chapterisation

Resources

Limitation and Scope

Critical interpretation and Documentation

MLA Handbook 8th Edition

In-text Citation

Bibliography/ Referencing Plagiarism

Module II: Practical- Writing and editing a Research Paper (90 Lectures)

Working Proposal

Final Proposal

Abstract

Outline of the Dissertation

Draft of the literature review

First draft of the Chapters

Second draft of the Chapters

The final Dissertation

Suggested Reading

1. Correa, Delia Da Souza & Owens, W.R. *The Handbook to Literary Research*.

Routledge. 2009 2. Kothari, C. R. & Gaurav Garg. *Research Methodology: Methods and Techniques*. New Age. 2019

3. *MLA Handbook for Writers of Research Papers*, Eighth Edition. MLA. 2016.

Mapping of Course Outcomes

Course Outcomes	Module 1	Module 2
CO 1	H	H
CO 2	H	H
CO 3	H	H
CO 4	H	H
CO 5	H	H
CO 6		H

EGSP6006: SEMINAR AND PRESENTATION**Credit: 02 (1-1-0) Objectives:**

To enable the students to identify and expand their abilities to absorb, synthesize and construct arguments in research.

To assess various works of literature to write research reports and papers.

To compose write-ups for scholarly journals by doing analysis of textual evidence.

Course Outcomes

Identify research topics for sustained and rigorous investigation so that original write-ups can be developed. (Applying)

Develop critical reading, research, discussion and composition around a particular topic/ theme or subject. (Creating)

Module I: Introduction to Seminar and Steps of Seminar (5 hours)

a) Introduction to Seminar

Research Methodology

Formulating a Research Paper

Tips and Techniques of a Good Presentation : Presentation - how to present a seminar paper; mode of presentation: essaytype presentation, paper presentation, power point (ppt.) presentation

Module II: Practical (25 hours)

Two presentations per period on predetermined and allotted topics

Each will be allotted 10-15 minutes for presentation.

Followed by a discussion and commentary on the paper presented.

Suggested Readings

1. Correa, Delia Da Souza & Owens, W.R. The Handbook to Literary Research. Routledge. 2009
2. Kothari, C. R. & Gaurav Garg. Research Methodology: Methods and Techniques. New Age. 2019
3. MLA Handbook for Writers of Research Papers, Eighth Edition. MLA. 2016.

Mapping of COs to Syllabus

COs	Module 1	Module 2
CO1	H	H
CO2	H	H

VALUE ADDED COURSES**EGES0138: EFFECTIVE COMMUNICATION SKILLS (1-0-1) (CREDITS: 02)****Course Outcomes**

Describe the types of communication. (Remembering)

Differentiate from a variety of social functions including greetings, introductions and farewells, making and responding to requests, suggestions, invitations and apologies, conducting simple transactions in shops and offices, asking for and giving directions, etc. (Understanding)

Illustrate the daily routines in a series of simple phrases and sentences. (Applying)

Categorize the form and function of the basic official correspondences. (Analysing)

Evaluate formal and informal writings, preparing reports, letters, memorandum, notices, agenda, minutes etc. (Evaluating)

Formulate the rationale of descriptive, narrative, expository and argumentative writing. (Creating)

Module I: Communication and Grammar skills (8 lectures)

Language and communication: Differences between speech and writing, Distinct features of speech, Distinct features of writing, Parts of Speech, Person, Gender, Number, Use of Tense, Aspect and Modals, Degrees of comparison, Sentence types, Negation and Relative Clauses, Narration, Voice change, Proverbs, Vocabulary, Proper use of words, Idioms, Accentuation, Intonation, Understanding Various Englishes.

Module II: Developing Communicative Skills (7 lectures)

Introductory, developmental, transitional and concluding paragraphs: Coherence and cohesion, Descriptive, narrative, expository and argumentative writing, Introduction to soft skills, people and social skills, presentation, interaction and effective communication.

Official letter, Paragraph writing, Note-making, Topic Sentence, Telephonic Conversation, Group Discussion regarding job interview & C. V. Writing, formal and informal writings, reports, handbooks, manuals, letters, memorandum, notices, agenda, minutes.

Module III: Self-Learning (15 lectures)

Practice and drill sessions, online learning via tutorials (link to be provided by the teacher in-charge), self-assessment of progress, submission of assessment reports to the teacher.

Suggested Readings

English and Soft Skills. S.P. Dhanavel. Orient BlackSwan 2013

Fluency in English - Part II, Oxford University Press, 2006.

Business English, Pearson, 2008.

Language, Literature and Creativity, Orient Blackswan, 2013.

The Cambridge Grammar of the English language. Huddleston and Pullam, CUP, 2002.

Mapping of Course Outcomes

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6		H	H

EGML0028: MYTH IN LITERATURE (2-0-0) (CREDITS: 02)

Course Outcomes

Remember some of the recurrent classical myths in literature (Remembering)

Understand that myths have strong metaphoric function (Understanding)

Understand how the application of the myth in the select texts throws more light in understanding the complex ideas therein (Applying)

Co-relate the original story in the myth to the story in the corresponding literature (Analyzing)

Rate the potentiality of the myth in leveraging literary ideas (Evaluating)

Adopt the myth as vehicle of thought in creative writings (Creating)

Module I: Myth Concepts (7 lectures)

Myth, mythology, mytheme, archetype, archetypal, archetypal criticism, mythopoeia, myth critics

Module II: Recurring Myths (15 lectures)

Myth of: Zeus (Jupiter/Jove), Venus (Aphrodite), Cupid (Eros), Adonais, Hercules, Odysseus, Achilles, Oedipus, Electra, Helen, Diana, Hera, Orpheus and Eurydice, Hades, Leda and Swan, Trojan War

Module III: Myth in Literature-significance of select myth (8 lectures):

Geoffrey Chaucer: : Myth of Thisbe and Dido in *Legend of Good Women*

P.B.Shelley : Myth of Adonais in "Adonais"

W.B.Yeats : Myth of Leda and Swan in "Lead and the Swan"

T.S.Eliot : Myth of Phiomela, Cleopatra and Tiresias *The Waste Land*

Suggested Readings

Frye, Northrop. "Myth, Fiction and Displacement"

Graves, Robert (1955). *The Greek Myth*. Penguin, 1992

Matyszak, Philip. *The Greek and Roman Myths – A Guide to the Classical Stories*. Thames and Hudson, 2010.

Powell, Barry B. *Classical Myth*. Oxford University Press, 2020

Bahun, Sanja. *Myth, Literature, and the Unconscious*. Routledge, 2013.

Mapping of Course Outcomes

Course Outcomes	MODULE 1	MODULE 2	MODULE 3
CO 1	H	H	H
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6	H	H	H

EGLA6005: LYRICAL ANALYSIS: SONGS AND POETRY

2 Credits (1-0-1)

Course Outcomes

Define important concepts related to lyrical analysis of English poetry. (Remembering)

Explain the usage of such ideas in the context of literary texts. (Understanding)

Develop lyrical analytical skills (Creating)

Module I: Prosodic Analysis- Key Concepts (6 Hours)

Prosody; Syllable, Foot, Accent, Pitch; Primary and Secondary accent; Rhythm, Rhyme, Metre; Scansion, Figures of Speech

Module II: Lyrical Poetry (8 hours)

Sonnet 18 by William Shakespeare

"Go, Lovely Rose" by Edmund Waller

"I Felt a Funeral, in my Brain" by Emily Dickinson

Module III: Poetic Song Analysis (8 hours)

"Knocking on Heaven's Door" and "Blowin' in the Wind" by Bob Dylan

"Hey Little Man" and "Rumble Jumble" by Lou Majaw

"Time" by Tom Waits

Module IV: Application (8 hours)

“The Impasse of Musical Theory” by I. A. Richards

Apply poetic analysis to any song and present it in class.

Suggested Readings

Jonathan Culler, *Theory of the Lyric*, Harvard University Press, 2017

Mike Mattison and Ernest Suarez, *Poetic Song Verse*, University Press of Mississippi, 2021

Jonathan Wells, *Third Rail: The Poetry of Rock and Roll*, MTV Books, 2007

Mapping of Cos to Syllabus:

COs	Module 1	Module 2	Module 3	Module 4
CO1	H	M	L	L
CO2	H	H	L	L
CO3	L	M	H	M
CO4	L	M	M	H

DEPARTMENT OF MASS COMMUNICATION

VISION:

To be a centre of excellence in teaching, learning and research committed to mould ethical and socially responsible media professionals and entrepreneurs who can deliver professional content for diverse media platforms.

MISSION:

The Department of Mass Communication seeks to:

Achieve excellence in teaching, learning and research.

Promote critical thinking and problem-solving skills.

Equip learners by combining the theoretical aspects with creative innovation and entrepreneurship practices.

Mould ethical and socially responsible media professionals and entrepreneurs.

Provide knowledge base and consultancy services to the community in the field of media and communication.

M.A. MASS COMMUNICATION

The M.A Mass Communication programme of Assam Don Bosco University is a two-year (four semesters) programme consisting of theory and practical components, taught and learned through a combination of lectures, hands-on training, seminar, guest lecture, industry-academia interface and project execution. The programme offers specialization in the area of Print Media, Electronic Media and Communication for Development.

PROGRAMME OUTCOMES – MA MASS COMMUNICATION

- PO 1: **Critical Thinking:** Gain conceptual and theoretical knowledge and learn to critically think and analyze the dynamics and contemporary phenomenon of mass communication.
- PO 2: **Scientific Temper:** Develop logical and creative thinking for the solutions in Print media, electronic media and Communication for development.
- PO 3: **Effective Communication:** Develop the communication skills, theoretical and practical knowledge among the students in print, digital and development communication.
- PO 4: **Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO 5: **Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO 6: **Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through service learning and social commitment.
- PO 7: **Environment and Sustainability:** Understand the environment issues and promote sustainable development goals.
- PO 8: **Self-directed and Life-long Learning:** Engage in higher studies, research and professional work and be a life- long learner in context of media studies.

PROGRAMME SPECIFIC OUTCOME: MA MASS COMMUNICATION

- PSO 1: **Understanding Communication and its Concepts:** An ability to define the meaning, purpose of communication and demonstrate the theoretical knowledge in the field of mass communication.
- PSO 2: **Application of Knowledge:** Apply communication skills and practices in context of social and cultural milieu of the North-eastern region.
- PSO 3: **Developing Critical Aptitude:** An ability to test and analyze research findings by demonstrating critical thinking and problem-solving skills.

PSO 4: **Enhancing Professional Skills:** An ability to develop professional skills and use in the field of print media, electronic media and development communication.

PSO 5: **Creating Multimedia Content:** An ability to create media programmes for varied media audience needs.

MAPPING OF COURSES TO PO/PSO MA Mass Communication

Sl. No	Name of Paper	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
1.1	History and Development of Communication	L	H			L	M		H	M	L	L	M
1.2	Philosophy of Communication	H	M	L	M	H	H		H	H	L	M	M
	Theoretical Perspectives of Communication	H	H	H	M	L			H	H	L	M	
1.3	Principles and Practices of Journalism	H	H	H	H	M	M	L	H	H	H	M	H
1.4	Media Literacy	H	H	H	H	M	H		H	M	L	L	L
1.5	Journaling	H		H	M	M	H		L	L	M	H	L
1.6	Techniques of Photography and Image Editing	H	H	M		M	M		H	M	H	H	H
1.7	Service Learning	H	H	H	H	H	H	H	H	H	H	H	H
2.1	Investigative and Data Journalism	H	H	H	H	M	H	L	H	H	H	M	H
2.2	Theories of Development Communication and Social Change	H	H	M	M	L	L			H	H	L	L
2.3	Communication Research Methodology	H	H	H	L	M	L		M	H	H	H	H
2.4	Digital Media	H	L	L	L	M	L		M	M	L	M	M
2.5	Rural Communication	H	H	H	H	L	N	H	L	H	H	L	L
2.6	Dissertation Phase – I	H	H	H	M	H	L		M	H	M	H	M
2.7	Audio-video Production	M	M	H	M	L	L		H	H	M	H	H
2.8	Service Learning – Community Media	H	H	H	H	H	H	M	H	H	H		M
3.1	Media Laws, Ethics and Social Responsibility	M	H	M	M	H	H	M	H	M	H	H	H
3.2	Advertising, Marketing and Public Relations	H	M	H	H	M	M	M	H	M	H	M	H
3.3	Dissertation Phase – II	H	H	L	L	H	M	L	H	M	H	H	H
	Specialization – Electronic Media												
3.2.1	Audio-Video Editing	M	H	H	M	M	M	M	H	M	M	H	H
3.2.2	Television and Video Production	M	H	H	M	M	M	M	H	M	M	M	H
3.2.3	Sound for Media	M	H	H	M	M	M	M	H	M	M	H	H
	Specialization – Print Media												
3.3.1	Political Communication	H	H	M	M	H	H	M	H	H	H	H	M
3.3.2	News Reporting and Editing	H	H	H	H	H	H	M	H	H	H	H	H

3.3.3	Health and Environmental Communication	H	H	H	M	H	H	H	H	H	H	H	M
Specialization – Communication for Development													
3.4.1	Programme Management					H	M	H	H	H	M	L	H
3.4.1	Situation Analysis for Communication Strategy					H	H	H	H	M	H	M	H
3.4.1	Planning Models and Communication Approaches					H	H	H	H	M	H	M	H
4.1	Media and Cultural Studies					H	M	H	H	M	H	M	H
4.2	Internship					H	H	H	H	H	H	H	H
Specialization – Electronic Media													
4.2.1	Film Appreciation					H	H	M	M	H	M	L	H
4.2.1	Final Project					H	H	H	H	H	M	M	H
Specialization – Print Media													
4.3.1	Business Journalism					H	H	H	H	M	M	H	H
4.3.2	Final Project					H	H	H	H	H	M	H	H
Specialization – Communication for Development													
4.4.1	Project Monitoring and Evaluation					H	H	H	H	H	M	H	H
4.4.2	Final Project					H	H	H	H	H	M	H	H

VALUE ADDED COURSES (MA)

Sl. No	Name of Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4
1.1	Communication Skills	H	H	H	M	M	L	H	H	H	M	H	L
1.2	Creative Writing	H	H	M	L	M	L	H	H	H	M	H	M
1.3	Event Management	H	H	H	H	H	M	H	M	H	H	H	M

DETAILED SYLLABUS MA MASS COMMUNICATION

MCRC0026: RURAL COMMUNICATION (3-0-0)

COURSE OBJECTIVES

- CO1 Define the meaning and concept of community and rurality (Remembering)
 CO2 Explain the role of communication in rural development (Understanding)
 CO3 Apply communication channels for rural development (Applying)

- CO4 Analyse the social, economic, political and cultural framework of rural communication (Analysing)
 CO5 Evaluate the need for media and communication for rural development (Evaluating)
 CO6 Design communication programme for rural development (Creating)

Module 1: Rural Communication and Participation (9 Lectures)

Community and Rurality: Concept and Definition, Meaning of Rural Communication, Communication Structure in Rural Settings- Folk and Traditional Media, Radio in Rural Communication, Community Media for Participatory Communication, Media and Communication Habits among Rural Communities, Media Penetration and Changing Rurality, Rural Communication Channels - Village Meetings; Village Market; Village fair, ICT and Rural Governance.

Module 2: Documenting Development in Rural Settings (9 Lectures)

Role of Communication in Rural Development, Documenting and Analysing Rural Development, Communication Agenda, Rural Health and Communication, Crisis and Natural Disaster Communication, Communicating Education and Agriculture, Communication and Extension Activities in Rural Settings.

Module 3: Evaluating Communication Needs in Rural Areas (9 Lectures)

Media and Communication Awareness among the Rural Mass, Assessing the Urban-Rural Divide, Communication Divide- Knowledge and Infrastructure, Need for Media and Communication Literacy, Communication Research in Rural Context- Participatory Action Research-Survey, Natural Resource Management, and Human Rights.

Module 4: Channelizing Development in a Rural Context (9 Lectures)

Contextualising Paulo Freire in the Process of Rural Development and Rural Communication, Context Specific Communication Local Culture, Tradition, Language and Folk-Art Forms, Intercommunity Communication, Utilising Intra- community Communication Channels, Disseminating Community Specific Information and Disbursing Local Knowledge, Participatory Action and Rural Development.

Module 5: Practicum (9 hours)

As part of this module, students are required to conduct community outreach programmes in rural areas on issues of rural development or design communication programmes for rural development.

Suggested Readings

Communication for Rural Development, M. Acunzo, 2014, FAO
 Communication for Development: Theory and Practice for Empowerment and Social Justice, 3rd Edition, Srinivas Raj Melkote, Sage India
 Communication Efficiency and Rural Development in Africa: The Case of Cameroon, Emmanuel K. Ngwainmbi, 1994, University Press of America
 Community Communications: The Role of Community Media in Development. F. J. Berrigan, F. J., 1979. UNESCO
 Framework on Effective Rural Communication for Development, R. D, Castello, 2006, FAO
 Pedagogy of the Oppressed, P. Freire, 1970, Continuum
 Strategic Communication for Rural Development. World Bank, F. M. Santucci, 2005

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	M				
CO2		H			
CO3			H		
CO4			M	M	
CO5	H		H		
CO6					H

MCML0027: MEDIA LITERACY (3-0-0)**COURSE OBJECTIVES**

Define the concept, meaning and characteristics of the media industry (Remembering)

Explain the functions of communication (Understanding)

Choose appropriate media channels for effective communication (Applying)

Distinguish different types of media (Analysing)

Assess the emerging trends in the communication industry (Evaluating)

Module 1: Introduction to Media Literacy (12 Lectures)

Understanding media landscape, Meaning and definition, Importance of Media literacy, Media audience, media literacy approach, Types and Role of Media, Ownership Pattern and Control of Mass Media, Communication and Information Industry, Information Society, New Media Culture.

Module 2: Digital Media (7 Lectures)

Information and Communication Technology (ICT), Digital file types: documents, picture, video and audio, Editing Software: Print, Audio and video, creating digital media content with mobile phone.

Module 3: Computer Mediated Communication (8 Lectures)

Internet, Websites, online social media, User Generated Content in social media, SEO, Blogging, Live Streaming, E- Governance, Digital Marketing.

Module 4: Convergence Media (7 Lectures)

E-newspaper and web-edition, Internet and Satellite radio, TV: Internet Television, YouTube Channel, MOJO, Interactive Learning, IT Act, 2000.

Module 5: Confronting Issues (10 Lectures)

Digital divide, Cyber Security, Cyber Crime, Cyber Bullying, Digital Privacy and Piracy, Digital investigation, Misinformation and Disinformation, Propaganda and fake news, Physical and emotional effects of Digital Media.

Suggested Readings

Beginners' Guide to Journalism: Effective Guide to Write Well, Influence People and Remain in News, Roy Barun, 2019, V&S Publishing

Convergence in Broadcast and Communications Media, John Watkinson, 2001, Routledge

Handbook of Journalism and Mass Communication, Virbala Aggarwal, 2012, Concept Publishing Company Ltd.

How the Web Was Won, Paul Andrews, 1999, Broadway

Media Literacy, James W. Potter, 2013, Sage Publications

Navigating Social Journalism: A Handbook for Media Literacy and Citizen Journalism, Martin Hirst, 2018, Routledge.

Theories of the Information Society, F. Webster, 2014, Routledge.

The Rise of the Network Society, Manuel Castells, 2009, Wiley-Blackwell

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H				
CO2			H		
CO3		H	M		
CO4				H	
CO5				H	

MCHD0028: HISTORY AND DEVELOPMENT OF COMMUNICATION MEDIA (3-0-0)**COURSE OBJECTIVES**

Demonstrate an understanding of the history of media and the evolution of the mediated environment (Understanding)

Organize a historical survey of media and diachronic analysis of a variety of mediated forms especially in the context of India (Applying)

Identify the rich folk heritage of India and its role in grass-root communication (Applying)

Evaluate the relationship between media and development in Indian culture, politics and society (Evaluating)

Module 1: Early history of Communication and the Printing Era (15 Lectures)

Communication in prehistoric era, Development of language and the oral tradition, Development of writing and record keeping, Development of printing in Europe and India, Development of newspapers and magazines, History of the Press in India: Colonial Period, National Freedom Movement, Post-Independence Era, Emergency and Post Emergency Era, Changing Readership, Print Cultures, Language Press.

Module 2: Development of Electronic Media (15 Lectures)

Development of Radio as a medium of mass communication, History of radio in India, Evolution of AIR Programming, Penetration of radio in rural India, Commercial Broadcasting, FM Radio, Overview of community radio, Development of Television as a medium of mass communication, History of Television in India, Television and the State 's Development Agenda; Prasar Bharati, Doordarshan, Cable and Satellite Television in India; Commercialization of Programming, The Coming of Transnational Television.

Module 3: Development of Visual Media and Folk Media (15 Lectures)

The early years of Photography, Development of film as a medium of communication, History of Films in India, Issues and Problems of Indian Cinema Types of folk media, use of folk media, Advantages of folk media, Folk Media and communication, Role of folk media in promoting – health, education, Women's issues and Community development, Folk vs electronic media.

Suggested Readings

The History of the Future: Oculus, Facebook, and the Revolution That Swept Virtual Reality, Blake J. Harish, 2019, Harper Collins.

Mass Communication in India, K. J Kumar, 2017, Jaico Publishing House.

The Handbook of New Media, L. A Lievrouw and Sonia Livingstone, 2005, Sage Publications

Traditional folk media in India: Practice & Relevance, Shyam Parmar, 2016, Bharati Prakashan.

The Story of Human Communication: Cave Painting to Microchip, Wilbur Schramm, 1988, Harpercollins College Div.

India's Communication Revolution: From Bullock Carts to Cyber Marts, Arvind M. Singhal, 2000, Sage Publications.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2		H	
CO3			H
CO4		H	

MCPC0029: PHILOSOPHY OF COMMUNICATION (3-0-0)**COURSE OBJECTIVES**

- CO1 Define the concept of communication (Remembering)
 CO2 Infer analytical reasoning on communication (Understanding)
 CO3 Identify the philosophical and sociological bases of communication (Applying)
 CO4 Analyse critically the purpose of human communication (Analysing)
 CO5 Interpret and decode media contents wisely (Evaluating)
 CO6 Discuss the idea of knowledge and psychological understanding of media text (Creating)

Module 1: Concept of Communication (10 Lectures)

Elements of Communication, Process of Communication, Role; Scope and Need of Communication in Society, Barriers to Communication, Types of Communication, Types and Characteristics of Mass Media Audiences, Functions of Mass and Social Communication.

Module 2: Philosophy and Knowledge (20 Lectures)

Epistemology, Ontology, Dialectic – Hegelian and universal, Buddhist philosophy of communication, Positivist and Post-positivist, Locke's account of knowledge, Phenomenology, Hyper-realism, Hegemony, Political economy and Frankfurt School, Marxist Media Theory, Propaganda model.

Module 3: Psychoanalysis of Communication (15 Lectures)

Philosophy of the unconscious, Oedipus concept, Id, Ego, Superego, Sexuality, Idea of myth.

Suggested Readings

An Essay concerning human understanding, John Locke, 1997, Penguin
 Capital, Karl Marx, 2016, Fingerprint Publishing
 Mythologies, Roland Barthes, 1972, Hill and Wang, Vintage
 Manufacturing Consent: The Political Economy of the Mass Media, Noam Chomsky, and Edward S. Herman, 2002, Knopf Doubleday Publishing Group
 The Unconscious, Antony Easthope, 2003, Routledge Publication
 The Ego and the Id, Sigmund Freud, 1962, Martino Fine Books

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2		H	
CO3	H		
CO4	H	M	
CO5			H
CO6		H	

MCTC0030: THEORETICAL PERSPECTIVES OF COMMUNICATION (4-0-0)**COURSE OBJECTIVES**

- Define the concept of semiotic theory and practice (Remembering)
 Explain the intersection between communication, in its many forms, and society and culture (Understanding)
 Apply communication theories and models in communication programmes and research (Applying)
 Analyse the link between major theoretical understandings of communication and the socio-cultural setting they have developed in (Analysing)
 Test the various models and theories of communication in real-world situations (Creating).

Module 1: Theories and Models of Communication (15 Lectures)

Normative Theories, Democratic Participation Theory, Shannon-Weaver's Mathematical Model, Aristotle's definition of Rhetoric, Berlo's SMCR Model, Westely and MacLean's Conceptual Model, Newcomb's Model of Communication, George Gebner's Model, Schramm's Interactive Model, Harold D. Laswell, De Fleur Model.

Module 2: Media Effects Theory, Psychological & Sociological Theory (15 Lectures)

Magic Bullet Theory, Two-Step Flow and Multi-Step Flow, Gate-Keeping Theory, Cognitive Dissonance Theory, Selectivity Theory, Cultivation Theory, Uses and Gratification Theory, Media Dependency Theory.

Module 3: Powerful Effects of Media (15 Lectures)

Dominant Paradigm, Spiral of Silence, Diffusion of Innovation, Agenda Setting, Marshall McLuhan's Medium Theory.

Module 4: Semiology and Postmodern Theories (15 Lectures)

Semiotic theory and practice - historical context and doctrinal perspectives in semiotics, Models of the Sign and types of Codes, Structuralism; Formalism and Post-Structuralism.

Suggested Readings

A History of Communication Study, Everett M Roger, 1997, Free Press

Communication Theory and Models, N Andal, 2004, Himalaya Publishing House

Mass Communication Theory: Foundations, Ferment, and Future (6th Ed), Stanley J Baran, J. and Dennis K. Davis, 2015, Wadsworth

Mass Communication Theory: An Introduction, Dennis McQuail, 2005, Sage Publications

The Medium is the Massage: An Inventory of Effects, Marshall McLuhan, 2008, Penguin Books

The Media of Mass Communication, J Vivian, 1999, Boston: Pearson Understanding Media: The Extension of Man, Marshall McLuhan, 2008, Routledge

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H		
CO2	M	M		
CO3			H	
CO4				H
CO5		M		

MCPJ0031: PRINCIPLES AND PRACTICES OF JOURNALISM (4-0-0)**COURSE OBJECTIVES**

Define the concept, meaning and function of journalism (Remembering)

Explain the role and responsibilities of a journalist. (Understanding)

Apply the concepts and techniques of journalism in news reporting (Applying)

Analyse the role of news media in society (Analysing)

Write, report and edit news stories (Creating)

Module 1: News & News Writing Principles (15 Lectures)

Concept of News, Types of News, News Values, Ethics, Concept of Reporting, Types of Reporting, Qualities of a Reporter, Roles and responsibilities of media journalists, Sources of news, Cultivation of sources, Emerging trends in journalism.

Module 2: News and Features format (12 Lectures)

News format vs. Features Format, Lead writing, Types of lead, Editorial, Feature, Column, Middle, Interviews, Reviews and Special Articles, Letter to Editors, Writing Headlines, Types of Headlines.

Module 3: Organisational Structure and Regulating Bodies (9 Lectures)

Editorial, Advertising, Marketing, Circulation, Accounts and Finance, News Production Hierarchy, Readership, Case study of news organisations, Registrar for Newspaper of India (RNI), Journalists' Union, Editors' Guild of India, Audit Bureau of Circulation (ABC), Press Information Bureau, Press Council of India (PCI), News Agencies.

Module 4: Editing and Layout (9 Lectures)

Meaning, Purpose, Tools & Techniques, Media language, Editing Symbols, Style Sheets, copy testing, Proof-reading, Page Layout – modular; horizontal; vertical; photo placements; photo-caption; use of artwork; breaking the layout, Agency Copy Editing, Page design – innovations in the edit page.

Module 5: Practicum (15 hours)

Basic of design, Introduction to page layout software, Field reporting and publication

Suggested Readings

Beginners' Guide to Journalism: Effective Guide to Write Well, Influence People and Remain in News, Roy Barun, 2019, V&S Publishing

Here is the News: Reporting for Media, R. Parthsarathi, 2009, New Delhi: Sterling Publishers

News Reporting and Editing, K.M. Srivastava 1995, Sterling Publishers

Social Meanings of News – A Text Reader, Dan Berkowitz, 1997, Sage Publication

Sociology of News, Michael Schudson, 2003, W.W. Norton & Company

The Twenty-First-Century Media Industry, Economic and Managerial Implications in the Age of New Media, John A. Hendricks, 2011, Lexington Books

The Rise of the Network Society, Manuel Castells, 2009, Wiley-Blackwell

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H	H			
CO2			H		
CO3	H	H			H
CO4			H	H	
CO5					H

MCID0032: INVESTIGATIVE AND DATA DRIVEN JOURNALISM (3-0-0)**COURSE OUTCOMES**

Define the meaning and concept of investigative and data journalism (Remembering)

Demonstrate how to conduct news investigation (Understanding)

Plan and execute investigative news reporting methodically and ethically (Applying)

Analyse different sets of data and information (Analysing)

Assess the risk involved in investigative reporting (Evaluating)

Module 1: Basics of Investigative Journalism (10 Lectures)

Concept, meaning and definition of Investigative Journalism, types and history, Sources, Research, Fact checking and editing,

Role of investigative reporting in a democratic society, Trends in Investigative Reporting, Investigative techniques,

Case studies, Associations of Investigative Journalists, The soul of the investigative reporter, ethics of investigative reporting.

Module 2: Digital Investigation (8 Lectures)

Understanding Digital Investigation, Computer Assisted Reporting, Web research and data collection, Data Literacy, Data Mining Tools, Open-Source Intelligence Tools (OSINT), Social Media Auditing, Online Fact Checking and Verification.

Module 3: Data Journalism (8 Lectures)

Concept, meaning, definition of Data Journalism, Data-driven Storytelling, Data Acquisition, Data Analytics, Reporting with Data, Public, Private and Open-Source Database, Overcoming Information Overload.

Module 4: Tools and Techniques of Data Driven Journalism (8 Lectures)

Analysis and Design, Tools and Techniques, Challenges with Data: Finding and Cleaning, Statistical Tools and Methods, Open-Source Software.

Module 5: Practicum (11 hours)

Develop an investigative pitch/plan for a major investigative story, Data Visualisation, Online Fact Checking, and Social Auditing.

Suggested Readings

Computer-Assisted Reporting: A Practical Guide, Brant Houston, 2003, Routledge

Data Literacy: A User's Guide, David Herzog, 2015, Sage Publication

Data Smart: Using Data Science to Transform Information into Insight, John Foreman, 2013 Wiley

Data Journalism: Past, Present and Future, John Mair, Richard Keeble and Megan Lucero, 2017, Theschoolbook.com

Data-Driven Storytelling, Nathalie H. Riche, Nicholas Diakopoulos, Christophe Hunter and Seelagh Carpendale, 2018, AK Peters/CRC Press

Investigative Journalism: Proven Strategies for Reporting the Story. William C Gaines, 2007, CQ Press

The Functional Art: An Introduction to Information Graphics and Visualization, Alberto Cairo, 2012, New Riders

The Investigative Reporter's Handbook: A Guide to Documents, Databases and Techniques. Brant Houston, 2002, Bedford/St. Martins

The Data Journalism Handbook, Jonathan Gray Liliana Bounegru, and Lucy Chambers, 2012, Shroff/O'Reilly
Visualization Analysis and Design, Tamara Munzner, 2014, AK Peters/CRC Press.

Mapping of COs to Syllabus

CourseOutcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1	H		H		
CO2		H			
CO3	M		H		H
CO4		H		H	H
CO5	H				H

MCTS0033: THEORIES OF DEVELOPMENT COMMUNICATION AND SOCIAL CHANGE (4-0-0)

COURSE OBJECTIVES

Define the basic terms related to development & development communication (Remembering)

Explain different models and approaches of development (Understanding)

Develop communication strategy for development (Applying)

Examine role of media in socio-economic development and social change (Analysing)

Assess situation for communication intervention (Evaluating)

Create advocacy and initiate behaviour change through communication channels (Creating)

Module 1: Introduction to Development (15 Lectures)

Meaning, definition and process of Development, Growth and Development, Characteristics of Developing and Underdeveloped countries, Regional Development, Development Challenges, Emerging Issues in Development.

Module 2: Theories, Models and Approaches of Development (15 Lectures)

Basic Needs Model, Theories and Paradigms of Development – Unilinear, Non-unilinear, Dominant, Alternative and New paradigms of development, Dependency Model, Marxist concept of stages of society, Social Responsibility Theory, Top Down (Trickle Down) Approach, Growth Pole Approach, Bottom Up (Grass Roots) Approach, Neoliberalism, New Millennium Development Goals.

Module 3: Concepts, Theories and Models of Development Communication (15 Lectures)

Origin, Meaning, Concepts, Definition Media and Modernization, ICT and Development, Participatory Communication, Approaches to Communication for Development: Diffusion of Innovation, Magic Multiplier, Development Support Communication.

Module 4: Social and Behaviour Change Communication (15 Lectures)

Concepts of SBCC, Managing information for social change; individual level behavioural change, Models of Change: persuasion model; health belief model; stages of trans-theoretical model; socio-ecological model, Communication planning models: ACADA Model; P-Process; COMBI Model and Integrated Communication, Case studies.

Suggested Readings

Communication for Development and Civil Society, V.S. Gupta, 2004, Concept

Communication for Development in the Third World, Srinivas Melkore & Steeve, 2001, Sage India

Communication and Development-The Challenges of the Twenty-First century, VS Gupta, 2000, Concept Publishing

Development Theory: Deconstruction/Reconstruction, Nederveen Jan Pieterse, 2001, Vistaar.

Development Theory, PW Preston, 1997, Blackwell

Diffusion of Innovations, Everett M. Roger, 2003, Free Press

Kiran Prasad, 2009, Information and Communication Technology: Reinvesting Theory and Action, BRPC

Media, Communication and Development: Three Approaches, Linje Manyozo, 2012, Sage

Media in Development Arena, RK Ravindran, 2000, Indian Publishers Distributors

Other Voices: The Struggle for Community Radio in India, Paravala V and Malik K V., 2007, Sage India

Mapping of CO to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2		H		
CO3			H	M
CO4			H	H
CO5				H
CO6				H

MCRM0034: MEDIA AND COMMUNICATION RESEARCH METHODOLOGY (4-0-0)**COURSE OBJECTIVES**

Define meaning, scope, objectives and significance of media research (Remembering)

Demonstrate appropriate methods for collecting and analysing research data (Understanding)

Apply research methods related to the disciplinary areas of communication and media (Applying)

Assess and appraise relevant literature (Evaluating)

Conduct research, write research reports and projects (Creating)

Module 1: Meaning and Objectives of Research (15 hours)

Media Research – Meaning; Scope; Objectives and Significance, Research Process, Formulation of Research Problem, Literature Survey, Research Design, Collection of Data, developing a Questionnaire, Aids for Writing Research Reports – Bibliography; Footnote and Reference; Synopsis and Abstracts, Writing of Report; Summary; Executive Summary; Conclusion and Recommendation.

Module 2: Research Methods and Applications (20 hours)

Techniques of Data Collection – Observation; Questionnaire and Interview; Content Analysis, Qualitative Methods - Field Experiments; Ethnography; Focus Groups; Case Studies, Quantitative Research Methods - Experimental Research; Survey Research; Content Analysis, Audience Research in Print and Electronic Media.

Module 3: Statistical Applications in Communication Research (25 hours)

Statistics – Definitions; Uses and Limitations, Classification and Tabulation of Data, Univariate and Bivariate, Diagrammatic and Graphical Presentations, Sampling - Types of Sampling; Guiding Principles of Sampling, Test of Hypothesis – Basics; Probability distribution; normal distribution; t-test; Chi- square test; Measures of Central Tendencies, Measure of Variability, Correlation - Computation of Product Moment; Correlation Coefficient; Spearman's Rank; Coefficient Correlation, Scaling Techniques – Arbitrary; Thurstone; Likert-Scale.

Suggested Readings

Communication research for Development: The ISRO Experience, Binod C. Agarwal and S.R. Joshi and Arbind Sinha, 1986, New Delhi: Concept Publishing Company.

Media Research Techniques, Asa A. Berger, 1998, Thousand Oaks: Sage Publication.

Media Analysis Techniques, Asa A. Berger, 1998, Beverly Hills: Sage Publications. 1998.

MLA Handbook for Writers of Research Papers, Joseph Gibaldi and Achtert S. Walter, 1994 New Delhi: Affiliated EastWest Press Pvt. Ltd.

Research Methodology Methods and Techniques, R. C Kothari, C.R, 2019, New Age International Publishers

Mass Media Research: An Introduction, Roger D. Wimmer, 2015, Cengage Learning

Writing your thesis, Paul Oliver, 2008, Sage Publications

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2		H	
CO3			H
CO4		H	
CO5	H		

MCML0037: MEDIA LAWS, ETHICS AND SOCIAL RESPONSIBILITY (3-0-0)

COURSE OUTCOMES

Define the salient features of media laws and ethics (Remembering)

Explain the essential features of the Indian Constitution in the context of press freedom (Understanding)

Examine the purpose and role of media professionals in society (Applying)

Analyse the legal issues pertaining to the media (Analysing)

Evaluate the relative merits and demerits of the ethical questions pertaining to the media (Evaluating)

Module 1: Legal System in India (10 Lectures)

Introduction to the Legal System: Jurisprudence, Sources of law: custom; precedent; statute, Types of law: criminal; civil; tort, History of media laws in India.

Rights, Rules and Laws: Justice and law; laws and society

Judicial Systems in Relation to Media: Basic features of the Indian Constitution, Structure of Judicial System in India – Supreme Court, High Court, Lower courts.

Constitutional Obligations: Freedom of Speech and Expression, Freedom of the Press, Right to Information Act, 2005.

Module 2: Media Laws (15 Lectures)

Laws Related to Media Profession: Introduction to Indian Penal Code, Press Council of India; Press Council Act, 1965, 1978, Cinematographic Act, 1952.

Public Interest Litigation and Defamation: Civil and Criminal law of defamation, Libel and Slander, Public Interest Litigation. *Media Laws relating to Women & Children:* Laws relating to Obscenity, Indecent Representation of Women (Prohibition) Act, 1986, The Children Act 1960, Juvenile Justice Act.

Freedom and Accountability of the Media: Freedom and Responsibility, Contempt of Court 1971, Protection of Civil Rights Act 1955, Parliamentary Proceedings Act 1971.

Module 3: Media Ethics (10 Lectures)

Ethics and Journalistic Professionals: Introduction to Ethics, Press Council's Norms of Journalistic Conduct, AIR News Policy for Broadcast Media; Broadcasting Code

Media and Social Responsibility: Media and pressure groups, Prasar Bharati Act 1990, The Broadcast Code Governing AIR *Rights and Duties of Media Professionals:* Politics and Elections, Investigative Reporting, Court Reporting

Module 4: Issues in Reporting (10 Lectures)

Media and Conflict Reporting: Conflict Scenario in North-East India, Ethical Issues in Conflict Reporting, International Humanitarian law

Cyber Laws: Information Technology Act 2000, Cyber Crimes, Cyber Crimes relating to Women and Children

Intellectual Property Rights: Copyright Act 1957, Design Act 1911, Trade and Merchandise Marks Act 1958, Patent Act 1970

Suggested Readings:

A Compendium of Codes of Conduct for Media Professional, Prabhakar M, et al., 1999, University Book House
Ethics, Frankena K. William, 2002, Prentice Hall India

Introduction to Ethics, Lillie William, 2003, Allied Publishers

Media Law and Ethics, Neelamalar M, 2010, PHI Learning Pvt. Ltd.

Media, Ethics and Laws, Singh P.P. et al., 1998, Anmol

Media Ethics, Paranjay Guaha Thakurta, 2011, Oxford University Press

Media Laws and Ethics: An Introduction to legal and ethical issues, Vartika Nanda, 2018, Kanishka Publishers

Social Media Communication: Concepts, Practices, Data, Law and Ethics, 3rd Edition Jeremy Harris Lipschultz, 2020, Routledge

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	
CO2	H			
CO3			H	
CO4		H	H	
CO5		H	H	H

MCAM0038: ADVERTISING, CORPORATE COMMUNICATION & PUBLIC RELATIONS (3-0-0)**COURSE OBJECTIVES**

Define the key terms related to advertising, public relations and corporate communication (Remembering)

Explain the different models and approaches of advertising, public relations and corporate communication (Understanding)

Develop public relations and corporate communication strategies for public & private enterprises (Applying)

Plan and execute ethically sound and socially responsible advertising strategies and public relations campaigns (Evaluating)

Produce multimedia ads for varied audiences (Create)

Module 1: Advertising (15 Lectures)

Need and Impact of Advertising: National and global scenario, Integrated marketing communication, Persuasion, retention and recall, Process of Advertisement Creation: media planning, visualization, copywriting, Brand Management: Concept and evolution, components of brands, image and personality.

Module 2: Corporate Communication (15 Lectures)

Defining corporate communication strategies, corporate communication in public sector, private sector and multi-nationals, strategic corporate communication and management, proactive and reactive media relations, media selection, symmetrical and asymmetrical models in handling crisis, Role of corporate communication in crisis and disaster management, use of media in crisis management.

Module 3: Public Relations (15 Lectures)

Definition and concept: Public relations, External and internal, Vertical and horizontal, Promotion of products and services, Image building, social marketing, Campaigns, Press Conferences and press releases, Conferences and conducted tours, staging of special events, Use of Various Media: Print, electronic, media and web, Outdoor media and exhibitions, Newsletters/brochures/video and audio material, Traditional media.

Suggested Readings:

Advertising and Promotion: An Integrated Marketing Communications Perspective, Belch, George E, and Michael A. Belch, 2004, McGraw-Hill.

Advertising Management, J. Jethwaney and S. Jain, 2012, Oxford University Press

Communication in Organisations, Fisher, D., 1999, Jaico Publishing House

Corporate Communication: Principles and Practice, Jaishri Jethwaney, 2018, Sage Publications

Crisis Communication Strategies: How to Prepare in Advance, Respond Effectively and Recover in Full, 1st Edition, Amanda Coleman, 2020, Kogan Page

Ogilvy on Advertising, Ogilvy David, 1997, Prion Books, London

Public Relations Management, Jethwaney, J and Sarkar, N. N, 2015, Sterling

Strategic Brand Management, 4th Edition, Keller, Parmaeswaran and Jacob, 2015, Pearson Education

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H	H	H
CO3		H	H
CO4	H	H	
CO5			H

MCAV0039: AUDIO-VIDEO EDITING (3-0-0)**COURSE OUTCOMES**

Identify the importance of Sound and Sound SFX (Remembering)

Understand the techniques of audio recording and editing (Understanding)

Execute video and audio tracks with effects (Applying)

Differentiate between the different techniques of Video Editing (Evaluate)

Plan, design and create digital video projects incorporating audio and video elements (Creating)

Module 1: Audio Editing (20 Hours)

Configuration of a PC for sound recording, Motherboards, Processor, Sound Card, Graphic card, Monitors, Recorders: Analog, Digital, Tape Based & Tapeless, Digital Audio Workstations (DAW's), Set up an audio editing software, The user interface, Waveform editing, Effects, Audio Restoration, Mastering, Sound design, Creating and recording files, Multitrack sessions, Multitrack session editing, Automation, Video soundtracks, The essential sound panel, The multitrack mixer, Creating music with sound libraries, Recording and output in the multitrack editor.

Module 2: Video Editing (25 Hours)

Installing video editing software, Optimizing performance of system and software, Performing non-linear editing, Understanding the user interface of the software, Setting up a project, Importing media, organizing media, Mastering the essentials of video editing- using the source monitor; viewing video on a second monitor; using a numerical keyboard; editing from the project panel; navigating the timeline panel; using essential editing commands; setting the duration for still images, Working with clips and markers, Adding transitions, Advanced editing techniques- performing four-point editing; changing playback speed; replacing clips and footage; nesting sequences; multi-camera editing, Putting clips in motion, Editing and mixing audio, Adding video effects, Colour correction and colour grading, Compositing techniques, Creating graphics, Exporting the timeline.

Suggested Readings:

Adobe Audition: Operation Manual, 2021, Adobe Press

Adobe Premiere Pro: Operation Manual, 2021, Adobe Press

Film Art: An Introduction, David Bordwell and Kristin Thompson, 2003, McGraw-Hill (first published 1979)

Film Editing: Great Cuts Every Filmmaker Should Know, Gael Chandler, 2009 Michael Wiese Productions

Grammar of the Edit Roy Thompson, Christopher J. Bowen, 2014, Focal Press (first published January 1st 2009)

In the Blink of an Eye: A Perspective on Film Editing, Walter Murch, August 1st 2001, Silman-James Press

Mixing Audio, Bob Katz 8. Mixing Audio, Roey Izhak, 2007, Focal Press

Modern Recording Techniques, David Miles Huber, 2005, Focal Press (first published in 1986)

Practical Recording Techniques, Fifth Edition 2009, Elsevier

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	
CO2	H	
CO3	H	H
CO4		H
CO5		H

MCTV0040: TELEVISION AND VIDEO PRODUCTION (3-0-1)**COURSE OUTCOMES**

Identify different genres of television production (Remember)

Understand the intricacies and nuances of screenwriting (Understanding)

Distinguish various equipment and tools required for television and video production (Analyse)

Assess the importance of cinematography in television and video production (Evaluate)

Produce television programmes for various audiences (Creating)

Module 1: Writing for Television: (10 Lectures)

Preparing to Think Visually: Diving Into the Screenwriter's Mind, Approaching Screenwriting as a Craft - Mise-en-Scene; Breaking Down the Elements of a Story, Structure of Story & Screenplay: Beginning, Middle, End; Dynamics of Characterization: Character Building, Constructing Dynamic Dialogues, Finalizing the Script: Maintaining an Audience's Trust, Turning Your Story into a Script, Rewriting Your Script, Adaptation and Collaboration: Two Alternate Ways to Work; Intro to Storyboarding/Visual Storytelling & Storyboards; Storyboarding Techniques: Drawing the components of the storyboard, Indicating motion in the storyboard.

Module 2: Genres and Audience (15 Lectures)

Nature of drama in television: Various shows, formats and genres, telecast patterns, audience viewership performance, Building the story, herd culture, Creating niche television programming: Importance of niche content, niche content channels, Differentiation of infotainment, edutainment, entertainment, lifestyle genres, Differentiation of genres, Specialty of different genres, popularity of genres, content on demand.

Module 3 Television and Video Formats (10 Lectures)

Digital Recording Formats SD, HD, 2K, 4K - Editing and compression - Digital sampling and storage - Technical formats of video- PAL, NTSC, SECAM, Digital television formats- ATSC, DVB, ISDB, DTMB, IPTV, Recording formats; "Time Code" in Video Recording.

Module 4: Lighting Equipment and Techniques (15 Lectures)

Understanding of colour, use of colour, Capturing the emotion; Role of light, Lighting techniques - Concept of lighting various planes; Understanding Various types of lights; Lighting accessories, grey card, Metering, Colour temperature meter, Camera filters, Types of lighting - Studio lighting for three cameras set up, Outdoor lighting, Lighting for documentary, Mood Lighting & Colour Lighting Theory and Practice.

Module 5: Lenses, Camera Movements and Techniques (10 Lectures)

Lenses: Type of Lenses, Power of Lenses, Understanding the shot requirement and usage of a lens, Lens and perspective: Depth of Field, Depth of focus, Focus pulling; Camera Movements, Camera angles, Usage and need of Track and trolley, Crane, Jimmy Jib, Poll Cam, Managing Movements, Single camera Setup, Multi camera setup and Continuity Exercise.

Suggested Readings

Before You Shoot: A Guide to Low Budget Film and Video Production, Helen Garvey, 1995, Shire Press

Breaking into Film by Kenna McHugh, 1998, Peterson Nelnet Co

Camera Terms and Concepts, David Elkins, 1993, Focal Press

Fundamentals of Film Directing, David K. Irving, 2010, McFarland & Company

How not to write a screenplay: 101 common mistakes most screenwriters make by Denny Martin Flinn, 1999, Lone Eagle

Motion Picture Camera and Lighting Equipment, David Samuelson, 1986, Focal Press (first published 1977)

Screen Adaptation: A Scriptwriting Handbook, Kenneth Portnoy, September 8th 1998, Routledge (first published 1998)

Screenplay: The Foundations of Screenwriting, Syd Field, 2005, Delta (first published 1979)

The Camera Assistant, Doug Hart, 1995, Routledge

Writing, Directing, and Producing Documentary Films and Videos, Alan Rosenthal, 2007, Southern Illinois University Press (first published in 1990)

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO1		H			
CO2	H				
CO3				H	
CO4			H	H	H

MCSM0041: SOUND FOR MEDIA (3-0-1)

COURSE OUTCOMES:

Define the key terms related to sound (Remembering)

Explain the basic principles of sound production (Understanding)

Develop sound recording skills for visual media (Applying)

Distinguish between analogue sound and digital sound (Analysing)

Assess the acoustic quality of a room for sound production (Evaluating)

Produce audio programmes (Creating)

Module 1: Introduction to Sound (15 Lectures)

Understanding sound, Human hearing process, Air pressure, Characteristics of sound: wavelength; amplitude; frequency; phase, Components of sound: pitch; volume; timbre; harmonics; rhythm; tempo; attack; sustain and decay, Propagation of sound waves, Mono and stereo sound, Hi-fi vs low-fi sound, Sound perspective, Sound texture, Natural sound: Ambience; speech; dialogue etc., Sound creation: studio sound; inventing sounds and sound creation in software.

Module 2: Analogue and Digital Sound (17 Lectures)

Meaning of analogue and digital, Analogue sound, Characteristics of analogue sound: phase; frequency response; signal-to-noise ratio, Digital sound, Characteristics of digital sound: sampling; quantization; bit rate; dither; jitter, Compression and audio codec: audio file types/formats; open and proprietary formats, file compression.

Module 3: Sound Recording (15 Lectures)

Microphones: construction and polar pattern, recording practices: location recording; studio recording; equipment for location recording; equipment for studio recording, Music and Sound effects, Creating soundscape, Off-screen; on-screen and nondiegetic sound, Sound for video: news stories; documentaries; internet videos, Audio cable and connectors.

Module 4: Studio Acoustics (13 Lectures)

Meaning and definition of acoustics, Studio acoustics, Noise sources, Sound isolation, Sound absorption, Noise control: acoustic treatment; technical requirement for construction of studio.

Suggested Readings:

Digital Audio, Dobrian Christopher (n.d.), Retrieved from <https://music.arts.uci.edu/dobrian/digitalaudio.htm>

Sound Design: The Expressive Power of Music, Voice and Sound Effects in Cinema, Sonnenschein David, 2001, Michael Wiese Productions.

The Sound Effects Bible: How to Create and Record Hollywood Style Sound Effects, Viers Ric, 2008, Michael Wiese Productions.

Transmedia Directors: Artistry, Industry and New Audiovisual Aesthetics, Vernallis Carol, 2020, Bloomsbury Academic.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H		
CO2			H	
CO3			H	
CO4		H		
CO5				H

MCPC0042: POLITICAL COMMUNICATION (3-0-0)

COURSE OBJECTIVES:

Define the key terms in political communication (Remembering)

Understand the different techniques of political communication (Understanding)

Critically analyse the relationship between media and politics (Analysing)

Develop a critical understanding of the role of communication in politics (Evaluating)

Module 1: Introduction to Political Communications (15 Lectures)

Political Communication: Concept, Theoretical Approaches, Theories and Political communication paradigm, Channels of Political Communication, communication and civic engagement.

Module 2: Media and Politics (15 Lectures)

Media Coverage of Politics, Framing, Opinion Polls, Election Coverage, Political Advocacy, The transmission of political information (Print/TV/SM), Media Bias, Campaign Advertising & Political Participation, Case Studies.

Module 3: Media, Power and Ideology (15 Lectures)

Constructing Ideology: Consensus as ideology; manufacturing consent; Ideology & hegemony, Identity formation and political mobilization, State and Information, Political process and Governance in India, Gauging Public Opinion, Public Opinion and Public Policy, Political Polarization.

Suggested Readings:

Media, Markets and Democracy, E Baker, 2004, Cambridge University Press

Necessary illusions: Thought control in democratic societies, N. Chomsky, 1995, House of Anansi.

The Press and American Politics, 3rd Edition, Richard, Davis, 2001, Prentice Hall. Ch. 2-3, pp. 25-86

Mediated Politics: Communication in the Future of Democracy, Robert M Entman, (Eds), 2001, Cambridge University Press

Manufacturing Consent: The Political Economy of the Mass Media, Edward, Herman and N. Chomsky, 1998, Pantheon Books

A Virtuous Circle: Political Communications in Post industrialist Societies, Pippa Norris, 2000, Cambridge University Press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2	H	H	H

CO3		H	
CO4			H

MCNR043: NEWS REPORTING AND EDITING (3-0-1)**COURSE OUTCOMES**

Define the meaning and concept of news reporting and editing (Remembering)

Understand the organisational structure of a newsroom (Understanding)

Develop editing skills for the print media (Applying)

Differentiate between news reporting and editing (Analysing)

Assess the quality of an editor in publishing a newspaper (Evaluating)

Design print media publications (Creating)

Module 1: News Gathering Process (15 lectures)

Principle of News Reporting, Elements of Reporting, Types of Reporting, Role and Importance of Sources, Cultivating, Verifying and Dealing with Sources of News, Attribution, Qualities of a good Reporter, Ethical aspects of Sourcing news & Reporting, Risk in reporting.

Module 2: Different Formats of News Report (15 lectures)

Factual and Routine news, Analytical News, Interpretative & Descriptive News, Investigative News and research based or indepth news, Sequential News, Breaking News.

Module 3: The Editing Process (15 lectures)

Structure of a Newsroom, Editorial desk, Functions of Editorial Desk, Nature and need for editing, Principles of Editing, Role, objectives and tools of editing; process of editing; Editing symbols; language in editing; Objectives of copy editing; editing agency copies; handling wire and correspondents' copy; Ensuring News value and other criteria; Checking facts, language, style, clarity & simplicity; Editing/revising press releases and handouts; Relevant graphics for copy, Style sheets and house styles; Photo Editing; Newsroom terminology in electronic editing; Magazine editing, Headline Writing: Principles, types and techniques.

Module 4: Practicum (15 hrs)

News editing: Hard news, soft news, Opinion and Analytical Pieces), News selection and placement; Preparing dummies; Graphics; Use of editing software; Photo editing and caption writing; Production of Lab Journal.

Suggested Readings:

News Writers' Handbook by M L Stein, Susan F Paterno, R Christopher Burnett, 2006, Blackwell Publications

Practical Newspaper Reporting, David Spark and Harris Geoffrey, 1997, Routledge Publishers

Writing and Reporting News: A Coaching Method by Carole Rich, 1993, CENGAGE Publications.

News Writing, George Hough, 2006, Kanishka Publishers

The Unwritten Rules of Copy Editing, 2nd Edition, Dominic Gettins, 2006, Kogan Page Publications

Reporting for Journalists. Chris Frost, 2001, Routledge

News Agencies: From Pigeon to Internet, PTI Style Book, M Shrivastava, 2007, New Dawn Press, Modern Journalism: Reporting and Writing, Diwakar Sharma, 2005, Deep and Deep Publications

Feature Writing for Journalists. Sharon Wheeler, 2009, Routledge Publications.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H	H	H	

CO2			H	
CO3			H	
CO4	H	H	H	
CO5			H	
CO6				H

MCHE0044: HEALTH AND ENVIRONMENT COMMUNICATION (3-0-1)**COURSE OUTCOMES**

Define the key terms in health and environment communication (Remembering)

Explain different models and approaches of health and environment communication (Understanding)

Develop communication strategy for public health and environment protection (Applying)

Examine the role of media in social change (Analysing)

Assess the situation for communication intervention (Evaluating)

Report news on health and environmental issues (Create)

Module 1: Health Communication (15 Lectures)

Introduction to Health Communication: Meaning of health communication, Conceptions of health, Health Communication issues, illness and well-being, Ethics of Health Communication, Health communication in public health, Enhancement of the quality of life, soliciting co-operation from stakeholders, Facilitating adoption process.

Module 2: Theories and Approaches to Health Communication (15 Lectures)

Health communication theories, Health Communication approaches and action areas: Persuasive approaches, Cultural perspectives, Emotional perspectives, public relations and public advocacy, Community mobilization, Planning, implementation and evaluation of public health communication campaign - Health communication planning process, Situation analysis and audience profile, Identifying programme objectives and strategies.

Module 3: Environment Communication (15 Lectures)

Environment journalism: emergence, rise of environment activism, role of the state, developments in India, relevant laws, UN initiatives, environment protection and the role of Media, Environmental journalism today, Skills for environmental journalism.

Module 4: Environmental Communication and Challenges (15 Lectures)

Media theory basics for the environmental journalist: Objectivity, Framing-News values, Agenda setting, Advocacy journalism, the media as environmental watchdog, Challenges for investigative environmental journalism. Writing an environment feature, environment research.

Suggested Readings:

Communicating Health: A Culture-centered Approach, Mohan J Dutta, 2008, Polity

Communication, Media and Environment, A Hansen, 2011, Routledge

Environment Journalism, H Bodker and I Neverla (Eds), 2013, Routledge

Health Communication – From Theory to Practice, Renata Schiavo, 2007, Wiley

Health Communication: Richard K Thomas, 2006, Springer

Health Communication: Strategies and Skills for A New Era, Claudia Parvanta, 2018, Jones and Bartlett Publishers

Journal of Health Communication, Taylor & Francis

Risk Communication and Public Health, Peter Bennet and Kennet Calman, 2001, Oxford Medical Publications

The Routledge Handbook of Environment and Communication, 2015, Routledge.

Mapping of COs to Syllabus

Course Out-comes	Module 1	Module 2	Module 3	Module 4
CO1	H		H	
CO2		H		H
CO3		H		H
CO4		M	M	H
CO5		H		H
CO6	H	H	H	H

MCPM0045: PROGRAMME MANAGEMENT (3-0-0)**COURSE OUTCOMES**

Understand the meaning and concept of project proposal writing (Understand)

Identify the principles and approaches of programme management (Analyse)

Undertake critical review of C4D projects (Evaluate)

Prepare development project management plans and programmes (Creating)

Module 1: Project Formulation and Appraisal (15 Lectures)

Overview of project management, Feasibility and technical analysis, Market and demand analysis, Economic and financial analysis, Formulation of Detailed Project Report (DPR).

Module 2: Project Planning, Writing and Scheduling (15 Lectures)

Meaning and concept of project planning, Need assessment and project feasibility, Rationale, Project components: Executive summary, Statement of need, Project goals, Project description, Budgeting, Organizational information, Materials and equipment, Human resources, Project costing and financing, organisation structures in project.

Module 3: Project Implementation, Budget and Results (15 Lectures)

Project team and competencies, Coordination and communication, Review Mechanism, Tracking project milestones, Report writing, production and supervision of key inputs, capacity strengthening activities/training, team building activities, Advance and contingency planning, Fund management, project-life-cycle, Results-based Management - outputs, outcomes and higherlevel goals or impact, Cost-Benefit Analysis (CBA), Sensitivity Analysis, Project management information system, material and equipment,, financial aspects, project Sustainability, Closing a project, Reviewing a project.

Suggested Exercise

Literature Review, Case Study, Field Survey, Project Writing, Project Reviews, PRA

Suggested Readings:

Gower Handbook of People in Project Management (Project and Programme Management Practitioner Handbooks), Lindsay Scott and Dennis Lock, 2013, Routledge

How to change the world: Social Entrepreneurs and the Power of New ideas, 2004, David Bornstein, OUP USA
Integrated Planning Process: Project Design & Proposal Writing, American Red Cross, 2006

IDRC. 2010. Resource Mobilisation a Practical Guide for Research and Community Based Organization http://www.idrc.ca/EN/Programs/Donor_Partnerships/Documents/Donor-partnership-guide-hyperlinked.pdf
 Impact Assessment of ICT-for Development Projects: A Compendium of Approaches, Richar Heeks and Ale-mayehu Molla, 2009, IDRC. http://www.sed.manchester.ac.uk/idpm/research/publications/wp/di/documents/di_wp36.pdf
 Results Based Management - <https://unhabitat.org/?rbm-handbook=1-1-what-is-resultsbased-management>
 Social Entrepreneurship: What Everyone Needs to Know, Bornstein David and Susan Davis, 2010, Oxford University Press
 World Bank. 2009. Resource Mobilisation.
http://siteresources.worldbank.org/INTBELARUS/Resources/Resource_Mobilisation.pdf

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	
CO2		H	
CO3			H
CO4		H	H

MCSA0046: SITUATION ANALYSIS FOR COMMUNICATION STRATEGY (3-0-1)

COURSE OUTCOMES

List the basic models and steps of communication strategy planning (Remembering)
 Understand the techniques of development communication planning (Understanding)
 Assess the situation for development communication and intervention (Evaluating)
 Examine the role of media in socio-economic development and social change (Analysing)
 Prepare develop communication strategy and plans (Creating)

Module 1: Socio-Ecological Framework and Situation Analysis

Underlying causes of development problems, Socio-Ecological Framework, Situation Assessments: Motivation- OpportunityAbility (MOA) Model, Case and project feasibility study, SWOT Analysis. Participatory Approach: PRA, Community Mapping, Social Auditing, Transect walk, Auto-photography.

Module 2: Literature Review and Formative Research

Research on current knowledge, attitudes, experiences, practices and beliefs among the participants groups, Understanding Local knowledge, Formative Research, Participatory Research, Participatory Rural/Urban Appraisal (PRA), Participatory Learning and Action (PLA), Most Significant Change (MSC), Appreciative Inquiry, Case study on C4D.

Module 3: Synthesising, Analysing and Reporting Data

Data synthesis, reporting, identifying long-term goals, determining preconditions needed to achieve the goals, linking interventions to results, identifying indicators of results and producing a narrative to summarize changes, issues and challenges.

Suggested Readings:

Communication for Development and Civil Society, V.S. Gupta, 2004, Concept
 Information and Communication Technology: Reinvesting Theory and Action (2Volumes), Kiran Prasad, 2009, BRPC
 Media, Communication and Development: Three Approaches, Linje Manyozo, 2012, Sage
 Participatory Communication: Working for Change and Development, S.A. White, 1994, Sage
 Participatory Communication Paolo Mefalopulos and Thomas, Tufte, 2009, World Bank Working Papers

Participatory Communication for Social Change (Communication and Human Values), Jan Servaes, Tom Jacobson and Shirley a White, 1996, Sage Publications

Participatory Video: Images that Transform and Empower, A Shirley White, 2003, Sage India

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2		H	
CO3		M	H
CO4			
CO5	H	H	H

MCCA0047: PLANNING MODELS AND COMMUNICATION APPROACHES (3-0-1)

COURSE OUTCOMES

Identify the steps in communication strategy development (Remembering)

Explain the basic principles and development planning models (Understanding)

Analyse the relevance of theoretical frameworks of communication for development (Analyse)

Critically analyse the key components of communication strategies (Evaluate)

Design and implement C4D programmes (Creating)

Module 1: C4D Planning Models (20 Lectures)

Understanding communication planning, Planning Models: ACADA Model, P-Process, COMBI Model and Integrated Communication, Individual Level Behavioural Change Models: Persuasion Model, Health Belief Model, Stages of Trans- theoretical Model, Issues and Challenges of Social and Behaviour Change Communication (SBCC).

Module 2: Communication Approaches (20 Lectures)

Defining Objectives: Programme Objectives, Behavioural Objectives and Communication Objectives, Dialogue-based approaches, Participatory communication, Communication Plan, Audience Mapping, Segmentation, Channels, Message design– Human-Centric Design (HCD), Message appeal, Message Testing, Material production and Toolkits.

Module 3: Communication Intervention and Strategy (20 Lectures)

Identifying key stakeholders, Preparation of Partnership Plan, Management Plan, Operation Guidelines, Levels of Intervention: Macro, Mezzo and Micro levels, Establishing objectives at multiple levels, Key steps leading to change, Logical Frame, Communication strategy: Advocacy: Effective advocacy, Media Advocacy, Celebrity Advocacy, Legal Advocacy & Executive/Legislative and Regulatory Advocacy), Social Marketing, Entertainment Education, Peer Education, Capacity and Capability Strengthening, Project Implementation, Feedback and Review.

Suggested Readings:

Community Dialogue Toolkit - Supporting Local Solutions to Local Challenges, <https://ccednet-rcdec.ca/en/toolbox/community-dialogue-toolkit-supporting-local-solutions-local>

Celebrity Advocacy and International Development (Rethinking Development, Dan Brockington, 1st Edition, 2014, Routledge

Hands-on Social Marketing: A Step-by-Step Guide, Kline Nedra Weirniech, 1999, Sage

Media, Communication and Development: Three Approaches, First Edition, Linje Manyozo, 2012, Sage Publications

Methods to support human-centric design, M. Maguire, 2001, International Journal of Human-Computer

Studies, 55(4), pp.587-634

Social Marketing-Changing Behaviour for Good, Nancy R. Lee and Philip Kotler, 2015, Sage Publications

The Limits of Media Advocacy, Communication, Culture and Critique 3(1):44-65

Theory and Principles of Public Communication Campaign, C.K. Atkin and R.E Rice, 2012, Sage

The Role of Message Tailoring in the Development of Persuasive Health Communication Messages, in

Christina Beck, Editor, Communication Year Book 33, S.M. Noar, G.G Harington and R.S. Aldrich, 2009

Writing Health Communication: An Evidence Based-Guide, Charles Abraham and Marieke Kools, 2011, Sage

Writing a communication strategy for development programmes, UNICEF, 2007,

https://sites.unicef.org/cholera/Chapter_7_communications/UNICEF_Writing_a_Comm_Strategy_for_Dev_Progs.pdf

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1			H
CO2	H		
CO3	H	H	
CO4			H
CO5	H	H	H

MCMC0048: MEDIA AND CULTURAL STUDIES (4-0-0)

COURSE OBJECTIVES

Describe the key concepts of cultural and media studies (Remembering)

Understand the cultural dynamics of society with the help of contemporary theory (Understanding)

Examine the role of media in mediation of social identity (Analysing)

Assess the diverse media and cultural practices (Evaluating)

Module 1: Media and Culture (15 Lectures)

Concept of Culture - meaning; dimensions, Basic theoretical framework - Critical Cultural Theory; Frankfurt School; Chicago School, Mass media and postmodern culture, Culture industries, Popular and mass culture, Multiculturalism and subcultures, Mediated culture, cultural hybridity.

Module 2: Media and Society (15 Lectures)

Media Manufacturing of Culture, Pluralism and Counter-Culture, Mediated Culture, Media & Margins, Media influence on culture, Gender; culture and space, Media and gender.

Module 3: Media, Culture and Identity (15 Lectures)

Identity and Culture, Mediated Identity, Gender, Body and the Culture of Modernity, Contesting Cultures, Techno-Culture, Cyberculture, Media Representations, Under-Representation, Gendered Representation, Visual Pleasure, Internet as a Cultural Platform.

Suggested Readings:

Cultural Studies: Texts and Contexts, First Edition, Prantik Banerjee, 2021, Dattsons

Communication as Culture, James W. Carey, 2008, Routledge

Media and Culture: An Introduction, Campbell, Richard, Martin, Christopher R, and Fabos Bettina, 2011

Media and Cultural Studies: Key Works, Gigi Meenakshi Durham and Douglas M. Kellner (eds.), 2006, Blackwell

Questions of Cultural Identity, Stuart Hall and Paul Du Gay (ed), 1996, Sage Publications

Representation: Cultural Representations and Signifying Practices - Vol. 2 (Culture), 1997, Stuart Hall, Sage

Sociology of Indian Culture, D.P. Mukerji, 1979, Rawat Publishers

What is Cultural Studies? A Reader., John Storey (Ed), John Storey, 2009, Hodder Education

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2	H		H
CO3			H
CO4	H	H	

MCBJ0050: BUSINESS JOURNALISM (3-0-0)**COURSE OBJECTIVES**

Describe the key terms related to business and finance (Remembering)

Understand different forms of business journalism (Understanding)

Write business news articles (Creating)

Module 1: Introduction to Business and Financial System (15 Lectures)

Basic knowledge of financial system and institutions, Gathering, distribution and allocation of revenue vis-à-vis Central Government and State Governments; finance commission/department, Central and State budgets: budget-making exercise, how to read a budget, concept of zero deficit budget, importance of Public Accounts Committee, Introduction to Tax Laws, Essential Commodities Act, MRTP, FERA, SEBI, RBI, IMF, Industry Bodies and other Financial Regulatory Bodies, Economic Policies.

Module 2: Basics of Business Journalism (15 Lectures)

Business journalism: Global and Indian context, types of business journalism, media and new trends in business journalism, international money market and new information technology, commercial database, ethics in business reporting – business journalism, servant or watchdog.

Module 3: Writing Business News (15 Lectures)

Sources of news on business, finance and industry – governments, chambers of commerce and industries, corporate, trading and industrial executives, share markets, commodities markets, money markets etc. Government policy decision, company reports, RBI reports; analysis of decisions, reports and statements, Data visualisation tools and presentation, ethics in business journalism.

Suggested Readings

Business Newspapers: Economic Times, Financial Express, Business Standard, Observer of Business and Politics, Business Line.

Business Journalism: A Critical Political Economy Approach, 1st Edition, Ibrahim Seaga Shaw, 2015, Routledge

Indian Economic Yearbook, National, Agarwal, A.N. & Verma H.O. New Delhi

Business Journalism: How to Report on Business and Economics, 1st Edition, Keith Yayas, Apress

Periodicals: Business India, Business World, Business Today, The Economist, Dalal Street Journal, Advertising & Marketing (A & M), Far Eastern Economic Review, EPW

Reporting Technical Information, Kennet Houp & Thomas Pearsall, 1984, Macmillan

Writing About Business: The New Knight-Bagehot Guide to Economics and Business Journalism, Revised Edition, Terri Thomson, 2000

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H		
CO2		H	
CO3			H

MCPM0051: PROJECT MONITORING AND EVALUATION (3-0-1)**COURSE OUTCOMES**

Identify the data-gathering techniques of communication projects (Remembering)

Describe the project monitoring and evaluation processes (Understand)

Undertake critical analysis of evaluation data (Analyse)

Prepare monitoring and evaluation plans, write reports and communicate findings (Create)

Module 1: Programme Monitoring, Evaluation and Promotion (20 Lectures)

Concept of project Monitoring and Evaluation (M&E), Project cycle, Distinction between M&E, evaluation and impact evaluation, Role of logic models, M&E Plan, Different types of evaluations, Monitoring Outcomes and Assumptions, Measurement of progress, Indicators of change, Impact assessment, Stakeholder Analysis Networks Analysis, Social Support & Recognition, Positionality and ethics, Outcome mapping, Strengths and weaknesses, Promotion of changed/adapted behaviour/results, Testimonial Reminders, Repetition.

Module 2: Data-gathering and Analysis (20 Lectures)

Quantitative and qualitative approaches, survey, community dialogues, interviews, data analysis, use of statistical tools, Baseline Data, Information Management, interpretation, data visualisation, assessing validity and reliability and determining generalisability of the data, Learning and accountability.

Module 3: Reporting and Documentation of M&E Data (20 Lectures)

Interpretation of M&E data, understand its uses, data preparation, documentation, Types of Records: Process, Narrative and Summary, Problem-oriented Recording, formulating recommendation, Reporting Project Progress and Findings, practicum, Reflective practice - Learning Lessons, Adapting the Plan, Continuous Improvement Communicating the Results.

Suggested Readings:

Can we know better? Reflections for development, Chambers, R, 2017, Rugby: Practical Action Publishing
How Change Happens, 2016, Oxford: Oxford University Press

Outcome Mapping: Building Learning and Reflection into Development Programs, Earl, S., Carden, F. and Stymulo, T., 2001, IDRC

Program Evaluation theory and Practice 2nd Edition, D.M. Mertens and Wilson, A. T., 2019, The Guildford Press

Planning, monitoring and evaluation in development organisations: sharing training and facilitation experiences, De Coninck, J. 2008, Sage

Ten Steps to a Results-Based Monitoring and Evaluation System, Kusek, J. Z. and Rist, R. C, 2004, The World Bank

The use and abuse of the logical framework approach, O. Bakewell and A Garbutt, 2005, Sida

The 'Most Significant Change' (MSC) Technique: A Guide to Its Use, R. Davies and J Dart, 2005

Mapping of COs to Syllabus

Course Out-comes	Module 1	Module 2	Module 3
CO1		H	
CO2	H		
CO3	H	H	
CO4	H		H

MCDM0052: DIGITAL MEDIA (3-0-0)

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective: The objective of the course is to provide a comprehensive overview of digital media, focusing on its development, impact, and role in contemporary society. Students will explore the global and national contexts of digital media, examining its influence on communication practices, media industries, and society.

Course Outcomes:

At the end of this course students will be able to:

- CO 1 Analyse the evolution, impact and societal implications of digital media. (Analysing)
- CO 2 Examine the role of digital media in transforming communication practices. (Applying)
- CO 3 Discuss key issues emerging from recent development in digital media. (Understanding)

Module 1: Digital Media and Society (6 Lectures)

Internet as a medium of communication, Types of internet based communication, Forms of computer mediated communication, Virtual communities, Evolution and development of digital media, Medium specific trends, Effects of digital media, Evolution and development of ICT, Growth and diffusion of ICT, Digital divide and Digital (In)Equality, ICT policies of India, Regulatory body, IT Laws and Rules, Agencies involved in cyber-security

Module 2: Social Media in Indian Scenario (10 Lectures)

History; definitions and types of Social media, Social media in India, Use of social media, Social media and interactivity, Content sharing, Social media tools and engagement, Fake news on social media, types and characteristics of social media audience, Marketing and social media audience

Module 3: Application of Digital Media (10 Lectures)

Online activism: Definition; Technology and activism; Characteristics of online activism; Online activism and social change, Democracy and digital media: Elections; political parties; politics; Citizen journalism, ICT for development: Education; Health; E-governance; Entrepreneurship, Artificial Intelligence

Suggested Readings

- Castells, M. (2004). *The Network Society: A Cross-Cultural Perspective* (Edward Elgar, 2004).
 Fuchs, C., and Sandoval, M. (Eds.). *Critique, Social media and the Information Society* (Routledge, 2006).
 Gerbaudo, P. *Tweets and the Streets: Social Media and Contemporary Activism*. (Pluto Press, 2018).
 Lievrouw, L., and Livingstone, S. *Handbook of New Media* (Sage, 2006).
 Manovich, L. *The Language of New Media* (MIT press, 2001).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2	M	H	H
CO 3		M	H

MCFA0053: FILM APPRECIATION (3-0-1)

(3 Credits – 45 hours) (L-T-P: 3-0-0)

Objective: The objective of the course is to provide a comprehensive understanding of film as an art form, cultural product, and means of communication. The course explores the aesthetic, technical, historical, and cultural dimensions of cinema, with a focus on global, national (Indian), and regional (Northeast Indian) contexts.

COURSE OUTCOMES:

At the end of this course students will be able to:

- Explain the origin and growth of cinema. (Understanding)
- Analyse films by using established film theories and film genre. (Analysing)
- Create well-structured film reviews and critical essays. (Create)

Module 1: Growth and Development of Cinema (6 Lectures)

Meaning of cinema, Beginnings of cinema, Silent Era to Studio era, Indian Cinema: Beginning of cinema in India; Arrival of sound to Post-independence era; Cinema and the Nation

Module 2: Social Context and Film Form (10 Lectures)

Classical Hollywood cinema, German Expressionism, Italian Neo-realism, French New Wave, Indian New Wave and Parallel Cinema, Third Cinema

Module 3: Alternative Visions (10 Lectures)

Auteur theory, Feminist film theory, Queer theory, Film genre: Genre theory; Western film, Film noir, Gangster film

Module 4: Indian Cinema (10 Lectures)

Growth of Bollywood, Liberalisation and Indian Cinema, Overview of Northeast India cinema: Historical development; Key filmmakers; Themes and narratives; Contemporary trends

Module 5: Film Culture (9 Lectures)

Evolution of censorship, Film criticism and cinephilia, Film festivals; Events and communities

Suggested Readings

Bordwell, D., & Thompson, K. *Film Art: An Introduction* (McGraw-Hill Education, 2012).
 Gokulsing, K. Moti & Dissanayake. *Handbook of Indian Cinemas* (Routledge, 2018)
 Monaco, J. *How to Read a Film: Movies, Media, and Beyond*. (Oxford Univ. Press, 2009).
 Nichols, B. *Engaging Cinema: An Introduction to Film Studies*. (W. W. Norton & Company, 2010).
 Ray, Satyajit. *Our Films Their Films* (Orient Publishers, 1993).
 Stam, Robert. *Film Theory: An Introduction* (Blackwell Publishers, 2000).

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	M		H	
CO 2		H	H		L
CO 3		L	L		H

MCTP6015: TECHNIQUES OF PHOTOGRAPHY AND IMAGE EDITING (0-0-2)

COURSE OUTCOMES

Show working knowledge of digital SLR cameras (Remembering)
 Demonstrate an understanding of composition and image design process (Understanding)
 Apply image editing and output techniques (Applying)
 Analyse and critique one's own artistic output (Analysing)
 Determine safe and responsible work practices (Evaluating)
 Create photographic work of acceptable standard (Creating)

Description:

To equip the learners with skills and knowledge about the art of digital photography, to enable the learners to professionally handle DSLR cameras, understand technical concepts from the different shooting modes to aperture and shutter speed; and apply composition techniques from finding effective backgrounds to rule of

the thirds., To provide hands-on training on outdoor photography as well as studio photography. Recommended Assignments:

Suggested Practicum:

Street photography, Landscape photography, Action Photo story, Cityscapes, Studio portrait, Building a Photography portfolio.

Suggested Readings

Basics of Digital Images. OIT Academic Computing, PDF.

Fundamentals of Photo Composition, Paul R. Comon, Sterling Publications.

The DSLR Cinematography Guide, R. Koo, Creative Commons, e-book.

Langford's Basic Photography, Michael Langford, Anna Fox and Sawdon Rechard Smith, Focal Press.

Understanding Exposure, Bryan Peterson, Amphoto Books.

Mastering Digital Cameras, Al Judge, Createspace Independent Pub.

MCJG6016: JOURNALING (0-0-1)

COURSE OUTCOMES

Demonstrate the ability to explore different options for handling daily experiences (Understanding)

Develop self-awareness, self-learning and communication skills (Applying)

Apply contextual and experiential learning in their everyday lives (Applying)

Improve creativity and imagination (Creating)

Description

During these 30 hours of the Course, students are required to maintain a daily reflective journal, using the Visible Thinking Routine as a critical structure for guiding their journal writing. Students are required to do journaling once a week and submit the journal to the assigned faculty member every Friday for analysis. Grades will be awarded for this course on the basis of the journal entries and a presentation at the end of the semester.

Suggested Readings

The principal's role in mentor programs, B. Brock, 1999, London: Kogan Pag.

Visible thinking: Unlocking causal mapping for practical business results, J. M. Bryson, 2004, Chichester, J. Wiley.

Journaling During Research, Kay Debra Logan, 2005, Library Media Connection; Vol. 23 Issue 6, p12

Journaling: Telling your professional "story," D. Miller, 2003, Library Media Connection

Social Behaviour and Personality, Hung-Yuan Lin and Chi-Hsian Chiang, 2013, In international journal, Volume 41, Number 1, 2013, pp. 113-122(10) Scientific Journal Publishers.

MCDI6017: DISSERTATION PHASE – I (0-0-2)

Description

Through this practicum students will be taught the different methods for conducting academic research. It will also teach students to conduct review of literature, prepare synopsis outline, format or structure of report. They will also learn how to add Appendices, such as references to sources of data, instruments of data collection; give Bibliography and footnotes.

The Exercise:

During this 60-hours course, students will have to choose a research topic of their choice, conduct a literature review with bibliography, and develop a research proposal which will be submitted in partial fulfilment for the requirement of Master's degree in Mass Communication. Students will also write and present a research paper.

Recommended Readings

Introduction to Mass Communication Research, Natziger, Ralph O. and David M. White. Baton Rouge: Louisiana State University Press, 1981.

Mass Media research: An Introduction, Wimmer, Roger D. and Joseph R. Dominick. Belmont: Wadsworth.
MLA Handbook for Writers of Research Papers, Joseph Gibaldi and Walter S. Achtert New Delhi: Affiliated East-West Press Pvt. Ltd., 1994.

Research Methods – The Basics, Nicholas Walliman, Routledge, 2011

Research Methodology Methods and Techniques, C.R Kothari

Research Methods in Social Sciences, O.R Krishnaswamy

Research Methods in Mass Communication, Stempel, Guido H. (III) and Bruce H. Westley (Ed). Englewood Cliffs: Prentice- hall Inc, 1981

Writing Your thesis, New Delhi: Sage Publications, 2008

MCAV6018: AUDIO-VIDEO PRODUCTION (0-0-2)

COURSE OBJECTIVES

Show awareness of safe and responsible work practices (Remembering)

Demonstrate an understanding of the audio-video production process (Understanding)

Experiment with different types of audio and video production tools (Applying)

Develop competency in editing and output techniques (Creating)

Create different formats of audio and video programmes (Creating)

The Exercise:

Basics of audio editing, Basics of video editing, Principles of scripting, Audio recording techniques and equipment, Radio Talk show, Radio Commercials, Studio recording, Outdoor recording, Hands-on training on Camera techniques and accessories, Framing and Shot sizes, Lighting techniques for video, Commercials, Video Interview, Live recording techniques.

Suggested Readings

Single-Camera Video Production, Robert B Musburger and Michael R. Ogden, 2014, Focal Press

Techniques of Radio Production, Robert Mcleish, 2015, Focal Press

The Videomaker Guide to Digital Video and DVD Production, Stephen Muratore and Matt York, Focal Press.

Video Production Handbook, Jim Owens, 2011, Routledge

Writing for Radio and Television in India, Krishnan K. Kedia, Cyber Tech Publications.

MCDP6019 DISSERTATION PHASE – II (0-0-2)

Project Description

During this practicum course students will complete data collection, analysis, preparation of research report and submit the final dissertation. The dissertation has to be systematically structured following proper methodology of communication research. Phase - I of the course is carried out in the 2nd Semester where students work upon research proposals, literature review and research methodology. Students will have to ensure that the dissertation is prepared keeping in view Intellectual Property Rights, maintenance of research ethics and avoidance of plagiarism. Students are required to make a presentation of the dissertation submitted to the department on the date set by the department.

Suggested Readings:

Research Methodology: Methods and Techniques, 4th Edition C.R. Kothari and Gaurav Garg, 2019, New Age International Publishers

Methodology of Research in Social Sciences, O.R. Krishnaswamy and M. Ranganatham, 2016, Himalaya Publishing House

Writing Your Thesis, Paul Oliver, 2014, Sage Publications, New Delhi

Research Methods in Mass Communication, III Stempel, Guido H. and Bruce H. Westley, 1988, Prentice-Hall.

Mass Media Research: An Introduction, Roger D. Wimmer and Dominick R. Joseph, 2005, Wadsworth Publishing Co. Inc.

Writing Successful Reports and Dissertations (Student Success) 1st Edition, Lucinda Becker, 2014, Sage Publications

MCIP6020 INTERNSHIP (5 Credits – 90 hours)

Description

Students will undertake 4-weeks internships in media and communication organizations during the winter vacation between third semester and fourth semester. They will discuss the choice of media and communication organization with their respective mentors and obtain the consent of the head of the department. Before going for the internship, an *Internship Agreement Contact* form from the concerned organization will be submitted by the student to their respective mentors. After completion each student will submit a copy of the *Internship Completion Certificate* to their mentors from the designated authority of the concerned media and communication organization.

The final evaluation will be on the basis of the following criteria:

Journal – 30%

Portfolio and Presentation – 50%

Written evaluation by the employer – 20%

Journal: Each student will keep a daily journal with an entry for each day spent doing work for the internship. This journal should be e-mailed to the mentor at the beginning of each work week. In this journal the students should summarize the activities and assignments on which the student worked. The student should also keep track of the number of hours for each week.

Portfolio: At the end of the internship, each student is required to prepare a professional portfolio that contains examples of the students' work during the internship. The portfolio will additionally contain a written evaluation of the media organization, employer evaluation of the student, a copy of the internship completion certificate, a one-page summary of the internship.

Employer Evaluation: At the end of the internship the supervising employer will be asked to submit a written evaluation of the student's performance.

Student Evaluation: At the end of the internship the student will be asked to submit a written evaluation of the employer. The department will issue the following to the students:

Internship Application Form – to be submitted to the mentor prior to internship.

Internship Agreement Contract – to be submitted to the mentor prior to internship.

Student Evaluation of the Internship – to be included in the portfolio

Employer Evaluation of Intern – to be included in the portfolio

Last date of Internship: To be notified by the department

Portfolio Submission and Presentation: To be notified by the department

MCFP6021 FINAL PROJECT(5 Credits – 90 hours)

Project Description:

Each student is required to submit a project based on her/his area of specialization or any other relevant areas of Journalism and Mass Communication/Advertising/Public Relations etc. They are required to choose the topic of their Final Project in consultation and supervision of the teacher/Mentor of the department and duly approved by the Head of the Department. The Final Project has to be submitted (two printed in bound form and a soft copy) as per the schedule duly notified by the department.

Suggested Project:

Designing and publication of newspapers/magazines/publicity posters/brochure

Project Evaluation Criteria

Project activity assessment: 20%

Evaluation of final project: 60%

Viva-Voce: 20%

Last date of project submission: To be notified by the department

Portfolio Submission and Presentation: To be notified by the department

VALUE ADDED COURSES**MCCS6122 COMMUNICATION SKILLS (1-0-1)****COURSE OBJECTIVES**

Identify the different styles of communication (Remembering)

Understand how to develop effective speaking skills (Understanding)

Evaluate various communication needs (Evaluating)

Develop professional oral & written communication skills (Applying)

Module 1: Basics of Communication (5 Lectures)

Essentials of effective Communication, Types & techniques of communication: Verbal & Non-Verbal Communication, Communication in organization, Communication Network in an Organization: Personal Communication, Internal Operational Communication, External Operational Communication.

Module 2: Oral Communication (13 Lectures)

Language in Communication, Phonetics, Spelling, Pronunciation, and Accent, Speech Drills, Oral Communication Skills: Seeking and giving information/suggestions/advice, Offering and responding to offers, Requesting and responding to requests, Congratulating people, Expressing condolences, Asking questions and responding politely, Apologizing and forgiving, Giving instructions, Seeking and giving permission, Expressing opinions, Group discussion, Seeking explanations, Expressing sympathy, Reading Skills: Skimming and Scanning, Levels of Reading, Reading Comprehension, Academic Reading Tips, Listening and speaking skills, Contextualised speaking.

Module 3: Written Communication (12 Lectures)

Writing Skills, Elements of Writing: Sentence, Phrases and Clauses, Forms of Written Communication, Formal & Informal Writing, Letter Writing, Notices, Summary, Note-making, Job application, Preparing a CV/Resume and Effective Profiling, Preparation of Cover letters, preparing for and Facing a Job Interview, Preparing a Presentation, Preparing Agenda and Minutes for Meetings, Writing Notices and Memos, Drafting an E-mail, Correspondence with Government Authorities/institutions, Office Orders, Enquiries and Replies, audience analysis.

Suggested Readings:

Business Communication, Meenakshi Raman and Prakash Singh, 2012, Oxford University Press

Oxford English Grammar, Sydney Greenbaum, 1996, Oxford University Press

Effective Technical Communication, M. Ashraf Rizvi, 2005, Tata McGraw Hill

Business Communication, Anjanee Sethi & Bhavana Adhikari, Tata McGraw Hill

Working in English, Leo Jones, 2001, Cambridge University Press

Speaking Personally, Gillian Porter Ladousse, 1983, Cambridge University Press

Communication Skills. Leena Sen, 2007, PHI Learning

English phonetics and phonology paperback with audio CDs (2): A practical course, P. Roach, 2009, Cambridge university press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	H
CO2		H	
CO3	H		
CO4		H	H

MCCW6123 CREATIVE WRITING (1-0-1)**COURSE OUTCOMES**

Demonstrate understanding on various forms of creative writing (Understanding)

Apply the techniques of creative writing for storytelling (Applying)

Write contents for various purposes (Creating).

Module 1: Introduction to Creative Writing (10 lectures)

Writing as an Art, Types of writing, Principles of writing, Characteristics of Good Writing, Elements of Writing: Form, Content, Audience, Style & Structure, Meaning of creative writing, Creative process and abilities for writing, Challenges in Creative Writing.

Module 2: Process and Techniques of Creative Writing (10 lectures)

Finding the ideas, sketching the plot, characterization, conflict, climax, resolution, Action Description, Point of View, Dialogue, setting atmosphere, Using technology in process of writing.

Module 3: Writing Exercises (10 Hours)

Content Writing, Reviews writings, Blogging, Feature and Opinion Pieces, Creative Writing, Short Story, Poetry, Fiction, Essay, Adventure Story, Reflective Writing, Persuasive Writing – Commercials, Figurative Writing, Travel Writing.

Suggested Readings:

Creative Writing – How to Unlock your Imagination, develop your writing skills – and get published, 7th Edition, Adele Ramet, 2007, Howtobooks

Creative Writing Course Book, Paul Mills, 2006, Routledge

The Cambridge Companion to Creative Writing, South Asian Edition, Morley, 2012, Cambridge University Press

The Five Minutes Writer, Margret Geraghty, 2007, HowToBook

The Cambridge Introduction to Creative Writing, David Morley, 2007, Cambridge University Press

The Psychology of Creative Writing, Scott Barry Kaufman and James C. Kaufman (Ed), 2009, Cambridge University Press

Word Power: A guide to creative writing, Julian Birkett, 2016, Bloomsbury Academic India

Writing on Both Sides of the Brain: Breakthrough Techniques for People Who Write, Henriette A Klauser, 1987, HarperOne

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO1	H	H	
CO2	H	H	

CO3			H

MC6124 EVENT MANAGEMENT (1-0-1)**COURSE OUTCOMES**

Understand the relevance of event management as a professional skill and career option (Understanding)

Demonstrate an in-depth understanding of the intricacies of managing an event (Applying)

Examine individual and team orientation in event planning and management (Analysing)

Plan and organise an event (Creating)

Module 1: Introduction to Event Management (6 lectures)

Concepts and types of events, Understanding and Introduction to the events landscape, Idea generation, Conceptualisation: Techniques/Methods.

Module 2: Event Planning and Administration (8 lectures)

Developing event vision/mission, objectives and goals, Event proposal, Strategic planning techniques: Action Plans; Event Group Sustainability methodologies, Logistics and operations: Use of work plan structures; time-plans; worksheets; Gantt Charts, Legal frameworks: Licenses and Permissions, Event administration strategies, Resource Mobilisation and techniques, financial management.

Module 3: Event Marketing (8 lectures)

Target Group Segmentations: Concepts and Strategies, Strategic and Integrated Marketing Communications for events, Event Branding, Digital marketing and audience building for events, Marketing plan creation; strategies and implementation, Skills for event managers and planners: negotiation and networking skills; image management; leadership.

Module 4: Post Event Documentation and Evaluation (8 lectures)

Documentation: aims; methods and techniques, Event evaluation methodologies, Audience feedback and review mechanisms, developing event follow-up strategies and action plans, Developing the Event Planners Journal.

Suggested Readings:

Event Management and Marketing: Theory, Practical Approaches and Planning, 1st Edition, Anukrati Sharma and Shruti Arora, 2018, Bharti Publications

Events Management: An Introduction C. Bladen, J. Kennel, 2012, Routledge

Event Marketing: How to Successfully Promote Events, Festivals, Conventions and Expositions, Leonard H. Hoyle, 2002, John Wiley and Sons Inc

Event Planning, 2nd Edition, J. Allen, 2009, Wiley

Event Planning: The Ultimate Guide, J. Allen, 2000, Wiley and Sons.

Planning Special Events, J. S. Armstrong, 2001, Josse Bass Wiley

Public Relations Campaigns and Techniques, F.R. Matera & R.J. Artigue, 2000, Allyn & Bacon 8.

Special Events: A New Generation and the Next Frontier, 6th Edition, J. Goldblatt, 2010, Wiley.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	H			
CO2	H	H	H	H
CO3		H		H
CO4	H	H	H	H

SERVICE LEARNING

MCLS0100: COMMUNITY MEDIA (2-0-0)

COURSE OUTCOMES

Define and explain service learning and participatory approach to social development (Remembering)

Classify the different types of community media (Understand)

Utilise community media for social change and development (Applying)

Analyse storytelling formats and content about development issues (Analyzing)

Identify opportunities for discussing development issues using community media (Evaluating)

Produce content for community media (Creating)

Module 1: Introduction to Service-Learning (5 Lectures)

Concept of Service Learning— definition, principles, models of different Higher Education Institution Service Learning; Service Learning as a medium of social change.

Module 2: Understanding Community and Community Participation (5 Lectures)

Understanding Community, Participatory approach to social development; Principles of community participation; Participatory Rural Appraisal.

Module 3: Community Media and Community Engagement (5 Lectures)

Understanding Community Media, Types, Purpose, Relevance and Significance, Skills, tools and Techniques of community media, Practices of Community Media, Participatory communication, socio-cultural media, Communication for Social and Behaviour Change, ethical issues.

Module 4: Community Practicum and Learning Activities (15 Lectures)

Internship, Community Mobilisation, Awareness/Advocacy campaign, folk performances, community meetings, rural reporting, community radio programmings, community video, case studies.

Suggested Readings:

A to Z in Projects Cycle Management: A Results Based Approach, P. J. Lukose, 2015, Media House Publications, New Delhi

Community Media: International Perspectives, Kinda K. Fuller, 2007, Plagrave Macmillan

Community Media: People's, Places, and Communication Techniques, Kevin Howley, 2005, Kindle Edition

Hand Held Vision: The Impossible Possibilities of Community Media, D. D. Halleck, 2002, Fordham University Press

Media, Communication and Development: Three Approaches, Linje Manyozo, 2012, Sage India

Methods for community participation: A Complete Guide for Practitioners, S. Kumar, 2002, New Delhi: Vistaar

Other Voices: The Struggle for Community Radio in India, Vinod Pavarala and Kanchan K Malik, 2007, Sage Publications

Participatory Development Practice: Using Traditional and Contemporary Frameworks, A Kelly and P. Westoby, 2018, London: Practical Action Publishing

Rural development: putting the last first, R. Chambers. R, 1983, New Delhi: Routledge

Service learning in higher education: concepts and practices, B. Jacoby, 2010, Michigan: Jossey-Bass Publishers

Service-learning: History, Theory and Issues, B. W. Speck and S. L Hoppe, 2004, Connecticut: Greenwood Publishing Group

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO1	M			
CO2		M	M	

CO3			H	H
CO4			H	H
CO5			H	H
CO6			H	H

DEPARTMENT OF PSYCHOLOGY

VISION

To be a centre of excellence in teaching, learning, research and in the practice of psychological counselling, thereby promoting community mental health and psychosocial competence in order to foster cohesion in the society.

MISSION

Department of psychology and counselling Assam Don Bosco University seeks to:

Achieve excellence in teaching, learning, research, practice and extension activities.

To nurture and develop the counselling skills of the students.

To prepare competent counsellors who are socially committed and culturally sensitive and are bound by the ethics of the profession.

To create an environment committed to promoting the application of science of psychological counselling to real world situation.

PROGRAM OUTCOMES – MSC PROGRAMME

- PO 1: Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- PO 2: Effective Communication: To build on effective inter and intra personal communications skills including empathy. Open mindedness, mutual respect, Confidence, effective listening, non-verbal communication, clarity and concision.
- PO 3: Scientific Temper: To build essential skills of different ways of life including questioning observing, physical reality, testing, hypothesizing, analyzing and communicating
- PO 4: Effective Citizenship: Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO 5: Ethics: Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
- PO 6: Environment and Sustainability: Building a contemporary state of art model using the theories of social sciences for sustainable development of the campus/environment.
- PO 7: Gender Sensitization and Social Commitment: To bring about a change in behavior and attitude and to instill empathy in the students to raise awareness about the gender equality concerns and to imbibe the sense of social responsibility for self and community to envisage ethical framework, obligation to work and cooperate with other individuals and organizations for the benefit of the society at large
- PO 8: Self-Directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

PROGRAM SPECIFIC OUTCOMES – MSC PSYCHOLOGY

- PSO 1: Knowledge and Attitude: To develop budding counselling psychologists who will be able to understand and demonstrate behavior, have attitudes in the basic areas of professional counseling.
- PSO 2: Research and Analytical Skills: Will be able to demonstrate competence in analysis and critically analyse scholarly work in areas of research, consultancy and counseling practice.
- PSO 3: Application: To equip students with knowledge in the fundamentals of psychology and counseling so that they PSO 4: understand the application of the field relating to different issues in psychology.
- PSO 5: Core Competency Skills: To enhance the core counseling skills, such as active listening, empathy, unconditional positive regard, congruence and so on and empowering the process of human development.

PSO 6: Ethics: To demonstrate the technical skills and ethical decisions appropriate for the holistic professional development in the field.

MAPPING OF COURSES WITH POS/PSOS

Sl. No.	Course	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PS O1	PS O2	PS O3	PS O4	PS O5
1.1	Theories of Personality	H	H	L	H	H	M	H	H	H	L	H	H	H
1.2	Concepts of Mental Health and Illness-I	M		M		M	H		L	M		M	M	M
1.3	Research Method and Statistics in Social Sciences		H	M	M			M	L	H		H	H	M
1.4	Cognitive Psychology	H	H	H	M	M		H	M	H	H	H	H	M
1.5	Eastern Approaches to psychology and Counseling	M	L	M	L	M	L	L	L	H	M	H	H	M
1.6	General Psychology	M	L	H	L	M	L	M	M	H	M	L	M	M
1.7	Practicum-I	H	L	H	M	H		M	M	H	M	H	H	H
1.8	Personal Growth	M	H		M	M	H	M	L		L	L	M	
2.1	Concepts of Mental Health and Illness-II		M	L	L	H	M	H	H	H	L	H		M
2.2	Bio-psychology	H	L	H	L	M	L	L	L	H	M	L	M	H
2.3	Psychological Testing	H	L	H	L	H	L	L	M	M	H	M	L	H
2.4	Health Psychology	H	L	M	L		L	M	M	M	M	L	H	M
2.5	Introduction to Social Psychology	M	H	M	H	M	M	M	L	M	M	M	H	M
2.6	Practicum-II	H	L	H	L	M	L	M	M	H	M	H	M	H
2.7	Field Work	H	H	M	H	M	H	M	H	H	M	H	H	H
2.8	Psychological First Aid	M	M	M	L	M			L	L	L	M	M	M
	Counselling Psychology Specialization													
3.1	Foundations of Counselling Psychology	M	M	M	L	H	L	L	M	H	M	M	H	M
3.2	Child and Youth Counselling	M	L	M		L		M	M	H	M	M	H	M
3.3	Disability and Rehabilitation Psychology	M	H	M	L	H	L	H	M	H	M	H	H	H
3.4	Practicum-III	H	L	H	L	M	L	M	M	H	M	H	M	H
3.5	Summer Internship	H	H	M	H	H	H	M	H	H	M	H	H	H
3.6	Study Tour	M	H	L		M	M	H	H	H	L	H	M	M
3.7	Supervised Internship I	H	H	M		M	M			H	M	H	M	
3.8	Research Project Phase I	M		M					M		H	M		L
4.1	Addiction and Trauma Counselling	H	M	M	L	M	L	M	M	H	M	H	H	H
4.2	Marriage and Family Counselling	M	L	M	M	M		M		L	L	M	H	M
4.3	Practicum-IV	H	L	H	L	M	L	M	M	H	M	H	M	H
4.4	Supervised Internship II	M		L		M			M	L			M	
4.5	Research Project Phase II	H		H		H			M		M	L		M
	Clinical Psychology Specialization													
3.1	Foundations of Clinical Psychology	M	M	M	L	H	L	L	M	H	M	M	H	M
3.2	Psycho diagnostics	M	L	M		L		M	M	H	M	M	H	M

3.3	Forensic Psychology	M	H	M	L	H	L	H	M	H	M	H	H	H
3.4	Practicum-III	H	L	H	L	M	L	M	M	H	M	H	M	H
3.5	Summer Internship	H	H	M	H	H	H	M	H	H	M	H	H	H
3.6	Study Tour	M	H	L		M	M	H	H	H	L	H	M	M
3.7	Supervised Internship I	M	H	M	M	H	L	H	M	H	M	H	H	H
3.8	Research Project Phase I	H		H		H	M		M		M	L		M
4.1	Psychotherapy	H	M	M	L	M	L	M	M	H	M	H	H	H
4.2	Neuropsychology	M	L	M	M	M		M		L	L	M	H	M
4.3	Practicum-IV	H	L	H	L	M	L	M	M	H	M	H	M	H
4.4	Supervised Internship II	M	H	M	M	H	L	H	M	H	M	H	H	H
4.5	Research Project Phase II	H		H		H	M		M		M	L		M

MSc PSYCHOLOGY –DETAILED SYLLABUS

PCSP0006: INTRODUCTION TO SOCIAL PSYCHOLOGY

(3 Credits – 45 hours)

Course Outcomes

Define the basic concepts of social psychology in different contexts. (Remembering)

Explain different concepts of social processes, social influence, group dynamics and group influence.

(Understanding)

Apply the theoretical concepts of social psychology into real life settings. (Applying)

Analyze the difference between social perception and social cognition as well as prejudice, stereotype, discrimination. (Analyzing)

Compare different types of groups and their functional systems. (Evaluating)

Discuss various social problems in light of the theoretical concepts of social psychology. (Creating)

Module I: Introduction (8 hours)

Social Psychology - Definition, Nature, Origin and Development, Social Psychology in Indian context.

Module II: Social Processes (12 hours)

Social perception or cognition, interpersonal attraction, social motives, social learning, socialisation and social roles, pro-social behaviour, aggression and violence.

Module III: Social Influences (12 hours)

Persuasion, attitude, prejudice, discrimination and stereotypes - nature and differences among them. Factors in the formation of attitudes, measuring attitudes, factors in attitude change.

Module IV: Group Dynamics and Group Influence (13 hours)

Formation of groups, structure and functions, types, group communication, group norms, conformity behaviour, co-operation and competition, social facilitation, leadership, group effectiveness, decision making, problem solving, group conflict and resolution.

Suggested Readings

Baron, R., A., Byrne, D., Social Psychology, New Delhi: Prentice Hall, 10th Edition (2006).

Mc David and Harai, Social Psychology; Individuals, groups, societies, Harper and Row (1968).

Moghaddam, F.M., Social Psychology: Exploring Universals Across Cultures, Freeman and Company (1997).

Dalal, Ajit K., A. Misra, Girishwar (Eds.), New Directions in Indian Psychology, Social Psychology, New Delhi: Sage (2001).

Eckes, Thomas and Trautner, Hanns M. (Eds.), The Developmental Social Psychology of Gender, Mahwah: Lawrence Erlbaum Associates, Publishers (2000).

Hogg, Michael A. and Cooper, Joel (Eds), The Sage Handbook of Social Psychology, Concise Student Edition, Los Angeles: Sage (2007).

Misra, Girishwar (Ed.), Applied Social Psychology in India, New Delhi: Sage (1990).

Pandey, Janak (Ed.), Psychology in India Revisited – Developments in the Discipline, Vol. 3: Applied Social and Organisational Psychology, New Delhi: Sage (2001)

Sharan, A.K. Social Psychology, New Delhi: Commonwealth Publishers (1999).

Linda steg, Abraham p. Buunk, applied social psychology: Understanding and managing social problems

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	M	M	M	
CO 3		H	H	H
CO 4			H	H
CO 5		H	H	H
CO 6	H			

PCEC0013: EASTERN APPROACHES TO PSYCHOLOGY AND COUNSELLING

(3 Credits-45 Hours)

Course Outcomes

Define the basic terms related to the different eastern approaches of psychology. (Remembering)

Classify among Indian/Chinese/Japanese approaches to psychology. (Understanding)

Make use of the appropriate Indian/Chinese/Japanese approaches to psychology in applied settings. (Applying)

Examine ancient and contemporary eastern approaches of psychology. (Analysing)

Recommend the suitable approach in applied settings. (Evaluating)

Develop a clear understanding of eastern and western approaches to Psychology. (Creating)

Module I: Introduction (7 hours)

Definitions, nature, differentiation of concepts-eastern, indigenous and Indian psychology; relationship between culture and psychology, emergence of non-western and indigenous perspectives to psychology.

Module II: Major Schools of Indian and Eastern Psychology (20 hours)

Indian approaches to Psychology-Upanishads, Sankhya, Dvaita and Advaita schools; current areas of research in Indian psychology. Chinese approaches to psychology - Taoism and Confucianism, Japanese approaches to Psychology -Morita and Naikan therapies.

Module III: Self and Consciousness (10 hours)

Viewpoints of Upanishads, Bhagavadgita, Buddhism and Jainism and other Eastern schools of thought.

Module IV: Indian and other Eastern Approaches to Health and Wellbeing (8 hours)

Yoga, Ayurveda, goals of life-concept of purusharthas, personality development-concept of Ashramas

Suggested Readings

Bankart, C. P. (1996). Talking cures: A History of Western and Eastern Psychotherapies. Pacific Grove, CA: Brooks/Cole.

Ajaya, S. (1983). Psychotherapy East and West. Honesdale (PA): Himalayan International Institute.

Berry, J. W., Poortinga, YpeH. And Pandey, J. (1997). Handbook of cross-cultural psychology, Tth Edition, Vol.1 Theory and method. Boston: Allyn and Bacon. (Chapters3,4and8byJ.G.Miller,D. Sinha, P.M. Greenfield) 5. Jones-Smith, E. (2012). Theories of counselling and psychotherapy: An integrative approach.

Thousand Oaks, CA: Sage.

Garg, Pulin K. K. and Parikh, I. J. (1995). Crossroads of culture: a study in the culture of transience, New Delhi: Sage.

Kakar.S.(1982). Shamans, mystics and doctors: A psychological enquiry into India and its healing traditions. Bombay: Oxford University Press.

Paranjpe, A. C. (1998). Self and identity in modern psychology and Indian thought. New York: Plenum.

Dunn, B. R., Hartigan, J. A., and Mikulas, W. L. (1999). Concentration and mindfulness meditations: Unique forms of consciousness? Applied Psychophysiology and Biofeedback, 24 (3), 147-165.

Kuyken, W., Byford, S., Taylor, R. S., Watkins, E., Holden, E., White, K., Barrett, B., Byng, R., Evans, A., Mullan, E., and Teasdale, J. D. (2008). Mindfulness-based cognitive therapy to prevent relapse in recurrent depression. *Journal of Consulting and Clinical Psychology*, 76(6), 966-978.

Segal, Z. (2008). Finding daylight: Mindful recovery from depression. *Psychotherapy Networker*, (Jan/Feb).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	H
CO 2		H	M	H
CO 3		H	M	H
CO 4	H	M	M	M
CO 5		H		H
CO 6	H			

PCTP0020 THEORIES OF PERSONALITY

(4 Credits- 60 hours)

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

Define personality. (Remembering)

Explain the rationale behind the theories of personality. (Understanding)

Identify the impact of environment and genetics in development of personality. (Applying)

Analyse modifications of self in perceiving environment. (Analysing)

Assess the relation between cultural and personality. (Evaluating)

Compare and contrast various perspectives of personality. (Creating)

Module I: Introduction to Personality (10 hours)

Definition and Nature of personality; Trait and Type Theories of Personality; Determinants of personality: Biological and socio- cultural- Hans Eysenk, Gray and Cloninger.

Module II: Classical approaches to Personality Development (20 hours)

Pre- Freudian (Structuralism- any two theorists; Functionalism- any two); Psychoanalytic; Post Freudian (Erikson; Eric Fromm); Neo- Freudian (Adler; Horney; Jung); Ego Psychology (Anna Freud; Hartmann; Rapaport)

Module III: Learning, Cognitive and Humanistic-Existential Approaches (20 hours)

Learning Approaches: Bandura

Cognitive Approaches: Rotter, Mischel

Humanistic-Existential Approaches: Frankl, Rollo May, Maslow, Rogers.

Module IV: Assessment of Personality (10 hrs)

Projective Tests- Ink blot test, Thematic Apperception Test, Sentence Completion Test Objective Tests; MMPI-II, 16PF, EPQ

Suggested Readings

Atkinson, R. L., Atkinson, R. C., Smith, E. E., Bem, D. J. and Hilgard, E. R. (1990).

Introduction to Psychology. New York: H. B. J. Inc.

Sternberg, R. J. (2010). Cognitive Psychology. New York: Cengage Learning

Passer, M.W. and Smith, R.E.(2010). Psychology: The Science of Mind and Behavior. New Delhi:

Tata McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	M
CO 2	H	H	H	M
CO 3		M	M	
CO 4	M	H	H	H

CO 5	M	H		M
CO 6			M	H

PCMH0021 CONCEPTS OF MENTAL HEALTH AND ILLNESS-I**(4 Credits - 60 hours)****COURSE OUTCOMES**

Define mental health and illnesses and list categories of mental illness as specified in DSM and ICD

(Remembering)

Classify and categorise mood disorders, obsessive compulsive and related disorders, anxiety disorders

(Understanding)

Apply diagnostic criteria of mood disorders, obsessive compulsive and related disorders, anxiety disorders to diagnose individuals with mental illnesses and select the appropriate psychological intervention for different childhood, adolescent and adult mental health related issues (Apply)

Analyse the distinction between normality and abnormality. Distinguish clinical features of different mental illnesses. (Analysing)

Evaluate Bio Psycho Social models and other models of mental health and illness. (Evaluate)

Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Module I: Introduction (10 hours)

Definition of mental illness and mental health. Historical review and changes in the concept of mental illness and mental health. Introduction to classification systems (DSM and ICD)

Module II: Models of Psychopathology (15 hours)

BioPsychosocial, Psychoanalytic, Behavioristic, Cognitive- Behavioral, Humanistic, Diathesis-Stress Model

Module III: Mood Disorders (Symptoms, Etiology and Treatment) (15 hours)

Unipolar Depressive Disorders in different population. Bipolar and Related Disorders in different population.

Module IV: Anxiety and Related Disorders (Symptoms, Etiology and Treatment) (10 hours)

Phobias in different population: specific phobia and social phobia. Generalised Anxiety Disorders in different population. Obsessive Compulsive and Related Disorders in different population: Obsessive Compulsive Disorder, Body Dysmorphic Disorder, Hoarding Disorder, Trichotillomania

Module V: Somatic Symptoms and Dissociative Disorders (Symptoms, Etiology and Treatment) (10 hours)

Somatic Symptom Disorder, Functional Neurological Disorder, Factitious Disorder, Dissociative Disorder: Dissociative Identity Disorder, Depersonalisation Disorder, Derealisation Disorder

Suggested Readings

Diagnostic and Statistical Manual of Mental Disorders (DSM-5), 2013 American Psychiatric Association.

Robert C.Carson, James N. Butcher, Susan Mineka, Jill M. Hooley, Abnormal Psychology, Pearson 13th edition, Sarason, Irwin G. a. Sarason Barbara R. Abnormal Psychology. The Problem of Maladaptive Behaviour.

New Delhi: PHI Learning Private Limited, 11th Edition, (2009).

Ahuja, Niraj, A Short Textbook of Psychiatry, New Delhi: Jaypee, 6th Edition, (2006).

Antony, John D., Mental disorders, Encountered in Counselling, A Textbook of clinical Psychology Based on DSM IV, Dindigul: Anugraha Publications, (2006).

Chaubé, S.P., Developmental Psychology, New Delhi: Neelkamal, (2007).

Gilbert, Paul, Psychotherapy and Counselling for Depression, Los Angeles: Sage, 3rd Edition (2007).

Humphrey, Geraldine M. A. Zimpfer David G. Counselling for Grief and bereavement. 2nd Edition. Los Angeles: Sage, (2008).

Korchin, Sheldon, J., Modern Clinical Psychology, Principles of Intervention in the Clinic and Community. New Delhi: CBS Publishers and Distributors, (1986).

Kumar Updesh and Mandal Manas K. (Eds)., Suicidal Behaviour, Assessment of People-at- Risk. Los Angeles: Sage, (2010).

Patel, Vikram. Where There is No Psychiatrist. A mental health care manual. Glasgow: Gaskell, (2003).

Patel, Vikram A. Thara. R. (Eds.). Meeting The Mental Health Needs of Developing Countries. NGO Innovations in India. New Delhi: Sage, (2003).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2			M	M	
CO 3			H		H
CO 4		H			
CO 5		H			
CO 6	H				H

PCRM0022: RESEARCH METHODOLOGY AND STATISTICS IN SOCIAL SCIENCE

(4 Credits- 60 hours)

COURSE/LEARNING OUTCOMES

Define the basic concepts of research and recognize the philosophical foundations of research. (Remembering)

Understand the steps in conducting research and the major research designs. (Understanding)

Analyse the collected data in research using different statistical measures. (Analysing)

Apply research design, tools and statistical measures to carry out research in social sciences. (Applying)

Compare natural and social sciences as well as the different approaches and research designs most commonly used in social sciences research. (Evaluating)

To create a research proposal using indicating appropriate research design method of data collection and statistical computation. (Creating)

Module I: Introduction to Research (10 hours)

Philosophical Foundations of Research. Natural and social science research-characteristics and scientific attitude. Scope of social science research-basic and applied research; Ethical concerns in Counselling research.

Module II: Research designs, approaches and types (12 hours)

Research designs: Descriptive, Exploratory, and Experimental: meaning, scope, characteristics, application in social work setting. Research Approaches: Qualitative and Quantitative Research: meanings, scope, methods, steps, sampling, data collection, analysis, interpretation and reporting. Strengths and weaknesses.

Evaluative research: Programme and projects evaluation: concept, types, steps, reports. Participatory research and action research: concepts, scope, application and steps.

Module III: Steps in Research Process (20 hours)

Problem Formulation: Identifying research issue, formulating research topic and problem, review of literature (library work), theoretical framework, formulating objectives, clarifying concepts, variables- conceptual and operational, formulating hypothesis.

Population and Sampling: Inclusion and exclusion criteria of population, the logic of sampling size and techniques: probability and non-probability sampling.

Tools for data collection: Levels, types of measurements, reliability, and validity of tools.

Constructing tools for data collection: questionnaire, interview schedule, scales. Quantification of qualitative data.

Sources, collection, and analysis of data: Secondary and primary sources. Data collection, data editing, coding, mastersheet, analysis, report writing, using computer for data analysis: coding, analysis- graphs and results. Professional report writing

Module IV: Introduction to Statistics (18 hours)

Statistics: Definitions, uses, and limitations. Classification, and tabulation of data, univariate and bivariate, diagrammatic and graphic presentations. Measures of central tendencies, Mean, Median, and Mode and their uses. Measures of variability range, variance, and standard deviation.

Correlation: Meaning and computation of coefficient of correlation as product moment, Spearman's Rank Correlations, interpretation of correlations.

Test of Hypotheses: Basics, Probability distribution, normal distribution. t-test, Chi-Square test and ANOVA.

Suggested Readings

Ahuja, R. (2001). *Research Methods*, Jaipur:Rawat.

Alston, M. Bocoles, W., (2003). *Research in Social Workers: An Introduction to the Methods* (Indian ed.), Jaipur:Rawat.

Baker, T. L. (1994). *Doing Social Research*, Singapore: McGraw Hill.

Goode, W. J. and Hatt, P. K. (1981). *Methods in Social Research*, Singapore: McGraw Hill.

Gupta, S. C. (1997). *Fundamentals of Statistics*, Delhi: Himalaya Publishing House.

Gupta, S.P. (1997). *Statistical Methods*, New Delhi: Sultan Chand and Sons.

Jacob, K.K., *Methods and Fields of Social Work in India*, Asia Publishing, Bombay, 1996

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques*, (2nd ed. reprint), New Delhi: New Age International.

Laldas, D.K. (2000). *Practice of Social Research*, Jaipur: Rawat.

Mikkelsen, B. (2005). *Methods for Development Work and Research-A New Guide for practitioners*, New Delhi: Sage.

Sarantakos, S. (2005). *Social Research*, New York: Palgrave Macmillan.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV
CO 1	H	M	M	
CO 2		H		
CO 3				H
CO 4			H	
CO 5		H		
CO 6		M	H	M

PCCP0023 COGNITIVE PSYCHOLOGY

(4 Credits-60 Hours)

Course Outcomes

Define the basic concepts of cognitive psychology, identify major theoretical foundations and recognize the historical background of cognitive psychology. (Remembering)

To understand the relationship between mind, brain and behaviour. (Understanding)

To analyse the scope and application of cognitive psychology. (Analysing)

To use measures of cognitive psychology in research and practice. (Applying)

To evaluate different cognitive methods, tools and their appropriate applicability. (Evaluation)

To develop an understanding of the scope and application of cognitive psychology. (Creating)

Module I: Introduction to Cognitive Psychology (10 Hours)

Definition, history of cognitive psychology and emergence of cognitive science, current trends.

The Brain and Cognition: Basic neuroanatomical principles, modern techniques for exploring cognition (EEG, fMRI, PET), cognitive experiments, Emotional Intelligence, Artificial Intelligence.

Module II: Memory Processes (15 Hours)

Sensory Memory, Short Term and Long-Term Memory- types, coding and retrieval; Working Memory: Nature, Theories, Educational Applications.

Semantic and Episodic Memory: Semantic vs Episodic Memory; Level of Processing and Hierarchical Network model.

Prospective Memory: Types and Common Failures of Prospective Memory in Everyday life. Forgetting: Incidental and Motivated Forgetting.

Module III: Attention & Perception (20 Hours)

Basic Concepts of Attention: Divided Attention, Selective Attention, Visual Attention and Auditory Attention. Bottleneck and Capacity theories, Automatic and Controlled Processing, Brain and Attention.

Modularity of Perception: Visual Perception (Form and Pattern), Space Perception and Cognition, Auditory Perception, Multimodal Perception, Synesthesia, Perception and Action.

Subliminal Perception; Gestalt Approach of Perceptual Organisation, Time Perception: Fourth Dimension, Pattern Recognition: Bottom Up and Top-Down Approach, Perceptual Learning, Depth Perception.

Module IV: Thinking, Problem Solving and Decision Making (15 Hours)

Types of thinking, Components of thinking: images, concepts, Creativity. Decision Making: Complex, Uncertain Decision Making; Human Problem Solving: Strategies and Heuristics.

Suggested Readings

Galotti, K.M. (2013). Cognitive Psychology In and Out of the Laboratory (5th ed.). Sage Publications Inc.

Kellogg, R.T. (2007). Fundamentals of Cognitive Psychology. Sage Publication.

Matlin, M. W. (2006). Cognition. John Wiley & Sons, Inc.

Riegler, G.L.R. (2008). Cognitive Psychology: Applying the Science of the Mind. Pearson Education.

Jahnke, J.C., & Nowaczyk, R.H. (1998). Cognitive Psychology. Prentice Hall.

Matlin, M. W. (1995). Cognition. Prism Book.

Reed, K.S. (2000). Cognition: Theory and Applications. Wadsworth.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	H
CO 2	H	H	M	M
CO 3	H		M	M
CO 4	M	H	H	
CO 5	M	M	M	
CO 6	H			M

PCGP0024: GENERAL PSYCHOLOGY

(3 credits – 45 hours)

Course/Learning Outcomes

Define psychology, name the different fields of psychology, list the different areas in which psychology is applicable. (Remembering)

Understand how the visual and auditory systems work. (Understanding)

Apply the theories of learning to modify behavior and application of different strategies for memory improvement. (Applying)

Analyse the strengths and weaknesses of the important theories of psychology. (Analysing)

Evaluate the contribution of psychology in different fields. (Evaluating)

Create a basic idea of personality and the important theories of personality. (Creating)

Module I: Introduction to Psychology (6 hours)

Introduction - Definition, nature, history, scope, purpose, and sub-fields of psychology Applications of psychology - stress and stress management, coping, well-being, resilience

Module II: Biological Basis of Behavior (10 hours)

Nervous System: Neuron and its structure, types of nervous system, Endocrine system: Hormones and their functioning Sensory systems: Structure and function of eye and ear.

Module III: Cognitive Processes (11 hours)

Learning: Classical Conditioning, Operant Conditioning, Latent, Insight, Observational learning.

Memory: Models of memory - Atkinson & Shiffrin, and Craik and Lockhart, Mnemonics, Forgetting - decay and interference Intelligence: Spearman's, Sternberg's, and Gardner's theories of intelligence

Module IV: Conative and Affective Processes (10 hours)

Emotion: Definition and theories of emotions (James-Lange, Cannon-Bard and Schachter-Singer).

Motivation: Motivational Cycle, types of motives (sociogenic and psychogenic), theories of motivation (Content theories:

Maslow, and Herzberg's 2 factor theory; Process theories: Bandura's self-efficacy theory, and Vroom's expectancy theory).

Module V: Theories of Personality (8 hours)

Trait & Type approaches, Psychoanalytic, Neo-Freudian (Jung, Adler), Existential (Frankl), and Humanistic theories (Rogers).

Suggested Readings:

Baron, R. A. & Misra, G. (2014). *Psychology (5th ed.,)*, New Delhi: Pearson Education.

Ciccarelli, S. K., White, J. N., and Misra, G. (2018). *Psychology*, New Delhi: Pearson Education.

Morgan, C. T., King, R. A., Weisz, J. R., and Schopler, J. (2017). *Introduction to Psychology (7th ed.,)*. New Delhi: Tata McGraw-Hill.

Nolen-Hoeksema, S., Fredrickson, B. L., Loftus, G. R. and Lutz, C. (2015). *Atkinson and Hilgard's Introduction to Psychology (16th ed.,)*. New York: Harcourt Brace Jovanovich.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2		H			
CO 3			H		
CO 4		H	H	H	H
CO 5	H				
CO 6					H

PCCM0025: CONCEPTS OF MENTAL HEALTH AND ILLNESS-II

(4 Credits – 60 Hours)

Course Outcomes

Define mental illnesses. (Remembering)

Classify and categorise developmental disorders, schizophrenia, personality disorders, substance related disorders, eating disorders and neurocognitive disorders. (Understanding)

Apply diagnostic criteria categorise developmental disorders, schizophrenia, personality disorders, substance related disorders, eating disorders and neurocognitive disorders to diagnose individuals with mental illnesses. (Applying)

Analyse the distinction between normality and abnormality. Distinguish clinical features of different mental illnesses. (Analysing)

Explain the causal factors of mental health and illnesses. (Evaluating)

Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Module I: Introduction (10 hours)

Causal Factors of abnormal behavior: Causes and Risk Factors for Abnormal Behavior Clinical Assessments and diagnosis and treatment

Module II: Developmental Disorders (Symptoms, etiology and treatment) (15 hours)

Intellectual Disability

Autism Spectrum Disorders ADHD

Learning Disabilities

Module III: Major Psychological Disorders (Symptoms, etiology and treatment) (15 hours)

Schizophrenia Spectrum Disorders

Personality Disorders

Module IV: Substance related and eating disorders (Symptoms, etiology and treatment) (10 hours)

Substance Related Disorders

Eating Disorders

Module V: Neurocognitive and Sexual Disorders (Symptoms, etiology and treatment) (10 hours)

Delirium

Dementia

Sexual dysfunctions

Suggested Readings:

Barlow D.H. and Durand V.M. (2005). Abnormal Psychology: An Integrated Approach (4th Ed.).Wadsworth: New York.

Bennett,P. (2006). Abnormal and Clinical Psychology: An introductory textbook. New York: Open University Press.

Carson, R.C., Butcher,J.N.,Mineka,S.& Hooley,J.M. (2008). Abnormal Psychology. New Delhi: Pearson.

Kearney, C. A. & Trull, T. J. (2012). Abnormal Psychology and Life: A dimensional approach. New Delhi : Cengage learning.

Kring,A.M.,Johnson,S.L.,Davison G.C. & Neale J.M. (2010). Abnormal Psychology (11th Ed.).NY: John Wiley

Diagnostic and Statistical Manual of Mental Disorders (DSM- IV TR), 2000 American Psychiatric Association.

Robert C.Carson, James N. Butcher, Susan Mineka, Jill M. Hooley, Abnormal Psychology, Pearson 13th edition.

Sarason, Irwin G. a. Sarason Barbara R. Abnormal Psychology. The Problem of Maladaptive Behaviour.

New Delhi: PHI Learning Private Limited, 11th Edition, (2009).

Ahuja, Niraj, A Short Textbook of Psychiatry,New Delhi: Jaypee, 6th Edition, (2006).

Antony, John D., Mental disorders, Encountered in Counselling, A Textbook of clinicalPsychology Based on DSM IV, Dindigul: Anugraha Publications, (2006).

Chauhe, S.P., Developmental Psychology, New Delhi: Neelkamal, (2007).

Gilbert, Paul, Psychotherapy and Counselling for Depression, Los Angeles: Sage, 3rd Edition (2007).

Humphrey, Geraldine M. A. Zimpfer David G. Counselling for Grief and bereavement. 2nd Edition. Los Angeles: Sage, (2008).

Korchin, Sheldon, J., Modern Clinical Psychology, Principles of Intervention in the Clinic and Community. New Delhi: CBS Publishers and Distributors, (1986).

Kumar Updesh and Mandal Manas K. (Eds)., Suicidal Behaviour, Assessment of People-at- Risk. Los Angeles: Sage, (2010).

Patel, Vikram. Where There is No Psychiatrist. A mental health care manual. Glasgow: Gaskell, (2003).

Patel, Vikram A. Thara. R. (Eds.). Meeting The Mental Health Needs of Developing Countries. NGO Innovations in India. New Delhi: Sage, (2003).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	M	M		
CO 3		H	H	H	H
CO 4			H	H	
CO 5		H	H	H	H
CO 6	H				H

PCBP0026: BIO-PSYCHOLOGY**(3 Credits- 45 hours)****COURSE OUTCOMES**

At the end of this course students will be able to:

Identifying biological bases of behavior. (Remembering)

Associating the role of the nervous system with behavior and emotions. (Understanding)

Examining the impact of bio chemicals in behavior and mental health at a conceptual level. (Applying)

Mapping the biological markers of individual difference. (Analyzing)

Reflecting on genetic and chromosomal bases of psychopathology. (Evaluating)

Develop conclusions on biological assessment of behavior. (Creating)

Module I: Introduction to Bio-psychology (7 hours)

History and scope; Major theoretical perspectives: Rene Descarte, Phinaes Gage, Charles Darwin. Nature versus Nurture controversy; Sub disciplines and allied fields; Methods in Bio Psychology.

Module II: Neurons and Genetic bases of behavior (10 hours)

Structure of neuron; Nerve impulse and Synaptic transmission; Neurotransmitters; Types of neuron.

Genetic bases of behavior: Structure of a gene, DNA and Chromosomes, Types and Functions of Genes, Genotype and Phenotype.

Module III: Nervous System (10 hours)

Central Nervous System: Brain and Spinal Cord.

Peripheral Nervous system: Division; Role of nervous system in controlling behavior.

Module III: The Endocrine System and behavior (10 hours)

Endocrine glands; Hormones; Role of endocrine system on emotions and behavior.

Module IV: Neuropsychological diseases (8 hrs)

Parkinson's disease, Huntington's disease, Alzheimer's disease, Chromosomal anomalies.

Suggested Readings:

Carlson, N. R. (2012). Foundations of physiological psychology. (Sixth Edition). Delhi: Pearson Education.

Passer, M.W. and Smith, R.E. (2010). Psychology: The Science of Mind and Behaviour. New Delhi: Tata McGraw-Hill

Breedlove, S. M., Rosenzweig, M. R., & Watson, N. V. (2007) Biological Psychology: An introduction to behavioral, cognitive, and clinical neuroscience, 5th Edition. Sinauer Associates, Inc., Sunderland, Massachusetts.

Green, S. (1995). Principles of biopsychology. UK: Lawrence Erlbaum Associates Ltd.

Pinel, J. P. J. (2011). Biopsychology, 8th Edition. Pearson Education, New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	
CO 2		H	M	
CO 3		H	H	M
CO 4	H	M	H	H
CO 5	H			H
CO 6	H		M	

PCPT0027: PSYCHOLOGICAL TESTING**(4 Credits - 60 hours)****Course Outcomes**

Define the basic concepts of psychological testing. (Remembering)

Classify the group and individual techniques of psychological testing. (Understanding)

Make use of different statistical concepts in data analysis. (Applying)

Examine the results of the statistical data analysis. (Analysing)

Recommend the suitable tool for data collection/interview in applied settings. (Evaluating)

Test the psychometric properties of a tool and develop a psychological tool using appropriate norms of tool construction. (Creating)

Module I: Introduction to Psychological Testing (9 hours)

History of Psychological Testing; Definition and Purpose and relevance of Psychological testing, Types of tests, Principles, Applications and Issues, Ethical and Social Considerations in Testing

Module II: Test Construction (15 hours)

Steps in test construction, Item Writing: types of items, General guidelines for item writing, Characteristics of a good psychological test: Objectivity, Standardization, Reliability: Meaning, Types of Reliability and Factors influencing Reliability. Validity: Meaning, Type of validity and Factors influencing validity. Norms: Norm referenced and criterion referenced tests, Types of Norms and Test Scales.

Module III: Assessment of Cognitive Abilities (13 hours)

Measurement of Intelligence: Types of Intelligence tests, Individual intelligence tests, Other broad range intelligence tests, Group intelligence tests, Psychological issues in intelligence testing Longitudinal studies, Problems in cross cultural testing

Module IV: Assessment of Personality (13 hours)

Measurement of Personality: Meaning and Purpose, Tools of Personality Assessment, Measurement of Interests, Values and Attitudes, Projective Techniques: Meaning and Types of Projective Techniques, Classification and Evaluation of Projective Techniques

Module V: Assessment of Aptitude and Achievement (10 hours)

Aptitude and Achievement: Distinction between Aptitude and Achievement Tests, Types of Aptitude tests, Types and selection of standardized Achievement Tests, Achievement test batteries.

Suggested Readings

Anastasi, A. and Urbina, S. Psychological testing. N.D.: Pearson Education (1997)..

Kaplan, R.M. and Saccuzzo, D.P. Psychological Testing: Principles, Applications, and Issues. Australia: Thomson Wadsworth (2007).

Gregory, R.J. Psychological testing: History, principles and applications. New Delhi: Pearson Education (2005).

Singh, A.K. Tests, Measurements and Research Methods in Behavioural Sciences. Patna: Bharati Aiken,

L.R., and Groth Marnat, G. (2006). Psychological Testing and Assessment. Boston, MA: Pearson (12th ed.) (2006).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H	H			
CO 2			H	M	H
CO 3		H			
CO 4		H			
CO 5		M	H	H	H
CO 6	M	H			

PCHT0028: HEALTH PSYCHOLOGY

(3 Credits 45 hours)

COURSE/LEARNING OUTCOMES

At the end of this course students will be able to:

Define the basic terms related to the field of health psychology. (Remembering)

Learn the approaches to changes in health behavior (Understanding)

Make use of psychological research methods, theories, and principles to enhance biopsychosocial approaches for health promotion and illness prevention. (Applying)

Examine the stressors and its impact on the etiology and course of many health related problems. (Analyzing)
 Estimate the management of various health related disorders. (Evaluating)
 Devise policies of health care delivery system beneficial to the public. (Creating)
 Develop awareness about the stressful impact of disabling/life-threatening illness on the patient and their family members as well as the health care providers. (Creating)

Module I: Introduction to Health Psychology (10 Hours)

Definition and emergence of health psychology. Need for health psychology. Research in health psychology: Experiments, Correlational Studies, Prospective and Retrospective Designs, Role of Epidemiology

Module II: Models of Health Behavior (8 Hours)

Health Belief Model, Cognitive Behavioral Approaches, Transtheoretical Model of Behavior Change

Module III: Health conditions and its Psychological Management (15 Hours)

Post Traumatic Stress Disorder, Cancer, COVID-19, Pain

Module IV: Health Care Services (12 Hours)

Health Care Delivery System: Developing vs. Developed nations. Patient-Provider Communication and Patient in Hospital Setting: Adults, children and children with special needs. CAM treatment (Prayer, Meditation, Guided Imagery) and Placebo Effect. Wellbeing of healthcare providers.

Suggested Readings

Taylor, S. E. Health Psychology (8th Edition). New York: McGraw Hill. (2012).

Ghosh, M. Health Psychology-Concepts in Health and Well-being. New Delhi: Dorling Kindersley (India) Pvt. Ltd. (2015).

Khatoon, N. Health Psychology. New Delhi: Dorling Kindersley (India) Pvt. Ltd. (2012).

Taylor, S. E., & Sirois, F. M. Health psychology. Toronto: McGraw-Hill Ryerson. (2012).

Baum, A., Revenson, T. A., & Singer, J. E. (Eds.). Handbook of health psychology. Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers. (2001).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		
CO 3	H			
CO 4			H	
CO 5				H
CO 6				M
CO 7				H

PCFP0029: FOUNDATIONS OF COUNSELLING PSYCHOLOGY

(4 Credits, 60 Hours)

Course Outcomes

Define the basic concepts of counselling psychology, identify major theoretical foundations and recognize the historical background of counselling psychology. (Remembering)

To understand the professional therapist-client relationship in a therapeutic setting. (Understanding)

To analyse the scope and application of counselling psychology. (Analysing)

To use the therapeutic skills of counselling psychology in practice. (Applying)

To evaluate different counselling models, therapeutic skills and their appropriate applicability. (Evaluation)

To develop an understanding of counselling skills, therapies and ethical guidelines of counselling practice. (Creating)

Module I: Introduction (10 Hours)

Meaning, Definition & Goals, Historical Background, Mental health development & the guidance movement, Difference between Counselling and other associated helping professions (psychotherapy, psychiatry, social work, guidance), Modern Trends in Counselling.

Module II: Counselling Process (10 Hours)

Settings for counselling, Steps in counselling, Therapeutic relationship: The importance of relationship, components of relationship, Facilitative conditions for the counselling relationship.

Module III: Counselling Approaches & Therapeutic Techniques (25 Hours)

Psychodynamic Approach: Psychoanalytic, Adlerian approach. Humanistic Approach: Existential, Client-Centered, Gestalt Therapy. Behavioural Approach: Operant-Conditioning, Classical-Conditioning. Cognitive Approach: Cognitive Therapy, Rational emotive therapy.

Other Approaches: Narrative Therapy, Expressive Therapy, and Biofeedback.

Module IV: Counselling Practice (15 Hours)

Ethical Issues: Professional Codes, Divided loyalties, Areas of ethical difficulty, Legal considerations. Conception of a professional Counsellor, Academic preparation, practical skills.

Special Areas in Counselling: Family group consultation – Counselling with families, children as well as parents, Adoption, Marriage & Pre-marital Counselling.

Counselling diverse population: Gender, counselling for geriatric clients, the ethnic minorities, and the physically challenged.

Suggested Readings

Ladany, N. & Inman, A. (2008) Handbook of Counseling Psychology, (4th ed.). John Wiley & Sons.

Warters, J. (1964): Techniques of Counselling, (2nd ed.), MacGraw Hill Book Company.

Steffler, B. (Ed.) (1965): Theories of Counselling, New York: MacGraw Hill Book Company.

Alam, Shah (2012). Modern Concept of Guidance & Counseling. Gyananda Prakashan.

Bordin, E. S. (1985): Psychological Counselling. Appleton Century Crofts, Inc.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		H	
CO 2		M		H
CO 3	H	H	M	M
CO 4			H	M
CO 5			H	M
CO 6			H	H

PCCY0030: CHILD AND YOUTH COUNSELLING

(4 Credits- 60 hours)

Course/Learning Outcomes

Define the basic concepts and goals of child counseling (Remembering)

Understand the specific issues faced by children and youth, especially pertaining to education, and career. (Understanding)

Apply the skills and techniques of counselling in child and youth-counselor relationship (Applying)

Compare and contrast among the major learning styles models and theories in counseling (Analyzing)

Appraise the significance of the child-counsellor relationship, and major theories in the counseling process. (Evaluating)

Build on the traditional views of learning styles models and improve counselling skills. (Creating)

Module I: Introduction (12 hours)

Definitions and goals of counseling for children and youth; Children and Youth-counsellor relationship, attributes of a counsellor, historical background and contemporary ideas about counselling

Module II: Academic Development (12 hours)

Learning-styles: VAK Model, Kolb's Experiential Model, MBTI Pattern, Honey and Mumford Model, Hemispheric Dominance Model, Gregorc Model, Gardner's Multiple Intelligence Model.

Study skills: reading, writing and note-making skills, studying skills and study habits, time management

Cognitive issues: causes and factors affecting attention, concentration, remembering, forgetting, experimental evidences and cognitive training

Module III: Major Theories in Counselling Children (14 hours)

Learning, Behavioural, Cognitive Behavioural Modification, Expressive therapy (play, art and drawing, drama, metaphor, storytelling)

Module IV: Counselling Children with specific problem (12 Hours)

Children and trauma: child abuse (physical, sexual, emotional), HIV/ AIDS, specific issues in educational settings

Techniques of assessment: Cumulative record, Anecdotal Record, Case Study, Sociometry

Module V: Career Counselling (10 hours)

Basic aspects: Nature, scope and importance of career counselling, role of counselor in career preparation, career decision making, career exploration techniques

Career development theories: Holland, Ginzberg, and Super

Career counselling with diverse population: children, adolescents, college students, women and adults.

Suggested Readings

Asch, M. (2000). *Principles of guidance and counselling* (1 ed.). New Delhi: Sarup and Sons.

Bowe Frank, G. (2000). *Birth to Five – early Childhood special education*, New York, Delmar Publishers Inc.

Butler, G., and Hope, T. (1997). *Managing your mind: The mental fitness guide*. Oxford University Press.

Cohen, L. G., and Spenciner, L. J., (2003). *Assessment of Children and Youth with Special Needs*. Boston: Allyn and Bacon.

Mangal S. K. (2008). *Essentials of Educational Psychology*, New Delhi, Prentice Hall of India Pvt Ltd.

Santrock, J.W. (2003). *Educational Psychology*. Boston: McGraw-Hill.

Woolfolk, A. (2007). *Educational psychology (10th ed.)*. Boston, MA: Allyn and Bacon.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H				
CO 2	M			H	
CO 3					H
CO 4		H			
CO 5			H		
CO 6	M	H	M		M

PCDR0031: DISABILITY STUDIES AND REHABILITATION PSYCHOLOGY

(4 Credits - 60 hours)

COURSE OUTCOMES

Define the concept of rehabilitation and list the methods of assessment and interventions for various disabilities (Remembering)

Illustrate the scope of rehabilitation psychology (Understanding)

Plan assessments and interventions for various learning, intellectual and physical disabilities and apply the models of rehabilitation in practice (Applying)

Analyse the general functions of rehabilitation psychology (Analysing)

Compare and conclude on the prevention and early intervention for various disability (Evaluating)

Modify the flaws in the successful implementation of various acts related to disability (Creating)

Module I: Introduction (15 hours)

Definition and models of disability. Definition and functions of rehabilitation (general and specific functions). Historical background of Rehabilitation Psychology. Behavioral problems and adaptive behavior

Module II: Cognitive and Academic disability (18 hours)

Intellectual Disability: review of terminology, diagnostic criteria, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Learning disabilities: diagnostic criteria, types, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Autism Spectrum Disorder: diagnostic criteria, types, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Psychotic disorders: diagnostic criteria, types, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Module III: Physical Disability (15 hours)

Hearing impairment: types, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Visual impairment: types, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Orthopaedic impairment: types, causes, prevalence, prevention, assessments, intervention and rehabilitation.

Module IV: Legal issues (12 hours)

The Mental Health Act, 2017: historical background and challenges. RPWD Act, 2016: historical background and challenges. RCI Act, 1992 : historical background and challenges. National Trust Act, 1999: historical background and challenges. Issues of certification

Suggested Readings

Tom Meehan Chris Lloyd, Robert King,, Handbook of Psychological Rehabilitation, Blackwell Publisher (2007)

Sonnenmeier. R, Mirenda. P, Autism spectrum Disorder and AAC (2008)

The professional Practice of rehabilitation counselling, Springer Publication company, 2011

Jeanne. B. Patterson, Foundations Of Rehabilitation Counselling with Person who are blind or visually impaired, American foundation for the blind, U.S (1997)

James K. Luiselli, Dennis C. Russo, Walter P. Christian, Effective Practice for children with Autism: Educational and Behavioural support Intervention that work (2008)

Kim Etherington, rehabilitation counselling in physical and mental health, Jessica Kingsley publication

David. R. Cox, Speciality Competencies in Rehabilitation Psychology (2002)

T. F. Rigger, Handbook of Rehabilitation Psychology.

Jules M. Rothstein, Serge H. Roy, Steven L. Wolf, The rehabilitation specialist 's Handbook (2005).

Chaturvedi, T.N. Administration for the Disabled: Policy and Organisational Issues. New Delhi : I.I.P.A (1981).

Mani, R.D. The Physically Handicapped in India Policy and Programme New Delhi: Ashish Publishing (1988).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	H	
CO 3	M			
CO 4			M	
CO 5				
CO 6				H

PCAT0032 ADDICTION AND TRAUMA COUNSELLING

(3 Credits- 45hours)

COURSE OUTCOMES

Define substance related disorders according to the classification of DSM 5/ICD-10. (Remembering)

Compare and contrast different psychological interventions for addiction related psychological disorders.

(Understanding)

Categorize the sources of trauma and trauma intervention. (Analysing)

Apply psychological interventions and techniques on trauma victims. (Applying)

To evaluate the effectiveness of Psychodynamic approach, CBT, MET, Group intervention in dealing with substance addiction. (Evaluating)

Create need based and behavioral management plan for patients with addiction and trauma survivors. (Creating)

Module I: Addiction Counselling (8 hours)

Definition, DSM-V diagnostic category – classification of drugs of abuse, stages of addiction

Module II: Treatment Methodology (15 hours)

Psychodynamic approaches, cognitive-behavioural therapies, motivational enhancement therapy. Problem-oriented treatment, solution-focused treatment, group therapy, family therapy and community based interventions.

Module III: Psychological Trauma (12 hours)

Introduction to Trauma: Definition, types of trauma, historical context of trauma, theoretical contexts of trauma counselling. Ethical perspective on trauma work, trauma and supervision.

Module IV: Trauma Intervention (10 hours)

Assessment in psychological trauma: Methods and intervention, models for trauma intervention, strategies and techniques for counselling survivor of trauma.

Suggested Readings

Rasmussen, S. (2000). *Addiction treatment: Theory and Practice*. London: Sage. 2) DSM-V (2013)

Wright, H. N. (2003). *The new guide to crisis and trauma counseling*. Gospel Light Publications.

Levers, L. L. (2012). *Trauma counseling: Theories and interventions*. Springer Publishing Company.

Trauma counselling - Theories and Interventions, LopezLevers, Lisa

Spiers, T. (Ed.). (2018). *Trauma: a practitioner's guide to counselling*. Routledge.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	M	H
CO 3			H	H
CO 4			M	H
CO 5		H		
CO 6		H		H

PCMF0033: MARRIAGE AND FAMILY COUNSELLING

(4 Credits – 60 hours)

Course Outcomes

Define the basic concepts of marriage and counselling. (Remembering)

Classify different developmental and emotional issues in different family life stages. (Understanding)

Identify the classical schools of marriage and family counselling. (Applying)

Analyse the Bowen's intergenerational approach. (Analysing)

Explain different therapeutic approaches of marriage and family counselling. (Evaluating)

Discuss the processes of counselling couples with special issues/problems. (Creating)

Module I: Introduction (10 lectures)

Historical evolution of Family and Marriage therapy; Goals of Family therapy; current trends in Family therapy; Fundamental concepts in Family therapy (Cybernetics and Systems theory, Social Constructivism) Stages of marriage, Divorce and remarriage, Marriage and Divorce: Role of Family Courts.

Module II: Family Across a Lifespan (16 lectures)

The family life cycle, stages of family life cycle. Key developmental and emotional issues in different stages: Young adulthood. Newly married, Child bearing, Families with preschool children, Families with school age children. Families with teenage children, Launching stage, Middle aged adult, Retirement

Module III: Classical Schools (12 lectures)

Bowen's Intergenerational Approach; Structural Family Therapy; Strategic Family Therapy; Experiential and Humanistic Family Therapies; Psychoanalytic and Cognitive Behavioural Family therapy.

Module IV: Recent Developments (12 lectures)

Postmodernism, Feminist and contextual work, Solution focused therapy, Narrative therapy, Integrative models. Application and evaluation of Family therapy. Skill development: Genograms. The stages of Family therapy: Planning; Assessment; Disengaging or recontracting.

Module V: Counselling Couples with Special Issues (10 lectures)

Treating sexual abuse and physical abuse issues in family; Counselling of alcoholics and drug-addicts; Counselling the terminally ill and patients with HIV/AIDS.

Data Communications and Networking, 4th Edition, Behrouz A Forouzan, 2007, TMH

Suggested Readings

Family Therapy – concepts and methods, 7th edition, Nichols, P.M and Schwartz C.R. Allyn and Bacon, Boston, 2006, Pearson education, Inc. Press, Inc.

Family Therapy: History, Theory, and Practice, 4th Edition, Gladding, S.T., 2006, Pearson/Merrill Prentice Hall.

Essential Skills in Family Counselling, JoEllen Paterson, et al. 2009, New York, New York, Guilford Press.

Mastering Competencies in Family Therapy: A Practical Approach to Theory and Clinical Case Documentation, 3rd Edition, Gehart, D.R., 2018, Cengage Unlimited.

Transformational Systemic Therapy, 4th Edition, Satir, V. Satir, 2008, Science and Behaviour Books.

Patterns of Brief Family Therapy: An Ecosystemic Approach, 5th Edition, Steve de Shazer., 1982, Guilford Publications.

Transformational Systemic Therapy, Satir, V. Satir, 2008, Science and Behaviour Books.

The Family Crucible: The Intense Experience of Family Therapy, Napier, A.Y and Whitaker, C., 1988,

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	M				
CO 2		H			
CO 3			M	H	
CO 4					
CO 5	M				H
CO 6		H			

PCFC0034 FOUNDATION OF CLINICAL PSYCHOLOGY

(4 Credits-60 hrs.)

Course Outcomes

Definition of clinical psychology, acquire knowledge and understanding the philosophical roots and historical events that have shaped the field of clinical psychology (Remembering)

Explore the underlying philosophical assumptions, individual contributors, and various forces that served to shape the emerging field of clinical psychology (Understanding)

Demonstrate familiarity with scientific, ethical, legal, and practice-oriented issues in the field (Applying)

Acquire a basic understanding of western (and, to an extent, Indian) philosophical thought, to articulate a philosophy of their own, and apply that philosophy to their professional work in field of clinical Psychology (Applying)

Think critically about the science of psychology, analyse psychological theory, research, and practice in a historical context, and develop ideas, critiques, and conclusions of their own (Analysis)

Adapt and develop a basic understanding about assessment and interventions in the context of clinical psychology (Creating)

Module-I- (12 hours) Basic Introduction to Clinical Psychology

Definition, Historical background: Early & Recent history; Nature and scope of the discipline: Theory and research; Developing a professional identity: Education & training, professional activities, ethical issues and employment settings.

Module – II (12 hours) Major theoretical models in clinical psychology

The role of theory; and theoretical models; Psychodynamic; Cognitive-Behavioural; Humanistic; Family systems.

Module- III (18 hours) Diagnostic Techniques

Nature and purpose of clinical interview, mental status examination; Observing behaviour, clinical judgement; communication strategies, diagnosis and assessment, Behavioural assessment, Psychological Assessment: Cognitive and Personality Assessment and case study

Module- IV (18 hours) Competencies in Clinical Psychology

The core competencies: Assessments, Evaluation, Formulation, Intervention, Communication/consultation, and service delivery,

Therapeutic Models (Behavioural approaches, cognitive therapy and cognitive-behaviour therapy, Psychodynamic therapy, Systemic and group approaches, Eclectic and integrative approaches)

Suggested Readings

Hecker, J. E., & Thorpe, G. L. (2011). Introduction to Clinical psychology: Science, practice, and ethics, 4th ed. India: Dorling Kindsley.

Korchin, J. S.(). Modern clinical psychology: Principles of intervention in the clinic and community. CBS Publishing

Pomerants, A. M. (2008). Clinical Psychology: Science, practice and culture. New Delhi: Sage publication

Gregory, R. J. (2000). Psychological testing: History, principles, and applications (3rd Ed.). Boston: Allyn & Bacon.

Wolman, B.B. (1965). Handbook of clinical psychology. N.Y: McGraw Hill INC

Groth-Marnat, G. (1999). Handbook of psychological assessment, 3rd ed. New York: John Wiley & Sons, Inc.

Course outcomes (COs) Mapping

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2	M	H	M	M
CO 3	M		H	
CO 4	M	H	H	
CO 5		H	M	H
CO 6	M	H	H	H

PCPG0035: PSYCHODIAGNOSTICS

(4 Credits: 60 hours)

COURSE OUTCOMES

Define the concept of assessment (Remembering)

Gather the significance and scope of psychological assessment in diagnosis and intervention (Understanding)

Apply various approaches of assessment in practice (Applying)

Estimate the appropriate assessments for different population as per the diagnoses. (Analysing)

Assess the socio-cultural factors in various assessments aiding in the diagnoses. (Evaluating)

Design psychopathology formulation which will impede the process of effective therapeutic sessions. (Creating)

Module I: Introduction to psychological assessment (15 hours)

Traditional approaches to assessment. Stages in psychological assessment. DSM 5 and ICD-10: Similarities and differences. Screening and Diagnostic tools

Module II: Clinical Interviewing (15 hours)

Types of Clinical Interview. Rapport formation and communication strategies. Diagnostic Interviewing. Interviewing with children and cultural issues

Module III: Intellectual and Neuropsychological assessment (15 hours)

Theories of intelligence, issues and controversies. Tests batteries: WAIS, WISC, MISIC, BKT. Approaches to neuropsychological assessment. Test batteries: Halstead-Reitan, Luria-Nebraska, PGI-BBD, AIIMS Comprehensive Neuropsychological Battery

Module IV: Behavioral and Personality Assessment (15 hours)

Development of Behavioral Assessment. Functional Analysis and other methods of behavioral assessments (Questionnaires, Self-monitoring, Analogue techniques etc.). Objective methods of personality assessments: MMPI-2, MCMI-III, EPQ-R. Projective methods of personality assessments: Rorschach, TAT, Projective drawings

Suggested Readings

Hecker, J.E., & Thorpe, G.L. (2005). Introduction to clinical psychology: Science, practice, and ethics (Low Price Edition). Delhi: Pearson Education.

Pomerantz, A.M. (2008). Clinical Psychology: Science, practice, and culture. Sage Publications: New Delhi

Trull, T.J., & Phares, E.J. (2001). Clinical psychology: Concepts, methods, and profession (6th ed.). Belmont, CA: Wadsworth/Thomson

Arun Kumar, (ed.), Clinical Psychology, Anmol Publication Pvt. Ltd., 2000.

Freedman, A.M., Kaplan, H.I. and Sadock, B.J., Comprehensive Text Book of Psychiatry (IIIrd Edition) Vol. 1.2. William and Wilkins, Baltimore, London, 1989.

Anastasi, A., & Urbina, S. (2005). Psychological Testing. 7th ed. Pearson Education: New Delhi, India.

Barlow, D.H. & Durand, V.M. (2005). Abnormal psychology: An Integrative Approach (4th ed.). Wadsworth/Thomson. Belmont CA.

Butcher J.N; Mineka Susan; and Hooley Jill M. (2014) Abnormal Psychology (15th Ed.) Dorling Kindersley Pvt. Ltd. of Pearson Education. New Delhi, India.

Sundberg, N.D., Winebarger, A.A. & Taplin, J.R. (2002). Clinical psychology: Evolving theory, practice and research. Prentice-Hall. New Jersey.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2			H	
CO 3			H	
CO 4		H		H
CO 5		H		
CO 6		H		H

PCR0036 FORENSIC PSYCHOLOGY

(3 credits – 45 hours)

Course Outcomes

Define forensic psychology and the role of a Forensic Psychologist. (Remembering)

Illustrate on the nature of crime. (Understanding)

Examine the social, psychological theories of crime. (Analysing)

Apply the methods of forensic psychological investigation. (Applying)

Explain the concept of Juvenile delinquency, sexual offenders and serial offenders. (Evaluating)

Create an idea about the importance of Forensic psychological assessment into practice. (Creating)

Module I: Introduction (11 hours)

Meaning, nature and definition of Forensic Psychology, Historical background, training of a Forensic psychologist, Ethical concerns in Forensic Psychology.

Module II: Theories of crime (12 hours)

Need for scientific understanding of crime, psychoanalytical conceptualization of crime, Eysenck's biosocial theory of crime social learning theory of crime, frustrated induced criminality, Neuropsychological theories of crime

Module III: Juvenile offenders and Sexual offenders (10 hours)

Nature and definition of Juvenile offenders, sexual offenders and serial offenders, Social risk factors, Psychological risk factors, family background, Intelligence and delinquency

Module IV: Forensic Psychological Investigation methods (12 hours)

Methods in Forensic Investigation-Polygraph, Brain electrical Oscillations Signature, Narcoanalysis, Applicability of Rorschach Inkblot Test, MMPI-II, Draw-a-Person Test in forensic settings.

Suggested readings

Nagel.Y.K.,Srivastava K.,Gupta A (2014) Handbook of Forensic Psychology. Author house UK Ltd 1663 Liberty Drive. Bloomington, IN 47403. USA

Horton N.A., Heritage.C.L.(2010). Handbook of forensic Neuropsychology. Springer Publishing company. New York

Mapping of COs to Syllabus

Course Outcomes	Module-1	Module-2	Module-3	Module-4
CO1	H			
CO2	H	H		
CO3	H		H	
CO4			H	
CO5	M			H
CO6				H

PCPC0037: PSYCHOTHERAPY

(4 Credits – 60 hours)

Course Outcomes

Define psychotherapy. (Remembering)

Classify and categorise major disorders with respect to psychotherapy. (Understanding)

Apply psychotherapeutic concepts and constructs to diagnose and intervene individuals with mental illnesses. (Applying)

Analyse the distinction among different types of psychotherapy. (Analysing)

Evaluate the applicability different types to psychotherapy to mental health and illnesses. (Evaluating)

Create a psychotherapeutic intervention plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Module I: Introduction (8 hours)

Historical background of psychotherapy; Principles and goals of psychotherapy; Professional training and ethics in clinical practice

Module II: Psychodynamic Psychotherapy (10 hours)

Psychoanalysis: Background and basic principles Psychoanalytic theory since Freud

Psychodynamic psychotherapy in contemporary clinical psychology

Module III: Humanistic, Experiential and Family Therapies (12 hours)

Humanistic psychotherapy

Eclectic treatment combinations Family therapy

Group therapy

Module IV: Cognitive Behavioural Interventions (15 hours)

Behaviour therapy techniques

Cognitive modification procedures

Cognitive behaviour therapy: specific applications in various psychological disorders Dialectic Behaviour

therapy

Module V: Relaxation Therapies (15 hours)

Progressive muscular relaxation

Autogenic training

Biofeedback

Eye Movement desensitization and reprocessing

Suggested Readings:

Encyclopaedia of Psychotherapy (2002). Academic Press

Beck, J.S (1995). Cognitive therapy: Basic and beyond. New York: Guilford Press.

Ellis, A. (1970). The essence of rational psychotherapy: A comprehensive approach to treatment. New York: Institute for Rational Living.

Walen, S.R., Diguseppe, R., & Dryden, W. (1992). A practitioner's guide to rational emotive therapy. Oxford University Press. Inc.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				
CO 2	M	M	M		
CO 3		H	H	H	H
CO 4			H	H	
CO 5		H	H	H	H
CO 6	H				H

PCNP0038: NEUROPSYCHOLOGY

(3 Credit-45 hours)

Course outcomes (COs)

Define the basic concepts of Neuropsychology and naming different biological systems involved in Neurological disorders. (Remembering)

Explain the neuropsychological basis of human behaviour. (Understanding)

Identify the difference and relation among brain structures, neurological and endocrine systems. (Applying)

Classify the sub-systems of the central nervous system of the brain. (Analysing)

Compare different neuropsychological systems causing Neuro-pathology. (Evaluating)

Discuss the major theoretical perspective, develop the awareness of the neuropsychological basis of behaviour and can able to formulate rehabilitation. (Creating)

Module-I: Foundation of neuropsychology (15 hours)

Brief history of Neuropsychology, Role of neuropsychology in clinical practice, Early Hypothesis, Localization theory, integrated theory of brain functions,

Major structures and functions of human Brain: Cerebral cortex, Frontal, temporal, parietal and occipital lobes functions and syndromes, Neuro-transmitters.

Module-II: Brain Damage and Neuroplasticity (12 hours)

Causes of Brain damage, Neuropsychological diseases (Stroke, Tumours, Epilepsy, Dementia, Traumatic Brain injury), Animal models of human neuropsychological diseases, Neuro-plastic responses to nervous system damage: Degeneration, Regeneration, Reorganization, and recovery, Neuroplasticity.

Module-III: Neuropsychological Assessments and Diagnosis (12 hours)

General Considerations in Neuropsychological testing, Rationale of the neuropsychological examination, appropriate referrals for neuropsychological evaluation, Psychometric issues in neuropsychological assessment:

Preliminary screening of neuropsychological functioning: Orientation (Arousal), Sensation and Perception, Attention/Concentration, Motor Skills, Verbal Functions/Language,

Visuo-spatial Organization, Memory, Judgment/Problem Solving.

Module-IV: Neuro-Psychological Rehabilitation (6 hours)

Basic concepts and models of Neuropsychological rehabilitation (Cognitive, Behavioural, Emotional and Psychosocial), Challenges ethics and guidelines of Neuro-psychological rehabilitation.

Suggested Readings:

Boller, F. & Grafman, J. (1988) Handbook of neuropsychology. New York: Elsevier.

Heilman, K.M. & Valenstein, E. (1993). Clinical Neuropsychology. New York: Oxford University Press.

Kolb, B., & Whisaw, I.Q. (1990). Fundamentals of human Neuropsychology. New York: Freeman, W.H

Pinel, J.P. (2006). Biopsychology. Pearson Education, Inc.

Walsh, K. W. (1978). Neuropsychology: A clinical approach. Churchill Livingstone.

Rosenzweig, M. R., Breedlove, S. M., & Leiman, A. L. (2002). Biological psychology: An introduction to behavioral, cognitive, and clinical neuroscience. Sinauer Associates.

Lezak, M. D., Howieson, D. B., Loring, D. W., & Fischer, J. S. (2004). Neuropsychological assessment. Oxford University Press, USA.

Hersen, M. (2004). Comprehensive Handbook of Psychological Assessment: Intellectual and neuro psychological assessment (Vol. 1); Personality assessment (Vol. 2); Behavioral assessment (Vol. 3). NY: Wiley

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	M
CO 2	M	H	H	M
CO 3	H	M	H	H
CO 4	M	H	H	M
CO 5	M	H	M	H
CO 6	H	H		H

PCPG6018 PERSONAL GROWTH I (P/NP)

(2 Credits - Workshop and assignment mode)

Course Outcomes

Understand the basic principles of psychology (Remembering)

Understand personality traits, values, skills and interests. (Understanding)

Gain self-awareness and emotional awareness (Applying)

Set specific, achievable short- and long-term goals (Analysing)

Module I: Introduction (15 lectures)

Self esteem, Self awareness, Emotional well being, Self-Motivation

Module II: Introduction (15 lectures)

Critical thinking, Personality development, Communication styles

Suggested Readings

Psychology of Success: Finding Meaning in Work and Life, 5th Edition, Denis Waitley, 2010, McGraw-Hill

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H	M	
CO 3	M	H	H	H
CO 4			H	

PCFA6019: PSYCHOLOGICAL FIRST AID (P/NP)**(2 Credits - Workshop and assignment mode)****Course Outcomes**

Remember the basic concepts of psychological first aid. (Remembering)

Understand the steps of psychological first aid. (Understanding)

Gain self-awareness and awareness about emergency care. (Applying)

Plan specific, achievable remedial measures (Analysing)

Module I: Introduction (15 lectures)

Definition, Phases, emergency psychological care, mental hygiene.

Module II: Introduction (15 lectures)

Critical thinking, planning emergency psychological intervention.

Suggested ReadingsPsychology of Success: Finding Meaning in Work and Life, 5th Edition, Denis Waitley, 2010, McGraw-Hill.**Mapping of COs to Syllabus**

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M			
CO 2		H	M	
CO 3	M	H	H	H
CO 4			H	

PCRP6020 RESEARCH PROJECT PHASE I (4 Credits)**Course outcomes**

Knowledge of the major theoretical approaches and findings in psychology. (Remembering)

Demonstrate knowledge about the research methods used in psychology,. (Understanding)

Apply the knowledge for preparing research design, and data analysis. (Applying)

Critically analyse information related to the study of behaviour and mental processes, and use the critical assessment in forming conclusions and arguments. (Analysing)

Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria. (Evaluating)

Develop the understanding of how to prepare a research proposal. (Creating)

Every student shall undertake a research project work under the supervision and guidance of a faculty member.

The student may choose the topic of research and start the preliminary work by the end of the second semester.

The students are expected to complete the Literature Review followed by a Literature Review presentation and the Proposal presentation during the Phase I. Students are expected to complete the data collection before the fourth semester.

In Phase II, students are expected to complete the data collection, data analysis and interpretation, and submission of final report. Submission of final copy of the dissertation will be followed by presentation of the research and viva voce examination.

The thesis is to be submitted to the department before the date notified. The mode and components of evaluation of Phase I and Phase II of the research project and the weightages attached to them shall be published by the Department at the beginning of the semester. There shall be a viva voce examination on the research project.

Mapping of COs to Syllabus

Course Outcomes	RESEARCH PROJECT PHASE I
CO 1	H
CO 2	M
CO 3	H
CO 4	H

CO 5	M
CO 6	H

PCSI6021 SUPERVISED INTERNSHIP I**(4 Credits)****Course outcomes**

Remembering the personal integrity, accountability, professional deportment and concern for the welfare of others. (Remembering)

Understanding of Psychological disorders, empathy, reflective practice, and self-care. (Understanding)

Applying scientific, theoretical, contextual approach to the discipline (Applying)

Analyse the symptom severity and clinical features of disorders. (Analysing)

Determine ethical and Legal guidelines of practice (Evaluating)

Develop effective work skills, including cognitive and expressive skills, self-directed learning & continuing education. (Creating)

Module I: Introduction

Analysing the situation: Need of counselling, space for counselling, information to clients, documentation, organizing supervision.

Module II: Internship

Taking in clients: first interview, documentation of the case, definition of counselling goals, building the counselling relationship, process of counselling, using skills of counselling, concluding counselling, documentation of the whole counselling process, evaluation; working in a team–role of counselling, resources and challenges, role in the team, case management: discussion, supervision. Evaluation of the internship will be based on the documentation, reports from the organisation, report of the supervisor and the presentation and the viva voce examination of the student at the end of the period of Internship.

Module III: Phases of Supervised Internship

The Supervised Internship is divided into two phases; Phase I and Phase II. Each of these phases consists of 45days (100 hours) of intensive practical learning programs in counselling setting under trained supervisors. The phases of the internship spread across the 3rd and 4th semester of Masters Degree program. The total credit for the supervised internship is divided equally across the final year semesters of the Master's Degree program.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	H
CO 2	H	H	
CO 3	M	H	H
CO 4		H	H
CO 5	H	M	M
CO 6	M	H	H

PCIP6022 SUMMER INTERNSHIP (Pass/Non-Pass)

Students are required to undergo a summer internship of two weeks' during the semester break between the second and third semesters. It is a P/NP course and shall be recorded in the third semester. The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in class room courses to the "real world" of social service agencies, medical institutions, the criminal justice system, business, and industry. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills. The summer internship enriches the students' academic experience while making a valuable contribution to the community and utilizing the vacation optimally.

Course Outcomes

Define the clinical features of psychological disorders. (Remembering)

Demonstrate fundamental knowledge and comprehension of the major concepts, theoretical perspectives, historical trends, and empirical findings in psychology. (Understanding)

Develop Scientific reasoning and critical thinking, including effective research methodology in solving problems related to behavior and mental processes. (Applying)

Analyse ethically and socially responsible behaviors for professional and personal settings, including development of values that build diverse communities. (Analysing)

Determine their basic area of interest to work further/specialize in clinical setting. (Evaluating)

Develop the competence in writing case studies, and interpersonal communication skills. (Creating)

Students are required to undergo a summer internship of two weeks' during the semester break between the second and third semesters. It is a P/NP course and shall be recorded in the third semester. The Summer Internship gives students an opportunity to apply the theories and principles that they have learnt in class room courses to the "real world" of social service agencies, medical institutions, the criminal justice system, business, and industry. During the internship, students can explore career interests, develop professional skills, learn how community organizations work and expand their clinical and interpersonal skills. The summer internship enriches the students' academic experience while making a valuable contribution to the community and utilizing the vacation optimally.

Mapping of COs to Syllabus

Course Outcomes	SUMMER INTERNSHIP (P/NP)
CO 1	H
CO 2	H
CO 3	M
CO 4	H
CO 5	H
CO 6	M

PCST6023 STUDY TOUR (Pass/Non-Pass)

COURSE OUTCOMES

Define mental illnesses and rehabilitation. (Remembering)

To understand counselling in real life setting. (Understanding)

To apply theoretical principles in order to understand the functioning of various mental health settings (Applying)

Distinguish clinical features of different mental illnesses. (Analysing)

Explain the importance of different models of mental health and illnesses in assessment. (Evaluating)

Develop practical knowledge about different psychological practice and rehabilitation setting. (Creating)

Module I: Introduction

During the programme the students shall undertake a study tour, along with the faculty members, to a place approved by the department. The places are to be so chosen as to be of educational benefit to students. During the tour, the focus shall be to visit and interact with NGOs, hospitals, state/national/ international organisations involved in psychological counselling.

Module II: Documentation and Evaluation

A report of the learning outcomes shall be submitted to the department at the end of the tour. The Study Tour shall be a Pass/No Pass course.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2
CO1	H	H
CO 2	H	
CO 3		H
CO 4	H	
CO 5	H	M

CO 6	H	

PCSI6024: SUPERVISED INTERNSHIP II**(8 Credits)****Course Outcomes**

Remembering and identifying intervention. (Remembering)

Understanding dynamics of history taking and therapeutic approach to psychological counselling.

(Understanding)

Apply the, theories skills and ethics in counselling. (Applying)

Analyse the trial and error essence of a counselling relationship and client needs. (Analysing)

Evaluate ethico-legal situations. (Evaluating)

Creating facilitative environment for clients in practice. (Creating)

Module I: Introduction

Analysing the situation: Need of counselling, space for counselling, information to clients, documentation, organizing supervision.

Module II: Internship

Taking in clients: first interview, documentation of the case, definition of counselling goals, building the counselling relationship, process of counselling, using skills of counselling, concluding counselling, documentation of the whole counselling process, evaluation; working in a team–role of counselling, resources and challenges, role in the team, case management: discussion, supervision. Evaluation of the internship will be based on the documentation, reports from the organisation, report of the supervisor and the presentation and the viva voce examination of the student at the end of the period of Internship.

Module III: Phases of Supervised Internship

The Supervised Internship is divided into two phases; Phase I and Phase II. Each of these phases consists of 45days (100 hours) of intensive practical learning programs in counselling setting under trained supervisors. The phases of the internship spread across the 3rd and 4th semester of Masters Degree program. The total credit for the supervised internship is divided equally across the final year semesters of the Master's Degree program.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2	M	M	M
CO 3	H	H	M
CO 4	M		H
CO 5	H		H
CO6	M	H	

PCRP6025: RESEARCH PROJECT PHASE II (6 Credits)**Course outcomes**

Knowledge of the major theoretical approaches and findings in psychology. (Remembering)

Demonstrate knowledge about the research methods used in psychology. (Understanding)

Apply the knowledge for preparing research design, and data analysis. (Applying)

Critically analyse information related to the study of behaviour and mental processes, and use the critical assessment in forming conclusions and arguments. (Analysing)

Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria. (Evaluating)

Develop the understanding of how to prepare a research proposal. (Creating)

Every student shall undertake a research project work under the supervision and guidance of a faculty member. The student may choose the topic of research and start the preliminary work by the end of the second semester. The students are expected to complete the Literature Review followed by a Literature Review presentation and

the Proposal presentation during the Phase I. Students are expected to complete the data collection before the fourth semester.

In Phase II, students are expected to complete the data collection, data analysis and interpretation, and submission of final report. Submission of final copy of the dissertation will be followed by presentation of the research and viva voce examination.

The thesis is to be submitted to the department before the date notified. The mode and components of evaluation of Phase I and Phase II of the research project and the weightages attached to them shall be published by the Department at the beginning of the semester. There shall be a viva voce examination on the research project.

Mapping of COs to Syllabus

Course Outcomes	RESEARCH PROJECT PHASE I
CO 1	H
CO 2	M
CO 3	H
CO 4	H
CO 5	M
CO 6	H

PCPP6026: PSYCHOLOGICAL ASSESSMENT-I (PRACTICUM-I)

(2 credits – 60 hours)

Course/Learning Outcomes

Define the important concepts of psychology research, and assessment techniques. (Remembering)

Understand the importance and steps associated with planning and conducting an experiment. (Understanding)

Apply the basic concepts of research and assessment techniques in measuring important psychological constructs associated with positive psychology. (Applying)

Categorize different types of intelligence assessment techniques. (Analyzing)

Evaluate the importance of different types of assessment techniques and measurement tools. (Evaluating)

Design and conduct an experiment. (Creating)

Module I: Introduction to Practicum (9 hours)

Primary modes of psychological enquiry: Experimental method, Observation, Survey, and Interview Psychometric Properties:

reliability, validity, standardization, sources of error

Module II: Experiment (14 hours)

Memory drum or Maze learning (offline)/serial positioning effect or cluster learning (virtual): Basic concepts, purpose, development, administration, scoring, interpretation

Module III: Positive Psychology - I (12 hours)

General well-being scale or psychological well-being: Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module IV: Positive Psychology - II (12 hours)

Brief-cope or Coping appraisal or behavior questionnaire: Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module V: Intelligence tests (13 hours)

Binet-Kamat Test of Intelligence (offline)/Draw-a-person (online): Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Suggested Readings

Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.

Baumgardner, S. R., and Crothers, M. K. (2010). *Positive psychology*. Upper Saddle River, N.J.: Prentice Hall.

Kaplan, R. M. & Saccuzzo, D. P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.

Kothari, C. R. (2004). *Research Methodology: Methods and Techniques* (2nd ed.) New Delhi: New Age International.

Morgan, C. T., King, R. A., Weisz, J. R., & Schopler, J. (2017). *Introduction to Psychology* (7th ed.). New Delhi: Tata McGraw-Hill.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III	Module IV	Module V
CO 1	H	M	M	M	M
CO 2		H			
CO 3			H	H	
CO 4					H
CO 5	H	M	M	M	M
CO 6		H			

PCPP6027: PSYCHOLOGICAL ASSESSMENT-II (PRACTICUM-II)

Define the basic terms related to aptitude, personality, projective techniques, positive emotions, posttraumatic growth and clinical rating scales.

Classify the various types of psychological tests on the basis of their use. (Understanding)

Make interpretations and draw conclusions based on the norms given in the manual. (Applying)

Examine the details of the rating scale/ test, the aim, applications, procedure of administration and results. (Analysing)

Estimate the purpose and importance of each of these tests. (Evaluating)

Test the administrator's decision-making process to select a particular test for assessment of a given psychological condition. (Creating)

Module II: Assessment of Personality: Projective Tests (20 Hours) (Offline/Online Classes):

House Tree Person Test (HTP)/ Picture Completion Test (PCT)/Human Figure Test: Basic concepts, psychometric properties of the test, administration, scoring, results and interpretation.

Module III: Assessment of Positive Emotion (10 Hours) (Offline/Online Classes):

Positive and Negative Affect Schedule (PANAS)/Multidimensional Emotional Questionnaire (MEQ): Basic concepts (Definition, Protective Factors of Mental Health & Resilience), psychometric properties of the test, administration, scoring, results and interpretation.

Module IV: Assessment of Posttraumatic Growth (10 Hours) (Offline/Online Classes):

Posttraumatic Growth Inventory: Basic concepts (Definition, Barbara Fredrickson's Broaden-Build Theory), psychometric properties of the test, administration, scoring, results and interpretation.

Module IV: Clinical Assessment Scales (20 Hours) (Offline/Online Classes):

Beck's Depression Inventory/State-Trait Anxiety Inventory: Basic concepts, psychometric properties of the test, administration, scoring, results and interpretation.

Suggested Readings

Baron, R.A. Psychology. (1995). 3rd edition. Delhi: Prentice Hall.

Morgan, C.T., King, R.A., Weisz, J.R., and Schopler, J. (2004). Introduction to Psychology, 7th edition, 24th reprint. New Delhi: Tata McGraw-Hill.

Gregory, R.J. (2006). Psychological Testing: History, Principles, and Applications (4th Ed.). New Delhi: Pearson Education.

Baron, Robert A. and Byrne, D. (2001). Social Psychology 8th Edition (Reprint). New Delhi: Prentice-Hall of India Pvt Ltd.

Carson, R.C., Butcher, J.N and Mineka, S. (2004). Abnormal psychology. 13th Edition. New Delhi: Pearson Education

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	M		
CO 2	M	H	H	H
CO 3	H	H	H	H
CO 4	H	H	H	H
CO 5		M		M
CO 6				H

PCFW6028: FIELD WORK**(2 Credits)****Course Outcomes**

Define counselling and mental illnesses (Remembering)

Understand the value of supervision (Understanding)

Apply the theoretical principles to individuals at various setups (Applying)

Distinguish clinical features of different mental illnesses. (Analysing)

Evaluate the models of mental health and illness. (Evaluate)

Create a management plan for patients on the basis of clinical features, diagnosis criteria and therapist competence. (Creating)

Module I: Introduction

The field work practice in the second semester shall focus upon the area of concentration chosen by the students. The students will be placed in the field for a minimum of eight days. The fieldwork setting shall be NGO's, hospitals, clinics and schools. The students are expected to apply all the skills and techniques of counselling whenever applicable depending upon the organization and their service. The students should be involved in the activities of the institution and fulfil the responsibilities as requested by the agency supervisor

Module II: Record and Documentation

Students shall prepare a daily report of the fieldwork activities and submit it to the concerned faculty supervisor. The faculty supervisor shall provide the necessary feedback and guidance to the students.

Module III: Evaluation

At the end of the semester the students shall submit a summary report of the cases taken and activities done during their placement. The students shall also appear for the viva voce examination at the end of the semester.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H		
CO 2	H	H	
CO 3	H	M	
CO 4	H		M
CO 5		M	M
CO 6		H	H

PCPR6029: PRACTICUM-III**(2 credits – 60 hours)****Course/Learning Outcomes**

Define the basic concepts of disability, intelligence and personality assessment. (Remembering)

Extend the theoretical knowledge of disability, personality and intelligence theories and assessment techniques into practice. (Understanding)

Make use of the important measurement tools to learn administration and scoring. (Applying)

Examining test scores and interpretation of results. (Analyzing)

Evaluate the importance of personality, intelligence and disability assessment. (Evaluating)

Construct conclusion from the results of psychological assessment. (Creating)

Module 1: Disability Assessment (20 hours)

Indian scale for assessment of autism (ISAA)/WHO Disability Assessment Schedule (WHODAS 2.0): Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module 2: Intelligence (20 hours)

Bhatia battery of performance test of intelligence (offline) or Vineland Social Maturity scale (online): Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation

Module 3: Personality assessment (20 hours)

Rorschach Inkblot Test (offline) or Eysenck Personality Inventory (online): Basic concepts, purpose, development, psychometric properties, administration, scoring, interpretation.

(Note. Owing to the importance of Rorschach in psychological testing if it is not possible to conduct this practical due to the mode of conduction of classes, the department will try to make sure that students have the knowledge of this test by conducting workshop on this topic.)

Suggested Readings

Aiken, L. R (2006). *Psychological Testing and Assessment* (12th ed.). Boston: Allyn and Bacon.

Anastasi, A., & Urbina, S. (1997). *Psychological testing* (7th ed.). Prentice Hall/Pearson Education.

Gregory, R. J. (2005). *Psychological testing: History, principles and applications*. New Delhi: Pearson Education.

Kaplan, R. M. & Saccuzzo, D.P. (2007). *Psychological Testing: Principles, Applications, and Issues*. Australia: Thomson Wadsworth.

Mapping of COs to Syllabus

Course Outcomes	Module I	Module II	Module III
CO 1		H	
CO 2	H		
CO 3			H
CO 4		H	
CO 5			H
CO 6	H		H

PCPR6030: PRACTICUM-IV

(2 Credits, 60 hours)

COURSE/LEARNING OUTCOMES (COs)

At the end of this course students will be able to:

Define the basic terms related to cognitive functioning, personality, projective techniques and clinical rating scales & choose a suitable method of psychological test to administer on a subject (Remembering)

Classify the various types of psychological and neuropsychological tests on the basis of their use.

(Understanding)

Make interpretations and draw conclusions based on the norms given in the manual. (Applying)

Examine the details of the rating scale/ test, the aim, applications, procedure of administration and subject results. (Analysing)

Recommend the use of a suitable psychological assessment for a particular disorder. (Evaluating)

Test the administrator's decision making process to select a particular test for assessment of a given psychological disorder. (Creating)

Module I: Neuropsychological screening and test batteries for assessing cognitive functioning and rule out neuropathology (20 hours)

Introduction to Neuropsychological assessments; importance and purpose; various types of Neuropsychological tests; administration, scoring, results and interpretation the tests

The Bender Visual-Motor Gestalt Test (BVGT) (Online/offline)/Rey-Osterrieth complex figure Test (ROCF) (Online/offline)

Gesell Drawing test of intelligence (Online/offline)/Mini Mental Status Examination (MMSE) PGI- BBD battery (offline)

Module II: Assessment of personality (22 hours)

Objective and Projective tests for assessing personality and psychopathology. Definition of Personality; Measurement of Personality; Various types of Personality tests, administration, scoring, results and interpretation.

Minnesota Multiphasic Personality Inventory -2 (MMPI-2) (offline) Sacks sentence completion test (SSCT) (online/offline) Thematic Apperception Test, other techniques (TAT) (online/offline)

Module-III (18 hours)

Rating scales for assessing the severity of Psycho-pathology and Evaluation of Impairment

Introduction to Clinical Rating Scales; Purpose of various rating scales; administration, scoring, results and interpretation; Hamilton Anxiety Rating Scale (HAM-A) (Online/offline)

Hamilton Depression Rating Scale(HDRS) (Online/offline) Barratt Impulsiveness scale (BIS) (offline/Online)

Note: A total of 6 practical were decided for the MSc 4th semester practicum course instead of 9 in both online/offline mode. A combination of online and offline mode of practicum mentioned in the syllabus should be included under the 6 practical (Syllabus has clearly mentioned practical to be conducted in the online/offline mode of classes).

Suggested Readings

Baer, L., & Blais, M. A. (2010). Handbook of clinical rating scales and assessment in psychiatry and mental health (pp. 735). New York: Humana Press.

Bellack, A.S. and Hersen, M. (Ed.s) (1998) Behavioral assessment A Practical Handbook (4th ed.). MA: Allyn and Bacon.

Exner, J. E. (2002). The Rorschach, basic foundations and principles of interpretation (Vol. 1). John Wiley & Sons.

Goldstein, G. and Hersen, M. (Ed.) (2000) Handbook of Psychological Assessment. (3rded). Oxford: Elsevier science.

Hersen, M. (2004).Comprehensive Handbook of Psychological Assessment (Vol. 4). Industrial and Organizational assessment. New York, NY: Wiley.

Schutte, N. S., & Malouff, J. M. (1996). Sourcebook of Adult Assessment Strategies. Behaviour Research and Therapy, 10(34), 846-847.

Course Outcomes (COs) mapping

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	M
CO 2	H	H	H
CO 3	H	H	H
CO 4	H	H	H
CO 5	H	H	H
CO 6	M	H	H

VALUE-ADDED COURSES**PCSO6034: SCHOOL PSYCHOLOGY****(2 credits- 30 hours)****Course Outcomes**

Gain knowledge about the concept of School Psychology. (Remembering)

Understanding the process of school counseling. (Understanding)

Analyze the needs of school children in the new digital world. (Applying)

Apply principles and concepts of counseling in school set up. (Analyzing)

Evaluate the gaps in the current scenario. (Evaluating)

Create a comfortable environment for children in need of intervention. (Creating)

Module 1: Introduction (5 hrs)

Historical background of school psychology, Definition nature and scope of School Psychology, Role of a School Psychologist as a Professional

Module 2: Guidance and Counseling in School setting (15 hrs)

Definitions, Ethics and Legal aspects, Characteristics of an effective counselor, Basic Counseling Skills- Active listening, reflecting, paraphrasing, questioning, confronting, Counseling process- Building, maintaining and terminations counselor's relationships.

Module 3: Tools and Techniques Practice (10 hrs)

Objective tools: Checklist, rating scales, self report inventories and other standardized tools.

Subjective Tools: Observation, anecdotal records, cumulative Records, Interview and case history

Techniques for group intervention: Group tasks, Group discussion, debriefing and interpretation, summary making.

Techniques for individual intervention: role plays, individual assignments, feedback charts Importance of Record Keeping

Suggested Readings:

Rao, Ramakrishna & Parnajpe, Anand (2008). Handbook of Indian Psychology. New Delhi: Cambridge University Press India Pvt. Ltd.

Thomas, Murray R. (1990) Counseling and Life – Span Development. New Delhi: Sage Publications,

Herr, Edwin (1974) Vocational Guidance and Human Development (Ed.). Boston: Houghton Mifflin,

Wallace & Lewis (1986). Becoming a Professional Counselor. New Delhi: Sage Publications,

Shrivastava, K.K. (2004) Principles of Guidance and Counseling. New Delhi: Kanishka Publishers.

Anastasi, A. (1977). Psychological Testing. (5th Ed.) New York: MacMillanPublishing Co. Inc.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	H	M	H
CO 2	H	M	H
CO 3	M	M	H
CO 4		H	H
CO 5		H	H
CO 6		H	H

PCCO6035: COMMUNITY MENTAL HEALTH**(2 credits- 30 hours)****Course Outcomes**

Gain knowledge about the underlying principles of Community Mental Health. (Remembering)

Understand current trends of practice and intervention. (Understanding)

Apply basic intervention skills in their community projects. (Applying)

Analyze gaps in the current functioning of Community Mental Health at regional levels. (Analyzing)

Evaluate intervention techniques in multicultural set ups. (Evaluating)

Organize awareness programmes for communities. (Creating)

Module 1: Introduction (2 hours)

Basic Principles of Community Mental Health, Counseling Skills, Counseling in Multicultural set up

Module 2: Mental Health Issues (6 hours)

Intellectual disability, Addiction, Developmental disorders, Suicide

Module 3: Identification, Assessment and Intervention (7 hours)

Identification of Mental Health Issues, Assessment of Mental Health Issues, Psycho-education, Evidence Based Practices (Behavior Therapy, Cognitive Behavior Therapy, Rational Emotive Behavior Therapy)

Module 4: Practical (15 hours)

Community Mental Health Projects

Suggested Readings:

Community Mental Health; Challenges for the 21st century. (2006). Rosenberg, J. & Rosenberg, S. Rotutledge

Ethics in Community Mental Health Care. (2002). Backlar, Patricia & Cutler, David L. (Eds.). Springer US.

Community Mental Health and Behavioral-Ecology; A Handbook of Theory, Research, and Practice.(1982).

Editors: Jeger, A.M., Slotnick, R.S. (Eds.). Springer US

Community Mental Health: Putting Policy Into Practice Globally.(2012).Graham Thornicroft , Atalay Alem, Robert E. Drake, Hiroto Ito, Jair Mari, Peter McGeorge, R. Tara, Maya Semrau (Ed.). Wiley-Blackwell

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	M	H
CO 2	H	H	H	H
CO 3		M	H	H
CO 4			H	H
CO 5			H	H
CO 6			H	H

PCLS6036: LIFE SKILLS EDUCATION

(2 credits-30 hours)

Course Outcomes:

Choose and gain knowledge about themselves, develop consciousness of self, self-confidence, feelings of mattering, manage personal emotions (Remembering)

Able to relate and work with others, practice collaborations, controversy with civility, engage across difference, be committed to ethical action (Understanding)

Apply self-knowledge, practice self-worth, congruence, commitment, identify passions and develop common purpose (Applying)

Able analyse academic knowledge and integrate into all aspects of living (Analysing)

Learn to evaluate and improve upon personal leadership strengths and weaknesses (Evaluating)

Create effective change and practice collective efficacy, develop critical thinking/ decision making skills, common purpose and a sense of connectedness within one's communities. (Creating)

Module –I: Introduction (5 hours)

Definition and Importance of Life Skills

Livelihood Skills, Survival Skills and Life Skills

Life Skills Education, Life Skills Approach, Life Skills Based Education

Life Skills Training - Implementation Models

Life Skills Education in the Indian Context

Module-II: Social Skills and Negotiation Skills (8 hours)

Introduction

Life Skills: Generic, Problem Specific and Area Specific Skills

Self-Awareness

Definition, Types of Self

Self Concept, Body Image, Self Esteem

Techniques used for Self Awareness: Johari Window, SWOT Analysis

Empathy

Sympathy, Empathy & Altruism

Effective Communication

Definition, Functions, Models, Barriers

Interpersonal Relationship

Definition, Factors affecting Relationships

Module-III: Coping Skills (5 Hours)

Coping with Emotions

Coping Skills

Coping & Emotions

Definition, Characteristics, Types

Classification: Wheel Model, Two-Dimensional Approach - Coping Strategies

Coping with Stress

Definition, Stressors

Sources of Stress

The General Adaptive Syndrome Model of Stress

Coping Strategies

Module-IV: Practical (12 hours)

Life Skills in Specialized Areas

Peer Education

Life Skills for Disaster Preparedness

Life Skills for Corporate Sector

Life Skills for Special Population

Life Skills for Geriatric and Palliative Care

Life Skills in Practice in Educational Settings

Suggested Readings:

Dahama O.P., Bhatnagar O.P, (2005). *Education and Communication for Development*, (2nd Edn.), Oxford& IBH Publishing Co. Pvt. Ltd. New Delhi.

Debra McGregor, (2007). *Developing Thinking; Developing Learning - A guide to thinking skills in education*, Open University Press, New York, USA

Duffy Grover Karen, Atwater Eastwood, (2008). (8th Edn.), *Psychology for Living- Adjustment, Growth and Behaviour Today*, Pearson Education Inc, New Delhi.

Hockenbury (2010). *Discovering Psychology*, Worth Publishers. New York

Nair .V. Rajasenan, (2010). *Life Skills, Personality and Leadership*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.

Nair. A. Radhakrishnan et al., (2010). *Life Skills Assessment Scale*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu.

Stella Cottrell, (2005). *Critical Thinking Skills: Developing Effective Analysis and Argument*, Palgrave Macmillan Ltd., New York

Nair. A. Radhakrishnan, (2010). *Life Skills Training for Positive Behaviour*, Rajiv Gandhi National Institute of Youth Development, Tamil Nadu. s

RGNIYD. (2008). *Facilitators Manual on Enhancing Life Skills. Tamil Nadu*

Family Health International, NACO, USAID (2007), *Life Skills Education tool kit for Orphans and vulnerable children in India*

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module
CO 1	H	M	M	M
CO 2	M	H		H
CO 3	M		H	
CO 4	H			H
CO 5			H	
CO 6	M		H	H

DEPARTMENT OF PUBLIC ADMINISTRATION

VISION:

Our unwavering commitment is to emerge as a distinguished centre of excellence in the domain of Public Administration, embodying unparalleled standards in learning, teaching, and research. Through the provision of bespoke experiences, we strive to instill profound human values, ultimately fostering nation-building.

MISSION:

Strive for academic excellence by delivering high-quality education, research, and practical training in Public Administration, fostering a deep understanding of theoretical frameworks and practical applications. Cultivate and nurture visionary leaders with the skills to navigate complex public sector challenges, promoting effective governance and upholding the highest standards of ethical conduct in public service roles. Encourage cutting-edge research initiatives that address contemporary societal issues, while fostering strong ties with the community and relevant stakeholders to drive positive societal development. Provide a personalized learning environment, catering to individual needs and aspirations, maximizing student potential for growth, success, and lifelong learning in the field. Enhance global awareness and prepare students to contribute effectively in an interconnected world, while dedicating efforts to contribute significantly to nation-building through competent and socially responsible public administrators driving positive change and sustainable development.

MA PUBLIC ADMINISTRATION -PROGRAM OUTCOMES (POs)

PO 1: Academic Excellence: Strive for academic excellence by delivering high-quality education, research, and practical training in Public Administration, fostering a deep understanding of theoretical frameworks and practical applications.

PO 2: Leadership Development: Cultivate and nurture visionary leaders who possess the skills and knowledge to navigate complex public sector challenges, promoting effective governance and public service.

PO 3: Research and Innovation: Encourage and support cutting-edge research initiatives that contribute to the advancement of knowledge in Public Administration, generating innovative solutions for contemporary societal issues.

PO 4: Personalized Learning: Provide a personalized and student-centric learning environment, catering to individual needs and aspirations, thereby maximizing the potential for growth and success.

PO 5: Ethical and Responsible Governance: Emphasize the importance of ethical conduct and responsible governance practices, preparing graduates to uphold the highest standards of integrity in their public service roles.

PO 6: Community Engagement: Foster strong ties with the community and relevant stakeholders, encouraging collaboration and knowledge exchange, resulting in a positive impact on societal development.

PO 7: Comprehensive Approach: Foster an interdisciplinary perspective and global awareness, promoting lifelong learning among students and faculty, to produce competent and socially responsible public administrators who can drive positive change, sustainable development, and contribute significantly to nation-building efforts in an interconnected world.

MA PUBLIC ADMINISTRATION -PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1: To foster a comprehensive comprehension of governance structures, processes, and institutions at the local, national, and international levels.

PSO 2: To enable students to gain an in-depth understanding and analytical proficiency in one of the specialized areas, including Human Rights, International Relations, or Public Policy, empowering them to address complex challenges within their chosen field.

PSO 3: To develop and enhance technical skills necessary for comprehensive professional advancement within their respective areas of specialization. This will equip graduates to make well-considered and responsible decisions in their professional endeavours.

PSO 4: To create avenues for sharing the outcomes of academic and disciplinary learning, encouraging students to engage in scholarly research and publish research materials that contribute to the advancement of knowledge in the field.

Mapping of Courses with POs/PSOs:

Courses	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO 4
DC Courses		H		M		H		H	M		M
DC 1	M		H		M		H		H	H	
DC 2		H		H	H		M	M		H	
DC 3	H		H		M			H			H
DC 4	M	H		H		H		H	M		M
DC 5	H		H		M	H		H		H	
DC 6		H		H		H	H		H		H
DC 7	H		H		H		H	H		M	
DC 8		H		M		H		H	M		M
DC 9	M		H		M		H		H	H	
DC 10		H		H	H		M	M		H	
DC 11	H		H		M			H			H
DC 12	M	H		H		H		H	M		M
DC 13	H		H		M	H		H		H	
DC 14		H		H		H	H		H		H
DC 15	H		H		H		H	H		M	
DC 16			H		M			H		H	
DE Courses		H		M		H		H	M		M
DE 1 HR	M		H		M		H		H	H	
DE 1 IR		H		H	H		M	M		H	
DE 2 HR/IR	H		H		M			H			H
DE 2 PP	M	H		H		H		H	M		M
DE 3 HR/IR	H		H		M	H		H		H	
DE 3 PP		H		H		H	H		H		H

DE 4 HR/IR	H		H		H		H	H		M	
DE 4 PP		H			H		H				H
DE 5 HR/IR			H			H			H		
DE 5 PP			H			H			M		H
DE 6 HR/IR	M			H		M		H		M	
DE 6 PP		H			H				H		H
SE 1		H		M		H		H	M		M
Value Add 1	M		H		M		H		H	H	
Value Add 2		H		H	H		M	M		H	
Value Add 3	H		H		M			H			H

DETAILED SYLLABUS

PASE0001: STATE AND ITS ELEMENTS

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Trace the evolution and emerging perspectives of the State (Remembering & Understanding)

Understand the relationship between State, Society and Public Administration (Understanding)

Analyze the origin and changing role of the state (Analyzing)

Evaluate the Interface between Citizens and Administration (Applying)

Module – I (15 hours)

Evolution and Perspectives of the State: Origin of the State, the Theory of Divine Origin, Force Theory, Matriarchal and Patriarchal Theory, Social Contract Theory, Evolutionary Theory; Elements and Functions of State; Changing Role of the State; Liberal and Marxist Perspective of the State, Neo-liberal Perspective, and Gandhian Perspective; Autonomy of the indirect economy, and kindness economy.

Module - II (10 hours)

Concepts: Liberty, Equality, Justice, Rights, and Sovereignty, Contemporary Issues, Political Culture & Political Development, Political Socialization. Understanding concepts of Public, Common Good, Welfare, Public Interest, Morality, Empathy, Efficiency and Effectiveness.

Module – III (10 hours)

Governmental structure: Various Forms of Government: Monarchy, Democracy, Oligarchy, Authoritarianism, and totalitarianism; Parliamentary & Presidential, Unitary & Federal.

Module - IV (10 hours)

Relationship between State, Society and Public Administration; People's Struggle for Democracy- Case Studies, Interface between Citizens and Administration; Political Parties, Pressure Groups, Electoral Reforms; Digital economy; Self-reliant theory.

Suggested Readings

An Introduction to Political Theory, Gauba · 2009 Publisher: Macmillan Publishers India Limited

Political theory ideas and concepts by Sushila Ramaswamy, 2010, Publisher: PHI Learning
 Institutional Theory in Political Science: 2nd Edition, B. Guy Peters, 2005
 Political Theory: An Introduction, by Rajeev Bhargava, Ashok Acharya, Pearson Education India
 Political Man, The Social Bases of Politics (Classic Reprint), 2017
 Rawls, R.H. - A Theory of Justice
 Sharma, U., Sharma, S.K. - Principles & Theory of Political Science

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	L	L	H
CO 3	H	L	L	L
CO 4	L	L	L	H

PAIA0002: INTRODUCTION TO THE PUBLIC ADMINISTRATION

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Understand the meaning, nature and scope of Public Administration (Remembering & Understanding)

Comprehend the changing paradigms of Public Administration (Understanding)

Analyse the events that gave shape to the discipline (Analyzing)

Evaluate the concept of Good Governance and its implications (Applying)

Module – I (10 hours)

Meaning, nature, scope and significance of Public Administration; Relation with other disciplines of social sciences;

Module – II (10 hours)

Evolution of the discipline and its present status; Ecology, Public and Private Administration.

Module III (15 hours)

New Public Administration; Public Choice Theory; New Public Management; State vs. Market Debate.

Module IV (10 hours)

Recent Developments in Public Administration; Challenges of Liberalization, Privatization and Globalization; Good Governance: concept and application; Good Governance indexes.

Suggested Readings

Henry, Nicholas - Public Administration And Public Affairs

Nigro, Felix, A. - Modern Public Administration

Dixit Manoj (et. al) - Public Administration

Awasthi & Maheshwari - Public Administration

Sharma & Sharma - Public Administration

Bhattacharya, M. - New Horizons of Public Administration

Bhambri, C.P. - Public Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	M	M
CO 3	M	H	L	L
CO 4	L	M	L	H

PACD0003: COMPARATIVE AND DEVELOPMENT ADMINISTRATION**Credits: 3 (45 lectures) (45 Hours)****COURSE OUTCOMES**

At the end of this course students are able to:

Understand the Concept, Nature, Scope and Significance of Comparative Public Administration (Remembering & Understanding)

Understand the ecological impact on the Public Administration (Understanding)

Analyze the problems of Comparative Research and development administration (Analyzing)

Evaluate the Changing pattern of Development Administration (Applying)

Module – I (15 hours)

Concept, Nature, Scope and Significance of Comparative Public Administration; Comparative Studies – Influence of

Globalization; Public Administration and its Environment. Approaches to the study of Comparative Administration: Institutional, Behavioral, Structural-Functional, Ecological and Systems Approaches

Module – II (10 hours)

Fred Riggs's Typology of Societies and Features; Problems of Comparative Research; Salient Features of the administrative systems of UK, USA, France and Japan

Module – III (15 hours)

Genesis of Development Administration; Development Administration: Meaning, characteristics, Traditional Administration versus Development Administration; Administration of Development and Development of Administration; Politics of Development Administration.

Module – IV (05 hours)

Temporal and Spatial Dimensions of Development Administration; Changing pattern of Development; A critique of Development Administration

Suggested Readings

Arora, R.K.- Comparative Public Administration

Chaturvedi, T.N.- Comparative Public Administration

Chatterjee, S.K. - Development Administration

Sapru, R.K.- Development Administration

Riggs, F.W.- The Ecology of Public Administration

Sharma, S.K. - Development Administration in India

Bhattacharya, Mohit – Bureaucracy & Development Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	H	H	H	M
CO 4	L	L	L	H

PAPP0004: PUBLIC POLICY**Credits: -3 (45 lectures) (45 Hours)****COURSE OUTCOMES**

At the end of this course students are able to:

CO1: Understand the public policy process (Remembering & Understanding)

CO2: Understand the Models and Trends of Public Policy in India (Understanding)

CO3: Analyze the issues related to Policy formulation; Implementation and evaluation (Analyzing)

CO4: Evaluate the public policies in India (Applying)

Module – I (10 hours)

Public Policy: Articulation, significance and approaches; Public Policy Process

Module – II (10 hours)

Public Policy and Globalization; Public Policy process in India; Models and Trends of Public Policy in India

Module-III (10 hours)

Policy formulation; Implementation; evaluation

Module –IV (15 hours)

Environmental Policy in India; Education Policy in India; Public Health Policy in India; MSME Policy of India.

Suggested Readings

Anderson, James E. - Public Policy making, Praeger, New York, 1975

Dror, Y. - Public Policy Making Re-examined, Chancellor, Pennsylvania, 1968

Sahani, P. - Public Policy Conceptual Dimensions, Kitab Mahal, Allahabad, 1987

Saigal, Krishna - Public Policy Making in India: An Approach to Optimisation, Vikas, New Delhi, 1983

Madan, K.D. et. al - Public Policy making in Government; Publication Division, Ministry of Information and Broadcasting, New Delhi, 1982

Bertch, Garg, K. Robert P. Clark and David M. Wood - Comparing Political System : Power and Policy in Three Worlds, Macmillan, New York, 1986

Sapru, R.K. - Public Policy Formulation, Implementation and Evaluation; Sterling, New Delhi, 2000

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	L	L
CO 2	L	H	L	L
CO 3	M	M	H	L
CO 4	L	L	L	H

PAEP0005: ENGAGED POLICY AND GOVERNANCE

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Understand the concept of Participatory Governance (Remembering & Understanding)

Understand the Pitfalls in Participatory Governance (Understanding)

Analyze the issues related to Community engagement at the Grassroots Level (Analyzing)

Evaluate Issues of local Engagement and Participation (Applying)

Module I (10 hours)

Participatory Governance: An Overview; The Rationale of Participation: Concepts and Challenges; New Governance Paradigm: The Emerging Partnerships/Engagement Initiatives

Module II: (10 hours)

Democracy, Social Inclusion and Development: Democracy and Development; Political Regimes, Political Participation and Social Inclusion; Innovations and Pitfalls in Participatory Governance

Module III: (10 hours)

Engaged Governance: Government Transparency in Policy Decisions; Engaging the Community at Grass-roots Level; Electronic Platforms for Receiving and Implementing Public Input

Module IV: (15 hours)

Participatory Local Governance: Participatory Governance Toolkits; Measuring Engagement or Participation; Issues in

Engagement and Participation; Case Studies a) Kudumbashree in Kerala, India b) Grameen Bank in Bangladesh c) Participatory Budgeting, Brazil d) Watershed Development Programme in Ralegansiddhi, India

Suggested Readings

Alexander, Jeffrey C. 2006. The Civil Sphere. New York: Oxford University Press.

Baiocchi, G., P. Heller, et al. 2011. Bootstrapping Democracy: Transforming Local Governance and Civil Society in Brazil. Stanford; Stanford University Press.

Barber, Benjamin. 1984. Strong Democracy: Participatory Politics for a New Age. Berkeley: University of California Press.

Boulding, C. and B. Wampler 2010. "Voice, Votes, and Resources: Evaluating the Effect of Participatory Democracy on Well-being." World Development 38(1): 125-135.

Bowler, S. and T. Donovan 2002. "Democracy, Institutions and Attitudes About Citizen Influence on Government." British Journal of Political Science 32(02): 371-390.

Diamond, L. J. 1999. Developing Democracy: Toward Consolidation. Baltimore, MD: Johns Hopkins University Press.

Fung A., E. Wright, et al. 2003. Deepening Democracy: Institutional Innovations in Empowered Participatory Governance. London: Verso Books.

Grindle, Merilee, 2007, Going Local: Decentralization, Participation, and the Promise of Good Governance. Princeton University Press.

Heller, P. 2000. "Degrees of Democracy: Some Comparative Lessons from India." World Politics 52(4): 484-519.

Isaac, T.M. Thomas and Patrick Heller. 2003. "Democracy and Development: Decentralized Planning in Kerala." In Deepening Democracy: Institutional Innovations in Empowered Participatory Governance. The Real Utopias Project IV. London: Verso.

Pateman, Carole. 1970. Participation and Democratic Theory. Cambridge: Cambridge University Press.

Sen, Amartya. 1999. Development as Freedom. Oxford: Oxford University Press.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PAAP0007: ADMINISTRATIVE THEORY AND PRINCIPLES (Core Course)

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Trace the evolution theories of Public Administration (Remembering & Understanding)

Understand the principles of Public Administration (Understanding)

Analyze the State of Administrative Theory in 21st Century (Analyzing)

Evaluate the theory and practice of public administration (Applying)

Module – I (15 hours)

Classical Perspectives: Woodrow Wilson: The Politics Administration-Dichotomy; Scientific Management: Taylor and the Movement; Classical Theory: Fayol, Urwick, Gulick and others; Bureaucratic Theory: Weber and his critics. Human relations perspectives/post-classical theorists: Elton Mayo and others; Mary Parker

Follett; Behavioural approach: Chester Barnard, Chris Argyris, Douglas McGregor, Rensis Likert; Organizational development and system approach.

Module – II (10 hours)

Administrative Behaviour: Decision making – Herbert Simon; Communication; Control; Leadership Theories; Theories of

Motivation: Abraham Maslow, Frederick Herzberg. Emerging theories: Geoffrey Vickers-Appreciative System; Warren Bennis Changing Organizations; New Organisational Culture, Pertinence of Critical Theory, State of Administrative Theory in 21st Century

Module-III (10 hours)

Basic Principles: Organization; Hierarchy; Unity of Command; Span of Control; Authority and Responsibility; Coordination; Centralization and Decentralization.

Module –IV (10 hours)

Delegation; Supervision; Line and Staff; Accountability and Control: Concept; Legislative Control; Executive Control; Judicial Control; Citizen and Administration; Role of Civil Society; People's participation; Right to information

Suggested Readings

Henry, Nicholas - Public Administration And Public Affairs
 Taylor, Frederick W. - The Principles of Scientific Management
 Etzioni, Amitai - Modern Organizations
 Bendix R., Max Weber - An Intellectual Portrait
 Blau, Peter H. - Bureaucracy in Modern Society
 Nigro, Felix, A. - Modern Public Administration
 Dixit Manoj (et. al) - Public Administration
 Sahni, Pardeep (et. al) - Administrative Theory
 Awasthi & Maheshwari - Public Administration
 Sharma & Sharma - Public Administration
 Bhattacharya, M. - New Horizons of Public Administration
 Bhambri, C.P. - Public Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	L	L
CO 2	L	H	L	L
CO 3	L	H	L	L
CO 4	M	M	M	H

PAIA0008: INDIAN ADMINISTRATION

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Trace the evolution of Indian Administration (Remembering & Understanding)

Understand the Structure & Functions of Public Administration in India (Understanding)

Analyze the role of District Administration in 21st Century (Analyzing)

Evaluate the Relationship between Police and Public (Applying)

Module – I (10 hours)

Evolution of Indian Administration: Mauryan, Mughal & British Period and British Legacies to Indian Administration.

Module – II (10 hours)

Central Administration: Structure & Functions of Central Secretariat: Cabinet Secretariat, Cabinet Secretary, Prime Minister's Office (PMO)

Module-III (10 hours)

State Administration: Structure & Functions of State Secretariat, Chief Secretary; State Secretariat Vs Directorate; Divisional Administration & The Divisional Commissioner.

Module –IV (15 hours)

District Administration; District Collector: Powers, Functions & Role, Law and Order in DM-SSP & Commissionary System, Relationship between Police and Public.

Suggested Readings

Maheshwari, S.R. - Indian Administration
 Singh, Hoshier - Indian Administration
 Arora, R.K. & Goel. Rajni - Indian Public Administration
 Johari, J.C. - Indian Govt & Politics
 Maheshwari, S.R. - State Administration
 Avasthi, A. & Avasthi, A.P. - Indian Administration
 Fadia, B.L. & Fadia, Kuldeep - Public Administration in India
 Singh, Hoshiyar and Singh, Mohinder - Public Administration in India
 Basu, D.D. Introduction to the Constitution of India
 Johari, J.C. - The Constitution of India
 Ramchandran, Padma – Public Administration in India
 Charabarty, Bidut & Chand, Prakash – Indian Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	H	H
CO 3	L	L	L	H
CO 4	L	L	L	H

PAPP0009: PUBLIC PERSONNEL ADMINISTRATION

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Trace meaning, nature, scope and significance of Public Personnel Administration

(Remembering & Understanding)

Understand the recruitment process in civil services (Understanding)

Analyze the Role of Civil services in Developing Countries (Analyzing)

Evaluate the issues related to Administrative Ethics and Reforms (Applying)

Module – I (05 hours)

Public personnel administration: meaning, nature, scope and significance

Module – II (10 hours)

Civil Services – Structure, Recruitment and training; Promotion; Pay and service conditions; Position Classification; Public Service Commissions; Union and state.

Module-III (20 hours)

Role of Civil services in Developing Countries. Civil Services-Citizenry Interface: Civil Society and Administration; Technology and Changing Nature of Public Services; Ethics and Accountability

Module –IV (10 hours)

Generalist and Specialist; Minister-Civil servant relationship; Administrative Ethics; Administrative Reforms.

Suggested Readings

Yoder, Dale - Personnel Management & Industrial Relations
 Flippo, Edwin B. - Principles of Personnel management
 Davar, Rustom S. - Personnel Management & Industrial Relations
 Second Administrative Reforms Commission Report.
 Monappa, Arun & Mirza, S.Saiyadain - Personnel Management.
 Stahl, O Glenn - Public Personnel Administration
 Hays, S.W. & Kearney, R.C. - Public Personnel
 Goel, S.L. - Public Personnel Administration
 Sinha, V.M. - Public Personnel Administration
 P. N. Parashar- History and Problems of Civil Services in India
 Yogendra Narain- Civil Services: Challenges And Resolutions
 Abhay Prasad Singh & Krishna Murari - Constitutional Government and Democracy in India
 S.K. Das - The Civil Services in India
 Lohit Matani, Vishal - An Introduction to Civil Services
 S.N. Singh - Politician Civil Servant Relationship and Public Administration in India
 Sandeep Sharma- Indian Civil Service And Public Administration

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PARM0010: RESEARCH METHODOLOGY

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Trace the role of Research in Theory-building (Remembering & Understanding)

Understand the Scientific Methods in Social Science Research (Understanding)

Analyze the role Sampling and Sampling Techniques (Analyzing)

Evaluate trends of Research in Public Policy and Governance; (Applying)

Module – I (15 hours)

Social Science Research: Meaning, Objectives, Scope and Importance of Social Science Research, Normativity and Objectivity in Social Science Research; Distinction between Method and Methodology; Role

of Research in Theory-building; Types of Research: Quantitative Research, Qualitative Research, Applied Research, Basic Research, Problem Oriented and Problem Solving.

Module – II (10 hours)

Scientific Methods in Social Science Research; Problem Formulation and Hypothesis; Identification of Variables, Concepts and Operationalization of Concepts; Hypothesis and Procedure of Hypothesis Testing and Estimation; Data: Sources-Primary and Secondary, Methods of Data Collection.

Module-III (15 hours)

Sampling and Sampling Techniques; Scales of Measurement: Measures of Central Tendency and Dispersion, Mean, Mode and Median, Standard Deviation, Correlation; Tools of Data Collection: Observation, Questionnaire, Interview Schedules; Processing and Analysis of Data; Research Design and Research Report Writing; Citation Pattern and Bibliography

Module –IV (05 hours)

Trends of Research in Public Policy and Governance; Ethics of Research in Public Administration; Use of Computers in Social Science Research.

Suggested Readings

L. Nagar and R. K. Das, Basic Statistics, New Delhi: Oxford University Press, 2000.
C. R. Kothari, Research Methodology: Methods and Techniques, New Delhi: Vishwa Prakashan, 1990.
David Dooley, Social Research Methods, (4th ed.), Upper Saddle River, NJ: Prentice Hall, 2001.
David E. Gray, Doing Research in the Real World, London: Sage Publications, 2004.
E. R. Babbie, The Basic of Social Research, (4th ed.), Australia: Thomson, 2007.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PAOB0012: ORGANIZATIONAL BEHAVIOUR

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Understand the concepts and approaches to organizational behaviour (Remembering & Understanding)

Understand the concepts of Attitude, Personality and Motivation (Understanding)

Analyze the Stress Management and Organizational Change (Analyzing)

Evaluate resistance to Change (Applying)

Module I (10 hours)

Concepts and Approaches: Organisational Behaviour (OB) - Meaning and Concept, Traditional and Modern Approaches to OB; Typologies of Organisation, Genesis, Needs and Goals of OB; Challenges of Organisational Behaviour

Module II (15 hours)

Attitude, Personality and Motivation: Attitude- Concept, Factors in Attitude formation, Attitude and Behaviour; Personality: Concept, Theories and determinants, Personality and Behaviour; Motivation: Concept,

Theories, Motivation and Behaviour, Motivational system and Incentives, Quality Work Life (QWL), Job Design and Motivation.

Module III (10 hours)

Stress Management and Organizational Change: Power and Politics - Concept, Significance, Concentration and Types of power, Reasons and Management of Organizational Politics.

Module IV (10 hours)

Stress Management: Concept, Causes and Effects of Stress, Coping Strategies; Organizational Change: Nature, Factors and Resistance to Change.

Suggested Readings

Kumar, Niraj. Organizational Behavior: A New Look Concept, Theory and Cases. New Delhi: Himalaya 2012.

Parikh, Margie and Rajen Gupta. Organisational Behaviour. McGraw Hill Education (India) Pvt Ltd, 2010.

Robbins Stephen P. Organizational Behavior 15 Paperback, New Delhi: Pearson 2013.

Prasad, L.M. Organizational Behavior. New Delhi: Sultan Chand and Sons, 2019.

Pershing, Sandra Parkes and Eric K. Austin. Organization Theory and Governance for the 21st Century. New Delhi: Sage, 2015.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	H
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PABF0013: BUDGET AND FINANCIAL ADMINISTRATION IN INDIA

Credits: 3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Understand the concept and significance of Budget (Remembering & Understanding)

Understand the Budget Policy orientation in India (Understanding)

Analyze the Budgetary Process in India (Analyzing)

Evaluate Central-State Financial Relations (Applying)

Module – I (10 hours)

Meaning, nature and scope of Financial Administration; Concept of Budget; Definitions of Budget; Significance of Budget; Types of Budget

Module – II (10 hours)

Budget Policy Orientation in India; Major actors in Budgetary Process in India

Module-III (10 hours)

Budget system in India; Budgetary Process in India; Financial Management in India;

Module –IV (15 hours)

Budget system reforms in India; Financial System reforms in India; Finance Commission; Central-State Financial Relations.

Suggested Readings

Lall. G.S. - Public Finance & Financial Administration in India

Mokherjee, S.S. - Financial Administration in India
 Chand, Prem - Performance Budgeting
 Handa, K.L. - Financial Administration
 Sury, M. M. Government Budgeting in India
 Geol, S.L. - Public Financial Administration
 Thavaraj, M.J.K. - Financial Administration of India
 Tyagi, B.P. - Public Finance
 S.K. Mahajan and A.P. Mahajan: Financial Administration in India

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PASW0014: SOCIAL WELFARE ADMINISTRATION

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Understand the concept and significance of social welfare administration in India
 (Remembering & Understanding)

Understand the Social Welfare Administration in New Economic Order (Understanding)

Analyze the role of various agencies in social welfare administration (Analyzing)

Evaluate the role of International Agencies for Social Welfare (Applying)

Module – I (10 hours)

Social Welfare Administration: Meaning, Scope & Significance, Approaches/Models; Meaning, Social Welfare State- meaning; Social Change and Social Justice; Social Welfare Administration in New Economic Order; Social Welfare in Democratic and Authoritarian States.

Module – II (10 hours)

Social Welfare Administration at Union Level: Composition and Functions of Ministry of Social Justice and Empowerment; Ministry of Tribal Affairs; Ministry of Women and Child Development, Ministry of Minority Affairs; CSWB & SSWAB; Social welfare administration at the state level.

Module-III (15 hours)

Social Welfare Policies and Programmes for SC/ST, OBCs, Women, Child, Disabled and Aged at Central & State level; Composition and Functions of National Commission: for SC/ST, Women, Other Backward Classes and Minorities; Sub Plan strategies for Welfare of Weaker Section.

Module –IV (10 hours)

International Agencies for Social Welfare: Composition and Functions of UNESCO, UNICEF, ILO, WHO (with special reference to India).

Suggested Readings

Mukherjee, Radhakamal - Social Welfare Administration
 Chaudhary, D.P. - A. Hand Book of Social Welfare
 Sachdeva, D.R. - Social Welfare Administration
 Prasad, R. - Encyclopedia of Social Welfare Administration

Shukla, K.S. - Social Welfare Administration in India
 Chandra, Sushil - Social Work in Uttar Pradesh
 Annual Reports of Ministry of Social Justice & Empowerment, Government of India.
 Goel, S.L. - Social Welfare Administration.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	H	L	L	L
CO 3	L	H	L	H
CO 4	L	L	L	H

PAEG0015: ENVIRONMENTAL GOVERNANCE

Credits: -3 (45 lectures) (45 hours)

COURSE OUTCOMES

At the end of this course students are able to:

Understand the concept of Global Environmental Governance (Remembering & Understanding)

Understand the Development and Environmental issues in India (Understanding)

Analyze the Impact of urbanization on Environment (Analyzing)

Evaluate the Urban Environmental Governance in India (Applying)

Module – I (10 hours)

Development – Environment Discourse; Global Environmental Governance

Module – II (15 hours)

Development and Environmental issues in India; Environmental Policy in India; Role of Judiciary in Environmental governance in

India; Civil Society and Environmental protection in India

Module-III (10 hours)

Urban Environmental governance and politics in India; Impact of urbanization on Environment and Public Health.

Module –IV (10 hours)

Urban Environmental Governance: Major initiatives; Environmental politics in Urban India; Environmental Protection and Peoples right.

Suggested Readings

Ajith Sankar- Environmental Management

Bruckmeier, Karl - Global Environmental Governance: Social-Ecological Perspectives

Arild Vatn- Environmental Governance: Institutions, Policies and Actions

J.P. Evans - Environmental Governance

Jean-Frederic Morin, Amandine Orsini- Essential Concepts of Global Environmental Governance

Frank Biermann, Philipp H. Pattberg - Global Environmental Governance Reconsidered

Prakash Chand Kandpal- Environmental Governance in India: Issues and Challenges

Albert Breton- Environmental Governance and Decentralisation

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PACA0016: CITIZENS AND ADMINISTRATION**Credits: -3 (45 lectures) (45 Hours)****COURSE OUTCOMES**

At the end of this course students are able to:

Understand the Interaction between Citizens and Administration (Remembering & Understanding)

Understand the Preconditions for Citizens-centric Administration (Understanding)

Analyze the Mechanism for Redressal of Public Grievances (Analyzing)

Evaluate the Changing role of Citizens (Applying)

Module – I (10 hours)

Interaction between Citizens and Administration; Citizens' Perception about Administration

Module – II (10 hours)

Preconditions for Citizens-centric Administration; Peoples participation in India

Module-III (10 hours)

Administrative Accountability; Mechanism for Redressal of Public Grievances

Module –IV (15 hours)

Grievance Redressal Mechanism in India; Governance Discourse and the Changing Role of Citizens.

Suggested Readings

S. N. Sadasivan - Citizen and Administration

Nita Sanghvi - Administration and the Citizen

Citizen, Customer, Partner, Engaging the Public in Public Management, by John Clayton Thomas · 2014

Citizens and the New Governance: Beyond New Public Management, by Luc Rouban 5.

Avasthi A & Maheshwari, S.R., Public Administration; Lakshmi Narain ' Agarwal: Agra.

Barnabas, A.P., Citizens' Grievances and Administration; IIPA, New Delhi.

Bhattacharya, Mohit, 1987. Public Administration-Structure, Process and Behaviour

Chaturvedi T.N. & Sadasivan S.N. (Eds), 1984. Citizen and Administration; IIPA: New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PADL0017: DECENTRALIZATION AND LOCAL GOVERNANCE**Credits: -3 (45 lectures) (45 Hours)****COURSE OUTCOMES**

At the end of this course students are able to:

Understand various approaches of decentralization (Remembering & Understanding)

Understand the concept of democratic decentralization (Understanding)
 Analyze the implication of the 73rd and 74th Amendment Acts (Analyzing)
 Evaluate the role of Peoples participation in Rural and Urban Development (Applying)

Module – I (10 hours)

Decentralization: The concept; the significance of decentralization; Approaches to Decentralization

Module – II (10 hours)

Types of Decentralization; Democratic decentralization and local governance in India

Module-III (10 hours)

Rural local government; Urban local government; Implication of 73rd and 74th Amendment Acts; Critical appraisal

Module –IV (15 hours)

Peoples participation in Rural and Urban development; Major Rural and Urban development programmes.

Suggested Readings

Pranab Bardhan, Dilip Mookherjee - Decentralization and Local Governance in Developing Countries – A Comparative Perspective
 T. R. Raghunandan - Decentralisation and Local Governments: The Indian Experience
 Rémi de Bercegol - Small Towns and Decentralisation in India: Urban Local Bodies in the Making
 D. Rajasekhar, M Devendra Babu, R Manjula - Decentralisation in Contemporary India: Status, Issues and the Way Forward
 Chandan Sengupta, Stuart Corbridge - Democracy, Development and Decentralisation in India: Continuing Debates

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PAEG0018: E-GOVERNANCE

Credits: -3 (45 lectures) (45 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Understand Electronic Service Delivery mechanism (Remembering & Understanding)
 Understand the Models of E-Governance (Understanding)
 Analyze the Evolution in E-Governance (Analyzing)
 Evaluate the significance of Technological Infrastructural Preparedness (Applying)

Module – I (10 hours)

Introduction to E-Government and E-Governance: Difference between E-Government and E-Governance; E-Government as
 Information System; Benefits of E-Government; E-Government Life Cycle; Online Service Delivery and Electronic Service

Delivery; Evolution, Scope and Content of E-Governance; Present Global Trends of Growth in E-Governance

Module – II (15 hours)

Models of E-Governance: Introduction; Model of Digital Governance: Broadcasting / Wider Dissemination Model, Critical Flow Model, Comparative Analysis Model, Mobilization and Lobbying Model, Interactive – Service Model / Government-to-Citizen-to-Government Model (G2C2G); Evolution in E-Governance and Maturity Models: Five Maturity Levels; Characteristics of Maturity Levels; Towards Good Governance through E-Governance Models

Module-III (10 hours)

E-Government Infrastructure Development: Network Infrastructure; Computing Infrastructure; Data centres; E-Government Architecture; Interoperability Framework; Cloud Governance; E-readiness; Data System Infrastructure; Legal Infrastructural Preparedness; Institutional Infrastructural Preparedness; Human Infrastructural Preparedness; Technological Infrastructural Preparedness

Module –IV (10 hours)

Case Studies: E-Government Initiatives in USA, UK and India.

Suggested Readings

R.P. Sinha- E-governance in India: Initiatives and Issues
 Prabhu- E-Governance: Concepts and Case Studies
 Sri Ram Khanna- Digital Drive, E-governance and Internet Services in India: Quality Dimensions
 Suri, P.K., Sushil - Strategic Planning and Implementation of E-Governance
 Basandra, S.K - Computers Today Galgotia Publishers Pvt. Ltd
 Bhatnagar S.S. - E-government: From Vision to Implementation
 Bhattacharya, J. - E-gov2.0: policies, progress and technologies
 Brien, J and Marakas G.M - Management Information System: India(TM)
 B. Srinivas - E-Governance Technique

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PADP6001: DISSERTATION – Phase I

Credits: -6 (90 Hours)

Every student shall undertake a research project work which has bearing on his/her area under the supervision and guidance of a faculty member. The preliminary work may begin in the third semester. The students are expected to complete the Literature Survey and Synopsis before going for data collection. The thesis is to be submitted to the department before the date notified. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the 3rd semester. There shall be a viva voce examination on the research project. 6 Credits of this course will be allotted in the 4th semester.

PADP6005: DISSERTATION – Phase II

Credits: -6 (90 Hours)

Every student shall undertake a research project work which has bearing on his/her area under the supervision and guidance of a faculty member. The preliminary work may begin in the third semester. The students are expected to complete the Literature Survey and Synopsis before going for data collection. The thesis is to be submitted to the department before the date notified. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the 3rd semester. There shall be a viva voce examination on the research project. 6 Credits of this course will be allotted in the 4th semester.

VALUE ADDED COURSES

PAEP0021: ENVIRONMENTAL POLICY AND ADMINISTRATION

Credits: -3 (45 lectures) (45 hours)

COURSE OUTCOMES

At the end of this course students are able to:

Understand the Development and Environmental issues in India (Understanding)

Understanding the Environmental Policies in India and recent developments
(Remembering and understanding)

Analyze the Impact of urbanization on Environment (Analyzing)

Evaluate the Urban Environmental administration in India (Applying)

Module – I (10 hours)

Development and Environmental issues in India; Environmental Policy in India; Role of Judiciary in Environmental administration in India; Civil Society and Environmental protection in India

Module – II (15 hours)

Development – Environment Discourse; Global Environmental Governance

Module-III (10 hours)

Urban Environmental administration and politics in India; Impact of urbanization on Environment and Public Health.

Module –IV (10 hours)

Urban Environmental administration: Major initiatives; Environmental politics in Urban India; Environmental Protection and People's right and duties; Steps taken by the government for environmental protection in the recent years.

Suggested Readings

Ajith Sankar- Environmental Management

Bruckmeier, Karl - Global Environmental Governance: Social-Ecological Perspectives

Arild Vatn- Environmental Governance: Institutions, Policies and Actions

J.P. Evans - Environmental Governance

Jean-Frederic Morin, Amandine Orsini- Essential Concepts of Global Environmental Governance

Frank Biermann, Philipp H. Pattberg - Global Environmental Governance Reconsidered

Prakash Chand Kandpal- Environmental Governance in India: Issues and Challenges

Albert Breton- Environmental Governance and Decentralisation

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PAIG0023: INNOVATION IN GOVERNANCE**Credits: 3 (45 lectures) (45 Hours)****COURSE OUTCOMES**

At the end of this course students are able to:

Understand the Institutional Framework for Promoting Innovations (Remembering & Understanding)

Understand the Methodological Approach for studying best Practices (Understanding)

Analyze the Innovations in Public Services (Analyzing)

Evaluate the role of citizen's participation in governmental innovations (Applying)

Module – I (10 hours)

Innovations in Governance: Meaning of innovation in governance; Perspectives and Challenges; Characteristics and Patterns of

Innovations; Institutional Framework for Promoting Innovations; Public Governance and Innovations: Administrative Reform to Innovation Discourse

Module – II (10 hours)

Understanding Innovations: Innovation for Achieving a Quality of Life, Methodological Approach for studying best Practices,

Capacities for Innovation and Best Practices

Module – III (10 hours)

Innovations in Public Services: Recent trends; Innovation Capacity in Organizations; Leadership and Innovation; Innovations in different sectors: General Administration, Urban Administration, Health Administration, Private Sector, Agriculture, etc

Module – IV (10 hours)

Transferability of Best Practices and Innovations: The Ombudsman against Corruption, Technology and Changing Nature of

Organizations, Best Practices of Knowledge Management Framework, Diffusion of Innovation in a Development Context

Module – V (05 hours)

Issue Areas: Originality and Replication of Innovations; Innovation with or Without Improvement; Citizen Participation in

Government Innovations; Research in Innovative Governance

Suggested Readings

Anttiroiko et.al. (Eds.) (2011), Innovations in Public Governance, IOS Press.

Bevir, Mark, ed. (2010) The Sage Handbook of Governance. Thousand Oaks, CA: Sage Publications.

Borins, S. (2001), The Challenge of Innovating in Government (PricewaterhouseCoopers Endowment for the Business of Government,) Governance Innovators Network, <http://www.innovations.harvard.edu/>
Innovations in Governance and Public Administration: Replicating what works, (2006) Department of Economic and Social Affairs, United Nations, New York

Jean Hartley (January 2005), Innovation in Governance and Public Services: Past and Present, Public Money & Management, pp.27-36.

Newman, J., Raine, J. and Skelcher, C. (2000), Innovation in Local Government: A Good Practice Guide (DETR, London).

Peters, B. Guy (1996) The Future of Governance: Four Emerging Models, pp. 1-20.

Pollitt, C. and Bouckaert, G. (2000), Public Management Reform: A Comparative Analysis (Oxford University Press, Oxford).

Sandford Borins, ed., (2008), Innovations in Government Research, Recognition, and Replication, Brookings Institution Press.

Stephen P. Osborne, Ed.,(2001), The New Public Governance? Emerging Perspectives on the Theory and Practice of Public Governance. London: Routledge

Walker, R., Jeanes, E. and Rowlands, R. (2002), Measuring innovation: Applying the literature based innovation output indicator to public services. Public Administration, 80, pp. 201–214.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	L	L	L
CO 2	L	H	L	L
CO 3	L	L	H	L
CO 4	L	L	L	H

PASL0200: SERVICE LEARNING

Course Code: Credits: 2 (30 lectures) (60 Hours)

COURSE OUTCOMES

At the end of this course students are able to:

Learn the concept of service learning and community engagement. (Remembering)

Understand the importance of service learning and community engagement for developing the skills of addressing real life issues in one's own community. (Understanding)

Develop an understanding of the importance of communication skills in interacting with community members. (Understanding)

Be exposed to and empathize with people who are less fortunate than they are, politically, economically, socially, academically etc. (Applying)

Organize awareness programmes, rallies, campaigns, social service etc. (Analysing)

Develop the skills of problem solving and reflective thinking. (Analysing)

Realize one's potentiality to make a difference in the life of their community members. (Evaluating)

Understand and experience various political and administrative issues that exist in the Society. (Evaluating)

Module I: Introduction to Service learning (10 hours)

Nature, Objectives, Historical Overview, Models, Qualities, Role of Higher Education Institutions (HEIs), Benefits, Challenges and Opportunities of Service Learning.

Module II: Social Responsibilities of HEIs (10 hours)

Understanding Social Responsibilities of HEIs, Community-University Engagement, Engaged Teaching, Research and Service, Principles for Community Engagement, Forms of Community Engagement, Community Based Participatory Research.

Module III: Understanding Rural Society (20 hours)

Rural Life Style, Rural Society, Rural Economy and Livelihood, Rural Institutions (Traditional Rural Organisations, Self-Help Groups, Panchayati Raj Institutions), Rural Development Programmes (Sarva Siksha Abhiyan, Beti Bachao Beti Padhao, Swachh Bharat, Ayushman Bharat, MNREGA etc.).

Module IV: Practices for Service learning and Community (10 hours)

Internship, Community Mobilization, Awareness/Advocacy campaign, community meetings, rural reporting, case studies.

Suggested Readings

Berryman, S., and Bailey, T. (1992): The Double Helix of Education and the Economy. New York: The Institute on Education and the Economy, Teachers College, Columbia University.

Blum, R. E. (May 10, 1995): Learning and Teaching: Our Work Together. Draft Concept Paper. Portland, OR: Northwest Regional Educational Laboratory.

Carnevale, A.; Gainer, L.; and A. Meltzer. (1990): Workplace Basics: The Essential Skills Employers Want. San Francisco: Jossey-Bass Publishers.

Collins, A., Brown, J.S. and S. Newman. "Cognitive Apprenticeship: Teaching the Craft of Reading, Writing and Mathematics", in L.B. Renick (ed.) Knowing Learning and Instruction: Essays in honour of Robert Glaser. Hillsdale, Erlbaum. Druiian, G., Owens, J. and S. Owen. "Experiential Education: Search for Common

Roots". in R. Kraft and Y. Kielomeier (eds.) Experiential Learning in Schools and Higher EducationJ'. Dubuque, IAI KendalVHunt Publishing Co. (1995), pp. 17-25.

Dukehart, L. (1994). Community as Classroom: A Report Based on Presentations at the Work Now and in the Future 11 Conference". 7th Portland, OR Northwest Regional Educational Laboratory.

Hamilton, S.F. (1990). Apprenticeship for Adulthood: Preparing Youth for the Future. New York: Free Press.

Zelldin, S. (1995). School to Work and Youth Development: Identifying Common Ground. Boston, M;A. High.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	L	H	L	L
CO 2	L	H	L	L
CO 3	L	L	L	H
CO 4	L	L	H	H
CO 5	L	L	H	H
CO 6	L	L	L	H
CO 7	L	L	L	H
CO 8	H	H	H	H

DE -1: Elective Group I - Choose any one**PAHR0024: INTRODUCTION TO HUMAN RIGHTS (HR)****Credits: 3 (45 Hours)****Course Outcomes:**

At the end of this course, students would be able to:

CO 1: Recall the meaning, kinds and nature of human rights, and their evolution and development at domestic and international levels (Remembering)

CO 2: Explain the nature and importance of UDHR, its universality and worldwide influence (Understanding)

CO 3: Identify the codification, nature and types of rights provided by the ICCPR (applying)

CO 4: Examine the state's obligations for implementing ICESCR (Analysing)

Module - I (15 hours) Understanding Human Rights:

Meaning of Human Rights; Kinds and Nature of Human Rights; Evolution of Rights - Developments at Domestic Level; Important Declarations of Rights; International Efforts to Develop Human Rights Norms.

Module – II (15 hours) Universal Declaration of Human Rights:

Objectives, Nature, and importance of UDHR; Critique of Human Rights; Universality of Human Rights; Worldwide Influence of UDHR; NGOs on Human Rights.

Module -III (15 hours) International Covenant on Civil and Political Rights:

Codification of Rights; Nature of International Covenant on Civil and Political Rights (ICCPR); types of Rights provided by the ICCPR; Limitations on the Exercise of Rights; Mechanism for monitoring the implementation of Rights; The procedure to file complaints.

Module - IV (15 hours) International Covenant on Economic, Social and Cultural Rights:

International Covenant on Economic, Social and Cultural Rights (ICESCR); Implementation Mechanism; The Nature of Obligations under ICESCR; Economic, Social and Cultural Rights under the Indian Constitution.

Suggested Readings

Baehr, Peter. *Human rights: Universality in practice*. Springer, 2016.

O'Byrne, Darren. *Human rights: An introduction*. Routledge, 2014.

Assembly, UN General. "Universal declaration of human rights." *UN General Assembly* 302.2 (1948): 14-25.

Nickel, James W. *Making sense of human rights: Philosophical reflections on the universal declaration of human rights*. Univ of California Press, 1987.

Joseph, Sarah, and Melissa Castan. *The international covenant on civil and political rights: cases, materials, and commentary*. Oxford University Press, 2013.

Schabas, William A. *UN International Covenant on Civil and Political Rights: Nowak's CCPR Commentary*. NP Engel Verlag, 2019.

Saul, Ben, David Kinley, and Jaqueline Mowbray. *The international covenant on economic, social and cultural rights: commentary, cases, and materials*. OUP Oxford, 2014.

Sepúlveda, M. Magdalena, and María Magdalena Sepúlveda Carmona. *The nature of the obligations under the International Covenant on Economic, Social and Cultural Rights*. Vol. 18. Intersentia nv, 2003.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H		

CO 3			H	
CO 4				H

PAIR0025: INTRODUCTION TO INTERNATIONAL RELATIONS (IR)**Credits: 3 (45 Hours)****Course Outcomes:**

At the end of this course, students would be able to:

CO 1: Explain the Basic concepts of IR, its development as a discipline, Actors and Processes, Power and Balance of Power, International Economics (Understanding)

CO 2: Identify the theories of International Relations (Applying)

CO 3: Examine the various Issues in Contemporary IR (analyzing)

MODULE I [15 hours]: Introduction and Basic concepts of IR:

Introduction: Why study IR – Development of IR as discipline – International System/International Society- Impact of Globalisation - Global South and IR

Actors and processes in IR: States and Non-State Actors (IGO's, NGO's, MNC's and terrorist groups).

Power: Definition and Exercising Power – Elements of National Power, Soft Power and Its relevance in the contemporary IR study.

Balance of Power – Bi-Polar/Unipolar/Multi-Polar and Non-Polarity- Soft balancing.

International Economics

Module II [15 hours]: Theories of International Relations:

Realist, Liberal, Marxist and Critical Theories of IR

[Newly added]

MODULE-III [15 hours]: Issues in Contemporary IR:

International Terrorism, Nuclear Proliferation, Human Security, Climate Change and Environmental Security, Energy

Security, Natural resource scarcity, Pandemic and Disaster Management, IR in Covid and Post Covid

Suggested Readings

Andrew F. Hart & Bruce D. Jones (2010-2011), How Do Rising Powers Rise?, Survival, vol. 52 no. 6, December –January, pp. 63–88.

Baylis, John and Steve Smith (2011): *The Globalisation of World Politics*, New York: Oxford University Press .

Derek McDougal (2012): Responses to 'Rising China' in the East Asian Region: soft balancing with accommodation, Journal of Contemporary China, 21(73), January, 1–17.

Joseph Y. S. Cheng (2011): The Shanghai Co-operation Organization: China's Initiative in Regional Institutional Building, Journal of Contemporary Asia, 41:4, 632-656.

Mary Martin and Taylor Owen (2010): The Second Generation of Human Security: lessons from the UN and EU Experience, *International Affairs* 86: 1, 211-224.

Michael Sheehan (2010): International Security: An Analytical Survey, Viva Books: New Delhi. Oxford University Press: New Delhi.

Paul R. Viotti and Mark V. Kauppi (2007): International relations and World Politics: Security, Economy, Identity, Pearson: Delhi.

Paul, T.V. (2009): *The Tradition of Non-use of Nuclear Weapons*, Stanford: Stanford University Press.

Seethi K.M.(2009): Perils of Nuclear Renaissance, Indian Journal of Politics and International Relations, vol. 1, JulyDecember

Tanja A. Börzel and Thomas Risse (2010): Governance without a state: Can it work? *Regulation & Governance*, 4, 113–134.

Thomas Wilkins (2010): The new 'Pacific Century' and the rise of China: an international relations perspective, Australian Journal of International Affairs, 64:4, 381-405

Vinodan.C. (2010): Energy, Environment and Security in South Asia, *International Journal of South Asian Studies*, vol.3, no.1, pp 1-12

PAIC0026: ISSUES IN CONTEMPORARY INTERNATIONAL RELATIONS (HR/IR)

Course Outcomes:

At the end of this course, students would be able to:

CO 1: Explain the Basic concepts of Globalisation and Challenges to Developing countries (Understanding)

CO 2: Identify Various Environmental Issues addressed at International levels (Applying)

CO 3: Examine the various Regional and Global Security Issues (analyzing)

Module I [Hours 15] : Globalisation and Challenges to Developing Countries

Globalization and (under)development- population explosion- human rights issues- international migration and refugee crisis

Module II [Hours 15] : International Relations of Environmental Issues

Sustainable development- the notion of collective goods- natural resource exploitation and scarcity- global warming and international climate regimes- disputes over resources- nuclear proliferation and international treaties

Module III [Hours 15] : Regional and Global Security Issues

Political instability in third world countries- energy security- cyber security- arms proliferation-Non State actors- terrorism and counter terrorism

Suggested Reading

Baylis, John & Smith S (Eds) (2014). *The Globalization of World Politics: An Introduction to International Relations*. OUP.

Betts, Alexander & Loescher G (Eds) (2011). *Refugees in International Relations*. Oxford University Press.

Brown C & Ainley K (2009). *Understanding International Relations* (4th ed). Palgrave Bull, Hedley (1977). *The Anarchical Society: A Study of Order in World Politics*. Macmillan.

Buzan B. & Lawson G. (2015). *The Global Transformation: History, Modernity and the Making of International Relations*: CUP.

Castles, Stephen & Davidson A. (2005). *Citizenship and Migration: Globalization and Politics of Belonging*. Routledge 6. Castles, Stephen & Miller M. J. (2003). *The Age of Migration: International Population Movements in the Modern World* (Third Edition). MacMillan.

Christian, Reus -Smith & Snidal D (eds.) (2008). *Oxford Handbook of International Relations*.

Clark I. (1997). *Globalization and Fragmentation: International Relations in the Twentieth Century*. Oxford University Press.

Dinar, Shilom. (2009). Scarcity and Cooperation along International Rivers. *Global Environmental Politics*, 9(1), 109.

- Fiddian-Qasmiyeh E. et al. (Eds) (2014). *The Oxford Handbook of Refugee and Forced Migration Studies*. Oxford University Press.
- Higgins, R. & Flory, M. (2003). *Terrorism and International Law*. Routledge.
- Robert Art & Robert Jervis (eds) (2012). *International Politics: Enduring Concepts and Contemporary Issues* (11th ed). Pearson.
- Samson, T. (2000). *Issues in International Relations*. Routledge.
- Teryima B, Ashaver (2013, Sep. -Oct.). Poverty, Inequality and Underdevelopment in Third World Countries: Bad State Policies or Bad Global Rules?. *IOSR Journal Of Humanities And Social Science (IOSR-JHSS)*, 15(6), 33-38.
- Vincent, R. J. (1995). *Human Rights and International Relations*. CUP.
- Zolberg A. R. Et al (1989). *Escape from Violence: Conflict and the Refugee Crisis in the Developing World*. Oxford University Press.

PAPF0027: POLICY FORMULATION- STRUCTURES AND PROCESSES (PP)

Credits: 3 (45 Hours)

Course Outcomes:

At the end of this course, students would be able to:

CO1- Recall the basic concepts and types of public policy (Understanding).

CO2- Identify the role of different institution in policy formulation (Applying)

CO3- Examine the agencies involved in policy formulation process (Analysing)

Module I (15 Hours) Introduction to Public Policy

Meaning, Nature and Scope of Public Policy; Significance of Public Policy; Types of Policy; Public Policy and Public Administration; Policy Cycle.

Module II (15 hours) Policy Formulation Structures

Inter-Governmental Relations; Role of Legislature; Role of Executive; Role of Judiciary; Role of Bureaucracy; Challenges in Policy Formulation.

Module III (15 Hours) Policy Formulation Processes

Techniques of Policy Formulation; Approaches/ Models of Policy Formulation; Agencies involved in Policy Formulation; Informal Channels of Policy Formulation; Role of International Organizations.

References:

- R.K Sapru, Public Policy: A Contemporary Perspective, Sage Publications India Pvt Ltd, 2017.
- Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
- Maniram sharma, Public Policy in India, Mahaveer Publications, 2023.
- Haridwar Shukla, Public Policy and Administration in India, Mahaveer Publications, 2021
- Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015
- Ramesh Kumar Tiwari and Aasha Kapur Mehta, Public Policy and Administration, Gyan Publishing House 2012.
- Christoph Knill and Jale Tosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.

DE 3 : Elective Group II - Choose anyone

PALM0028: LABOUR MIGRATION, CITIZENSHIP AND GOVERNANCE (HR/IR)

Credits: 3 (45 Hours)

Course Outcomes:

At the end of this course, students would be able to:

CO 1: Recall the meaning, nature, reasons, and impact of labour migration. (Remembering/ Understanding)

CO 2: Identify the issue of human rights violations of migrant labourers. (Applying)

CO 3: Explain the Contribution of Labour Migration in India's Development (Understanding)

CO 4: Examine the issues of Labour migration and citizenship rights. (Analysis)

Module - I (15 hours) Understanding Labour Migration

Labour migration-meaning; nature and determinants; reasons and impact; Migrant Labours and human rights; International labour standards on labour migration; the role of ILO.

Module – II (15 hours) Labour Migration in India:

Overview of Labour Migration in India; Contribution of Labour Migration in India's Development; Labour Rights and Labour Standards for Migrant Labour in India.

Module -III (15 hours) Citizenship:

Significance; Nature of Citizenship; Labour migration and citizenship rights.

Module - IV (15 hours) Case studies:

Case Study on Inter-State Labour migration in India; Case Study on International Labour migration; Active citizenship case studies.

Suggested Reading:

Amrith, Megha, and Nina Sahraoui, eds. *Gender, work and migration: agency in gendered labour settings*. Routledge, 2018.

Panneerselvam, A. S. "Uncertain journeys: labour migration from South Asia".

Rajan, S. Irudaya, ed. *India migration report 2010: Governance and labour migration*. Taylor & Francis, 2020.

Acharya, Ashok. *Citizenship in a globalizing world*. Pearson Education India, 2011.

Mahanta, Nani G. *Citizenship Debate over NRC and CAA: Assam and the Politics of History*. SAGE Publishing India, 2021.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2	H	M		
CO 3		H		
CO 4			H	M

**PASE0029: INDIA IN SOUTH EAST ASIAN POLITICS
(HR /IR) (3 CREDITS)****Course Outcomes:**

At the end of this course students are able to:

CO 1: relate important aspects of the history of India and South East Asia (Remembering).

CO 2: explain the policies of India in relation to South East Asian Countries. (Understanding)

CO 3: Identify various Important International institutions and agencies in South East Asia (Applying)

CO 4: Examine the challenges faced by India by South East Asian Politics. (Analysing)

Module I Historical Developments:

Historical, cultural, political, Trade and Social history of India with South East Asia, Indian Influence on South east Asia,

Module II India and its Neighborhood:

Look East Policy, Act East Policy, Kaladan Multi-modal Transit Transport Project,

Module III International Institutions:

ASEAN, RECP, ADB, JICA, World Bank, SCO, BRICS, BIMSTEC

Module IV Indian Challenges:

Golden Triangle, South China Sea and Chinese Claims, String of Pearls, CPEC, OBORI, Malaccan Dilemma, Border Disputes, and Insurgency.

Suggested Readings:

Devotta, Neil (2015) An Introduction to South Asian politics. Routledge Publishing: New Delhi.

Ahmad, Ahrar (2013) Government and Politics in South Asia. West View Press: Colorado,US.

Pandit, Dhulipudi, Santishree and Basu, Rimli (2012) Cultural Diplomacy in South-East-Asia: India's Look East Policy, Buddhism as an instrument of Foreign Policy. LAP Lambert Academic Publishing: London, UK.

Ludden, David (2015) India and South Asia: A Short History (Short Histories). Pan Macmillan India: New Delhi.

Tat,Urni (2022) India's Development Diplomacy: Understanding Development Cooperation As a Tool For Strategic Engagement In South Asia. KW Publishers: New Delhi.

Bhattacharyya, Daipayan (2016) Government as Practice: Democratic Left in a Transforming India (South Asia in the Social Sciences) Cambridge University Press: New Delhi.

PAPP0030: PUBLIC POLICY IN INDIA (PP)

Credits: 3 (45 Hours)

Course Outcomes:

At the end of this course students are able to:

CO 1: Recall the various stages and determinants of public policy(Remembering).

CO 2: Explain the various determinants of Public Policy (Understanding)

CO 3: Identify India's developmental policies(Applying).

CO 4: Examine the policies for weaker and marginalized sections (Analysing).

Module I (15 Hours): Introduction to Public Policy in India

Historical perspectives and developments of Public Policy (Five Year Plans); Socio-economic and political determinants of Public Policy; Technology and Public Policy; Ethics in Public Policy

Module II (15 Hours) India's Developmental Policies

Education Policy; Health Policy; Environmental Policy; IT Policy; Economic Policy.

Module III (15 Hours) Policies for Weaker and Marginalized Sections

Tribal Development; Children Welfare; Women Empowerment; Policies for Senior Citizens; Transgender Inclusion;

References:

Rajesh Chakrabarti and Kaushiki Sanyal, Public Policy in India, Oxford University Press, 2016.
 Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.
 Maniram sharma, Public Policy in India, Mahaveer Publications, 2023.
 Haridwar Shukla, Public Policy and Administration in India, Mahaveer Publications, 2021
 Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015
 Veerendra Mishra, Transgenders in India: An Introduction, Taylor and Francis Group, Routledge Publications, 2023.
 John Baldock et. al., Social Policy, London: Oxford University Press, 2011.

PADV0031: DATA MANAGEMENT AND VISUALISATION**Credits: 2 (L.T.P 1-0-1) 15+30 hours****Course Outcomes:**

At the end of this course, students would be able to:

CO 1: Exhibit a basic understanding of data management and visualization (Understanding)

CO 2: Apply knowledge of data management and visualization to solve a business problem. (Applying)

Module – I Data Management & Visualisation:

Meaning and significance of data management; Data Management Platforms and software. Meaning and significance of data visualization; Data Visualization tools and software.

Module -II Data Management & Visualisation – Practical:

SAS - Statistical Analysis System

Visualization software (Tableau, Excel, Power BI)

Suggested Reading:

Strengtholt, Piethein. Data Management at Scale. N.p., O'Reilly Media, 2020.

International, Dama. DAMA-DMBOK: Data Management Body of Knowledge. United States, Technics Publications, 2017.

Data Visualization: Trends and Challenges Toward Multidisciplinary Perception. Germany, Springer Nature Singapore, 2020.

Grant, Robert. Data Visualization: Charts, Maps, and Interactive Graphics. United States, CRC Press, 2018.

Mapping of COs to Syllabus

	Module 1	Module 2	Module 3	Module 4
CO 1	H	H		
CO 2			H	H

PAIO0032: INTERNATIONAL ORGANISATIONS AND NATIONAL INTEREST (HR/IR)**Credit 3 (Hours 45)****Course Outcomes:**

At the end of this course students are able to:

CO 1: Recall key concepts and importance of IOs and national interests (Remembering)

CO 2: Identifying theoretical perspectives of IOs and national interests (Applying)

CO 3: Examine the functioning of the United Nations Organization and other International Organisations (Analysing)

Module 1 (Hours 10): International Organisations (IOs) and National Interest:

Key concepts, necessities of IOs, IOs and national interests, the demand for international regime

Module 2 (Hours 15): Theoretical approaches to international organizations and national interests: Theories and approaches to IOs and national interest

Module 3 (Hours 20): Functioning of the United Nations Organization and other IOs:

Evolution and Development, role and achievement of the UNO and other IOs, issues and challenges; nation-states' response to the UNO (case study of the permanent member states; non-permanent member states like India)

Suggested Readings:

Lenz, T., Hooghe, L., Marks, G. (2019). A Theory of International Organization. United Kingdom: OUP Oxford.

Pease, K. S. (2018). International Organizations: Perspectives on Global Governance. United Kingdom: Taylor & Francis.

Krasner, S. D. (2020). Defending the National Interest: Raw Materials Investments and U.S. Foreign Policy. United States: Princeton University Press.

Burchill, S. (2005). The National Interest in International Relations Theory. United Kingdom: Palgrave Macmillan UK.

Weiss, T. G. (2019). The United Nations and Changing World Politics. United States: Taylor & Francis.

Coicaud, J. (2007). Beyond the national interest: the future of UN peacekeeping and multilateralism in an era of U.S. primacy. Washington: United States Institute of Peace Press.

Roach, S. C., Griffiths, M., O'Callaghan, T. (2014). International Relations: The Key Concepts. United Kingdom: Taylor & Francis.

PAPI0033: POLICY IMPLEMENTATION (PP)

Credits: 3 (45 Hours)

Course Outcome:

At the end of this course students are able to:

CO 1: Explain the policy implementation system, models and approaches (Understanding).

CO 2: Identify policy implementation techniques and challenges (Applying).

CO 3: Examine the impact of public policy through case studies (Analysing).

Module I (15 Hours) Policy Implementation System

Policy Implementation as a Concept; Systems and Issues of Policy Implementation; Approaches/ Models in Policy Implementation;

Module II (15 Hours) Implementation Techniques

Conditions for Successful Implementation of Public Policy; Agencies in Policy Implementation; Challenges in Policy Implementation.

Module III (15 Hours) Case Studies in Policy Implementation

Suggested areas- Education, Health, Tribal Development, Weaker Sections. Evaluation and Feedback: Monitoring and Social Audit.

Suggested Readings

Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.

Christoph Knill and Jale Tosun, Public Policy: A New Introduction, Red Globe Press, London, 2020.

Paul Cairney,. Understanding Public Policy: Theories and Issues, Red Globe Press, London, 2020 4.

Jaideep Singh, Case Studies in Public Administration, Indian Institute of Public Administration, 1983.

Maniram sharma, Public Policy in India, Mahaveer Publications, 2023.

Haridwar Shukla,Public Policy and Administration in India, Mahaveer Publications, 2021.

Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015

PACG0034: CHINA AND THE GLOBAL SYSTEM (HR/IR)

Credit 3 (Hours 45)

Course Outcome:

At the end of this course students are able to:

CO 1: Explain the policy implementation system, models and approaches (Understanding).

CO 2: Identify policy implementation techniques and challenges (Applying).

CO 3: Examine the impact of public policy through case studies (Analysing).

Module 1 (Hours 15): Rise of China and the debate on Asian Century

1.1 Theoretical Explanations: China as a major power

1.2 China's Foreign policy and World view- Peaceful Rise and State power

1.3 Chinas perspectives on Asian Century

1.4 China and the UNO

Module 2 (Hours 15): China and Global powers

2.1 US- China relations

2.2 Russia- China relations

2.3 EU-China relations

2.4 India- China Relations

2.5 Japan – China

Module 3 (Hours 15): Chinas engagement with the regions

3.1 OBOR (One Belt, One Road)

3.2 Neighbourhood policy – South Asia- East Asia and South

East Asia 3.3 Territorial disputes: Maritime disputes: South China

Sea Boundary dispute

Suggested Readings:

Dahlman, C. (2011). The World Under Pressure: How China and India Are Influencing the Global Economy and Environment. United States: Stanford University Press.

Cao, C., Han, X., Parker, R., Appelbaum, R. P., Simon, D. (2018). Innovation in China: Challenging the Global Science and Technology System. United Kingdom: Polity Press.

He, A. (2016). The Dragon's Footprints: China in the Global Economic Governance System Under the G20 Framework. Canada: McGill-Queen's University Press.

Liu, W. (2014). China in the United Nations. United States: World Century Publishing Corporation.

Oertel, J. (2015). China and the United Nations. Germany: Bloomsbury Publishing.

Mifune, E., Kondapalli, S. (2010). China and Its Neighbours. India: Pentagon Press.

Tai, M. (2019). China and Her Neighbours: Asian Diplomacy from Ancient History to the Present. United Kingdom: Zed Books.

PAPO0035: POLICY ANALYSIS (PP)

Credits: 3 (45 Hours)

Course Outcome:

At the end of this course students are able to:

CO 1: Explain the basic concept and framework of policy analysis (Understanding)

CO 2: Identify methods and techniques of Policy Analysis (Applying).

CO 3: Examine the various issues involved in policy analysis (Analyzing).

Module I (15 Hours) Introduction to Policy Analysis

Meaning of Policy Analysis; Stages in Policy Analysis; Types of Policy Analysis; A Framework of Public Policy Analysis in Indian Context.

Module II(15 Hours)

Policy Analysis Scenario: Policy Sciences: Nature, Scope and Utility; Methods and Techniques of Policy Analysis; Civil Societies and democratization of Policy Analysis;

Module III (15 Hours)

Issues in Policy Analysis: Ethics in Policy Analysis, Key elements of Policy Analysis (Stuart S. Nagel); The major Dimensions of policy analysis; Policy Analysis and Emerging Crisis

References:

Jean Dreze, Social Policy, New Delhi: Orient Blackswan Private Limited, 2016.

V. K. Agnihotri, Public Policy: Analysis and Design, Concept Publishing Company, 1995.

Rachel Meltzer and Alex Schwartz, Policy Analysis as Problem Solving: A Flexible and Evidence-Based Framework, Routledge, 2018.

Bidyut Chakrabarty and Prakash Chand, Public Policy: Concept, Theory and Practice, Sage Publications India Pvt Ltd, 2016.

Kuldeep Mathur, Public Policy and Politics in India, Oxford University Press, 2015

Ramesh Kumar Tiwari and Aasha Kapur Mehta, Public Policy and Administration, Gyan Publishing House 2012.

Rajesh Chakrabarti and Kaushiki Sanyal, Public Policy in India, Oxford University Press, 2012.

DEPARTMENT OF SOCIAL WORK

MASTER OF SOCIAL WORK- MSW

VISION

To be a centre of excellence in Social Work teaching, learning, research and practice which promotes commitment to social justice, fosters social consciousness and sensitivity, and upholds the dignity and worth of all.

MISSION

The Social Work Department of Assam Don Bosco University seeks to:

Promote rights based approaches to development based on the International declaration of human rights
Achieve excellence in teaching, learning, research, practice, outreach programmes and extension services
Promote critical thinking and innovative intervention in response to societal and environmental problems
Mould professionally competent individuals who are sensitive and committed to the values, principles and ethics of social work

Create and foster an environment of justice and respect for all by promoting social consciousness, courage of conviction, appreciation for diversity and caring for creation.

PROGRAM OUTCOMES – MSW PROGRAMME

- PO 1: Critical Thinking and Professional Judgment:** Apply theoretical knowledge to make a critical analysis, intervene using innovative frameworks and evaluate and follow up.
- PO 2: Effective Communication:** Engage in inter-personnel, behavioral change communication and be proficient in Information Communication Technology.
- PO 3: Gender Sensitization, Social Commitment and Social Interaction:** Work in teams and partnerships at local, national and transnational projects and settings with focus on gender equity and cultural sensitivity
- PO 4: Effective Citizenship:** Engage in service learning and community engagement programmes for contributing towards achieving of local, regional and national goals.
- PO 5: Ethics:** To engage in social work practice as per National Association of Social Worker's ethical framework.
- PO 6: Environment and Sustainability:** Participate and promote World sustainable development goals 2030.
- PO 7: Self-directed and Life-long Learning:** Engage in continuous learning for professional growth and development.
- PO 8: Scientific Temper:** - Gaining aptitude for research for contribution to knowledge enterprise and documentation of social work theory and practice.

PROGRAM SPECIFIC OUTCOMES

- PSO 1: PSO 1: Conceptual clarity:** Students get familiarized and attain conceptual clarity in social work theories, perspectives, models, methods and processes of social work practice.
- PSO 2: PSO2: Attaining procedural skills:** Students attain knowledge of different steps of doing a work/intervention as per local, national and international protocols- norms, legal bindings and regulations.
- PSO 3: PSO3: Strategic intervention skills:** Learn what should be done when, and how it should be done when it comes to social work interventions in the fields of children, women, families, community development, health and mental health, development projects, and other welfare activities.

PSO 4: PSO4: Attitudinal change: Working with the personal self for meaningful and enriching social work professional career.

LIST OF COURSES

SI.NO	Course
1.1	History, Ideologies and fields of Social Work
1.2	Human Growth and Development
1.3	Introduction to Indian Society, Polity and Economics
1.4	Social Work with Communities and Social Action
1.5	Environment and Disaster Management
1.6	Gender Studies
1.7	Concurrent Field Work and Rural Practicum
1.8	Service learning/Rural practicum
2.1	Social Casework Practice with Individuals and families
2.2	Social Work Practice with Groups
2.3	Social Work Research and Statistics
2.4	Social Welfare Administration
2.5	Introduction to Disability Studies
2.6	Concurrent Field Work II
3.1	Social Justice, Human Rights & Para-legal Education
3.2	Emerging Social Work Perspectives and Integrated Approach
3.3	Computer Applications for Social Sciences (Lab)
3.4	Community Development: Rural, Tribal and Urban
3.5	Governance and Community Development
3.6	Family Centered Social Work Practice
3.7	Social Work Practice with Children
3.8	Medical Social Work
3.9	Mental Health and Social Work
3.10	Organisational Structure, Behaviour and Development
3.11	Policies For Development Organisations – Urban, Rural and Tribal Communities
3.12	Introduction to Child Psychology and Development
3.13	Rights of the Child – Legal Framework, National and International Instruments
3.14	Continuous Field Work I
4.1	Social Development and Social Policy
4.2	Project cycle Management and Resource Mobilisation
4.3	Dissertation (Research Phase I and Research Phase II)
4.4	Community Health and Population Management
4.5	Community Development Practice with Disempowered Communities
4.6	Development Concerns and Women Empowerment
4.7	Families With Special Needs
4.8	Psychiatric Social Work
4.9	Community Health and Services
4.1	Human Resource Management: Social Work Perspective

4.11	Corporate Social Responsibilities – Concepts & Ideologies
4.12	Children with Special Needs
4.13	Child Centered Social Work Practice
4.14	Continuous Fieldwork II
4.15	Internship
VALUE ADDED COURSES	
4.16	Results Based Management of Projects and Programmes
4.17	Academic Writing, Research Proposal Development and Dissertation Writing Course
4.18	Working with Diversity

Mapping of Pos and PSOs.

Sl.No	Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3	PSO4	
1.1	History, Ideologies and fields of Social Work	H			L	H				H			M	
1.2	Human Growth and Development	H	M							H	M			
1.3	Introduction to Indian Society, Polity and Economics	H	M		L		L			H				
1.4	Social Work with Communities and Social Action			H		M	M		M	H	M	M	M	
1.5	Environment and Disaster Management	H		H			H		M	H		M	M	
1.6	Gender Studies	H		H		M		M	M	H	M		H	
1.7	Concurrent Field Work and Rural Practicum	M	M	L	L		M			H	L	L	L	
1.8	Service learning/Rural practicum		H	H	H	M	L	M	H	L	M	H	M	L

2.1	Social Casework Practice with Individuals and families	H	M			H			H	H	H	H	H
2.2	Social Work Practice with Groups	H	H			M				H	H	M	H
2.3	Social Work Research and Statistics	H		L		M		M	M	M	L		
2.4	Social Welfare Administration	H	M		M	M				H	M	H	
2.5	Introduction to Disability Studies	H				M				H	M		
2.6	Concurrent Field Work II	H	H	M	M	M		M		H	M	M	M
3.1	Social Justice, Human Rights & Para-legal Education	H		M	H	M				H	M		M
3.2	Emerging Social Work Perspectives and Integrated Approach	H		H		M		M	L	H	H	M	
3.3	Computer Applications for Social Sciences (Lab)	M	H		L			H					M
3.4	Community Development: Rural, Tribal and Urban	H		H	M	M	H		M	H	H	H	H
3.5	Governance and Community Development	M			M		L	H		H		H	H
3.6	Family Centered Social Work Practice	H		H		M				H	H	H	M
3.7	Social Work Practice with Children	H	H	M	M	H				H	H	M	H
3.8	Medical Social Work	H	H			H			M	H	H	H	H
3.9	Mental Health and Social Work	H	H						M	H	H	H	H
3.1	Organisational Structure, Behaviour and Development	H	M			L		M		H		M	
3.11	Policies For Development Organisations - Urban, Rural and Tribal Communities	H		M			M			H	H	H	H
3.12	Introduction to Child Psychology and Development	H				H		M		H	H	H	H
3.13	Rights of the Child – Legal Framework, National and	H		H	H	H				H	H	H	

	International Instruments												
3.14	Continuous Field Work I	H	H	H	H	H	H	H	H	H	H	H	H
4.1	Social Development and Social Policy	H		H	M					H	M	M	
4.2	Project cycle Management and Resource Mobilisation	H				L		H		H	M	H	
4.3	Dissertation ((Research Phase I and Research Phase II))	H	H			M		H	H	H			M
4.4	Community Health and Population Management	H		H	M	M			M	H	H	H	H
4.5	Community Development Practice with Dis-empowered Communities	H		L	M			M		H	H	H	H
4.6	Development Concerns and Women Empowerment	H	M	H	M	M			M	H	H	M	M
4.7	Families With Special Needs	H	H	H		M				H	H	H	H
4.8	Psychiatric Social Work	H	H			M		M	H	H	H	H	H
4.9	Community Health and Services	H		H		M			M	H	H	H	H
4.1	Human Resource Management: Social Work Perspective	H				M		H		M		H	
4.11	Corporate Social Responsibilities - Concepts & Ideologies	H				M			M	H		M	
4.12	Children with Special Needs	H	M	H		M			M	H	H	H	H
4.13	Child Centered Social Work Practice	H	M	H		M			M	H	H	H	H
4.14	Continuous Fieldwork II	H	H	H	H	H	H	H	H	H	H	H	H
4.15	Internship	H	H	H	H	H	H	H	H	H	H	M	H
4.16	Results Based Management of Projects and Programmes	H	M	H	M	M	H	H	H	M	H	M	H
4.17	Academic Writing, Research Proposal Development and	M	M	H	M	M	H	H	H	M	M	M	H

	Dissertation Writing Course												
4.18	Working with Diversity	M	H	M	H	M	H	M	H	M	M	H	M

DETAILED SYLLABUS

SWHI0035: HISTORY, IDEOLOGIES AND FIELDS OF SOCIAL WORK

(3-0-0) (3 Credits - 45 hours)

Course Outcomes:

Introduce the basic concepts of social work to the students. (Understanding)

Introduce to the students the history and philosophy of social work, its methods and fields (Remembering)

Introduce social work as a profession (Applying)

Motivate the students to appreciate social work as a profession and to recognize the need and importance of social work education, training and practice. (Creating)

Module I: Introduction to Social Work (11 hours)

Concepts and Definitions: – Social Work, Social Service, Social Welfare, Social Reform, Social Defense, Social Policy, Social Action, Social Legislation and Social Advocacy ; Principles, Objectives, Scope and Goals ; Process of Social Work; Professional values and Code of ethics; Skills of social worker

Module II: History and Ideologies of Social Work (11 hours)

Historical development of Social Work in UK, USA and India: The Elizabethan poor law (1601); Charity Organization Society (1869); The Settlement House Movement, (USA); The Poor Law Commission of 1905; The Beveridge Report (1941); Social Reforms and Social Movements; Gandhian Philosophical Foundation to Social Work in India.

Module III: Social Work Profession (11 hours)

Social Work Theories; Professional organizations; Indian Association of Professional Social Workers; National Association of Social Workers; International/Indian Council of Social Workers; International Association of Schools of Social Work

Module IV: Fields of Social Work Practice (12 hours)

Family, Child and Youth Welfare; Social Work Practice in Industries/ Industrial Social Work; Social Work for weaker sections:

Aged, Persons with Disability, Women Welfare; Environment/Ecology; Healthcare: Medical and Psychiatric; School Social Work; Correctional Administration

Suggested Readings

Gore. M.S, Social Work and Social Work Education, Asia, Publication house, Mumbai, 1965

Jainendra Kumar Jha, Practice of Social work, Anmol Publications, New Delhi, 2002,

Joshi.S.C, The Handbook of Social work, Akansha Publishing House, New Delhi, 2004.

Paul Chowdhury, Introduction to Social Work, ATMA RAM and SONS, Delhi, 2000.

Sanjay Bhattacharya, Social work – An Integrated Approach, Deep and Deep Publications Pvt Ltd, New Delhi, 2003

Walsh Joseph, Theories of Direct Social work practice, Thomson Brooks, Cole, 2006

Allan, June, Bob Pease and Linda Briskman (ed.). Critical Social Work – An Introduction to Theories and Practices, Rawat Publications, Jaipur, 2003.

Bhattacharya, Sanjay, Social Work Interventions and Management, Deep and Deep, New Delhi, 2008

Bogo, Marion, Social Work Practice – Concepts, Processes and Interviewing, Rawat Publications, Jaipur, 2007

Cox, David and Manohar Pawar, International Social Work – Issues, Strategies and Programs, Vistar Publications, New Delhi, 2006

Desai, Murli, Ideologies and Social Work, Rawat Publications, Jaipur, 2002

Dominelli, Lena, Social Work: Theory and Practice for a Changing Profession, Polity Press, London, 2004

Skidmore AR and Milton G Thackeray, Introduction to Social Work, Prentice Hall, New Jersey

Lukose P J, Social analysis: A guide for the Social Workers, Media House Publications, New Delhi-2015.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2		H	M	
CO 3	M	H	H	H
CO 4			H	H

SWGD0036: HUMAN GROWTH AND DEVELOPMENT**(2-0-0) (2 Credits - 30 hours)****Course Outcomes**

Introduce the basic concepts of human growth and development. (Remembering)

Introduce the Personality theories (Understanding & Applying)

Introduce the Concept of Mental Health and discuss the role of social worker in promoting it. (Understanding and Creating))

Introduce the concept of health, causes, symptoms, treatment and prevention of communicable and non-communicable diseases (Understanding, Applying, Analyzing and Evaluating)

Module I: Meaning of Growth and Development (8 hours)

Meaning of growth, development and maturity, Principles of human development

Approaches to the study of human development: biological, maturational, psychoanalytic, behavioural, cognitivedevelopmental, ecological, Social

Influence of socialization and development - family, social groups, institution, community and culture.

Module II: Developmental Stages and Personality Theories (10 hours)

Physical, Emotional, Cognitive and Social aspects of the following developmental stages with special reference to Indian conditions – Infancy, Babyhood, childhood, adolescence, adulthood, old age.

Personality theories – Freud, Jung, Adler, Erikson, Rogers, Maslow

Module III: Mental health (5 hours)

Concept of Normalcy and abnormality - Symptoms, Causes and treatment of neuroses and psychoses, personality disorder and mental retardation.

Role of Social Workers in Promoting Mental Health

Module IV: Physical Health (7 hours)

Concept of health, hygiene, WHO definition of health; nutrition, malnutrition and its impact on growth

Communicable and non-communicable diseases - Symptoms, causes, treatment, prevention and control of some common diseases – communicable: T.B., Leprosy, STD, HIV, Typhoid, Chickenpox, Malaria, Hepatitis; non-communicable: Hypertension, Diabetes, Cancer, Malnutrition and deficiency diseases.

Institutions and agencies intervening in human growth and development- family, education, Health care systems

Suggested Readings

Berk, Laura E. Development through the Lifespan, 5th edition. Allyn and Bacon. London: 2009

Ahuja, Niraj. A Short textbook of Psychiatry, Himalaya Publishing House. New Delhi: 2005

Bhattacharya, Sanjay Dr. 2008. Social Work: Psycho-Social and Health Aspects. New Delhi: Deep and Deep Publication, 1992.

Clifford T. Morgan, Richard A. King, John R. Weisz, John Schopler, Introduction to Psychology, Tata Mc.Graw Hill Edition.

Coleman James. C, Abnormal Psychology and Modern Life, D.B. Taneporevela. Mumbai: 1975

Dandapani S., General Psychology, Neelkamal Publications Pvt. Ltd. Hyderabad: 2007

Diagnostic and Statistical Manual of Mental Disorders – 4th Edition. DSM – IV-TR. American Psychiatric Association. Washington DC: 2000

Hurlock, Elizabeth, Developmental Psychology, Tata Mc Graw Hill. New York: 2001

Kaplan Saddock, Synopsis of Psychiatry. 7th Ed. BI Waverly Pvt. Ltd. New Delhi: 1994

Park. J.E and Park. K, TextBook of Preventive and Social Medicine, Bansaridas Bhanot. Jabalpur: 2003

Robert A. Baron, Psychology, 5th Edition. Pearson. Prentice Hall: 2001

Steinberg, Laurence, Adolescence, McGraw Hill Inc. New York: 1993

WHO, The ICD – 10 Classification of Mental and Behavioural Disorders, Diagnostic Criteria for Research, AITBS Publishers and Distributors (Regd.). Delhi: 2004

Archambeault, John. (2009). Social Work and Mental Health, UK: Learning Matters Pvt Ltd.

Paula Nicolson, Rowan Bayne and Jenny Owen. (2006). Applied Psychology for Social Workers, UK: Palgrave Macmillan Ltd. (3rd Edition).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	M	H	H	
CO 3		M	H	
CO 4	M			H

SWIS0037: INTRODUCTION TO INDIAN SOCIETY, ECONOMICS AND POLITY

(2-0-0) (2 Credits- 30 hours)

Course Outcomes

Understand the concept of society& culture, major social institutions, structure, stratification, different approaches to the study of society and to develop an understanding on social change and social mobility; (Remembering and Understanding)

Understand and define basic concepts of economic and political theories
(Remembering and Understanding)

Explain how the economic and political institutions are organized, and how they have a bearing on human society (Applying)

Identify and evaluate the political institutions, processes and experiences of India, with special reference to North East India (Evaluating and Creating)

Module I: Basic Sociological Concepts (10 hours)

The concept of society – Meaning, definition and characteristics of society;

The concept of culture - Meaning, definition, elements & characteristics;

Social structure and stratification- Caste, Class, Tribes, Gender & Religion;

Approaches to the study of society- Structural Functionalism approach; Conflict/ Dialectical approach; Symbolic Interactionism;

Social institutions- Marriage, Family, Education& Religion;

Social change and social mobility; Social Work and society

Module II: Basic Concepts in Economics (10 hours)

Concept and definition: economy, micro and macroeconomics; market, demand and supply, national income, national income indicators; per-capita income, standard of living, poverty and its measurement in India

Economic systems: capitalism, socialism, communism, mixed economy, neoliberalism

Global economic institutions: World Bank, IMF, WTO, Asian Development Bank

Globalisation and Indian economy: Special Economic Zones and MNCs

Growth, development and social justice

Social work and economics

Module II: Basic Concepts in Politics (10 hours)

The concept of state – Meaning and definition, and elements; Nationalism and Nation State;

Perspectives of the state – Liberal, Marxist, Feminist, Gandhi, and Ambedkar

Key concepts-Liberty, Equality, Justice, Power, Legitimacy, Authority, Sovereignty;

The Constitution of India, and the Federal characteristic of Indian state;

Citizenship: rights and duties;

North East India: Decentralised governance & political movements

Suggested Readings

Abbas, H. Indian government and politics. New Delhi: Dorling Kindersley. (2010).

Ananth, V.K. India since independence: making sense of Indian politics. New Delhi: Dorling Kindersley. (2010).

Anthony, G. Sociology. Cambridge: Cambridge Polity Press. (2001).

Behera, M.C. (Ed.). Globalization and development dilemma: reflection from North East India. New Delhi: Mittal Publications. (2004).

Boyes, W., & Michael, M. Textbook of economics: Indian adaptation (6th ed.). New Delhi: Houghton Mifflin Co. (2005).

Desai, S. B. et al. Human Development in India: challenges for a society in transition. Hyderabad: OUP. (2010).

Dreze, J., & Sen, A. Uncertain glory: India and its contradictions. New Delhi: OUP. (2013).

Gupta, D. (Ed.). Social Stratification. New Delhi: Oxford University Press. (1997).

Guru, G., & Sarukkai, S. The Cracked Mirror: An Indian Debate on Experience and Theory. New Delhi: OUP (2017).

Hayami, Y., & Godo, Y. Development economics: from poverty to the wealth of nations, (3rd ed.). New Delhi: OUP. (2010).

Johari, J.C. Contemporary political theory: new dimensions, basic concepts and major trends. New Delhi: Sterling Publishers. (2006).

Mankiw, N. G. Principles of economics. Manson OH South West: Cengage Learning. (2008).

Menon, N Gender and Politics in India. New Delhi: Oxford University Press. . (1999).

Schrems, J. Understanding principles of politics and the state. Maryland: University Press of America. (2007).

Sen, A. Development as. New York: OUP. (1999).

Sesagiri, N. (Ed.). Survey of rural India: a comprehensive study of gram panchayat and community development block, (Vol. 26). New Delhi: GyanPrakashan. (2013).

Xaxa, V. State Society and Tribes. New Delhi: Pearson Education. (2014).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2	M	H	H	
CO 3		M	H	
CO 4	M			H
CO 5	H		M	H

SWCS0070: SOCIAL WORK WITH COMMUNITIES AND SOCIAL ACTION

(3-0-0) (3 Credits– 45 hours)

COURSE OUTCOMES

Define and spell community organisation and social action as methods in social work education and practice.(Remembering)

Explain the concepts related to community organisation and social action as methods of social work education and practice.(Understanding)

Apply the understanding of the concepts of community organisation and social action in the fields of practice.(Applying)

Analyze various field situations and apply there levant methods to address social concerns. (Analyzing)

Assess and choose community organisation or social action strategies to address social issues.

(Evaluating)

Combine effectiveness of community organisation or social action models and strategies and make modification if required for effective intervention in communities. (Creating)

Module I: Concepts of Community (11 hour)

Understanding Community: Definition, Concept, Types(Urban, Rural, Tribal and Open Communities), Structure and Functioning; Community Power Structure and Leadership; Community Dynamics.

Module II: Community Organization (11 hours)

Community Organization: Definition, Scope, Philosophy, Principles; Community Organization and Community Development; Approaches to Community Organization; Role and Skills of Social Worker in the Community; Techniques and Strategies of Community Organization.

Module III: Phases of Community Organization (11 hours)

Process of Community Organization - Study and Survey, Analysis, Assessment, Discussion, Organization, Action, Reflection, Modification and Continuation.

Module IV: Models of Community Organization, Community Development and Social Action (12Hours)

Models of Community Organization; Social Action – Principles and Process of Social Action and its Scope in India; Approaches to Social Action: Radical and Right based; Models of Community Development: Locality Development, Social Planning Model, Social Action Model, Saul Alinsky Model.

Suggested Readings

Bhattacharya, Sanjay, Social Work an Integrated Approach, Deep and Deep, New Delhi, 2006

Christopher, A.J.,and Thomas William, Community Organization and Social Action, Himalaya Publications, New Delhi, 2006

Freire, Paulo, Education for the Oppressed, Seaburg Press, New York, 1970

Freire, Paulo, Cultural Action for Freedom, Penguin, Harmonds Worth, 1972

Kumar,Somesh,MethodsforCommunityParticipation–aCompleteGuideforPractitioners, Vistaar Publications, New Delhi, 2002

Prasad, Ankit, Social Welfare and Social Action.New Delhi: Mittal Publications

Ross.M.G.,CommunityOrganisation.Theories,Principles,andPractices,HarperandRow,NewYork, 1955

Siddqui, H.Y., Working with Communities, Hira Publication,New Delhi, 1997

Skidmore, A. Rex and Milton. G. Thackeray, Introduction to Social Work, Prentice Hall, New Jersey,1976

Shrivasta, S. K (1988) Social Movements for development, Allahabad: Chugh Publications

Siddique, H.Y. (1984) Social Work and Social Action,New Delhi: Harnam Publications

ZastrowH.Charles–ThePracticeofSocialWork–AComprehensiveWorktext,BROOKS/COLE– Cengage Learning Publications,9th Edition

Alinsky Saul (1971) Rules for Radicals: A Practice Primer for Realistic Radicals, Vintage

RM Mac Iver and Charles H Page, Society – An Introductory Analysis, Surjeet Publications

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	M	M	H
CO 2	H	H	M	M
CO 3			H	
CO 4				H
CO 5		M		M
CO 6	M		H	

SWEM0038: ENVIRONMENT STUDIES AND DISASTER MANAGEMENT(3-0-0)**(3 Credit- 45 hours)****Course Outcome:**

Understand the interrelatedness of human life and environment (Understanding)

Develop an understanding of problems arising out of environmental degradation and globalization (Analysing)

Understand the roles of State in disaster management (Evaluating)

Study the role of social work practice in tracking environmental issues and disaster management (Creating)

Module I: Environment and Sustainable Development (11 hours)

Concepts: Environment and Ecology; the Interrelatedness of living organisms and natural Resources; Global Environmental Crisis and its linkages to the development process. Global warming, Environmental politics and resource development regimes; Sustainable development: Management and Conservation changes

Module II: The State and the Environment (11 hours)

State of India's Environment: Waste Management; Pollution – Air, Water, Soil, Noise; Laws Related to environment; Social Work and Environment: Environment Education, Environment Ethics, Promotion Environment Movements, Environment Management – EIA.

Module III: Concept of Disaster and Models of Disaster Management (11 hours)

Disaster: Definition, Natural and Human made disasters; multiple causes and effects; Stages of disaster; Development and Disaster; Preventive Measures; Models of Disaster: Crunch Model and Release Model

Module IV: Roles of Organizations in Disaster Management (12 hours)

Disaster Management and Phases. Pre-disaster: Prevention, Preparation, Education, Vulnerability and Preparedness. Actual Disaster: Contingency, Short Term and Long Term Plans, Search, Relief, Rescue, Recovery and Restoration. Post Disaster: Rehabilitation and Commemorations; Role of Social Workers and Voluntary Agencies: Role of Social Work Professionals at different levels

Suggested Readings

Abbasi S.A., Wetlands of India: Ecology and Threats Vol. 1-3, 1997.

Dorr Donal, Social Justice Agenda: Justice, Ecology, Power and the Church, 1990.

Goel P.K., Environmental Guidelines and Standards in India, 1996.

Madhav Godgil; Ramachandra Guha, Ecology and Equity: The use and abuse of nature in contemporary India, 1995.

Neugeboren Bernard, Environmental Practice in the Human Services: Integration of Micro and Macro Roles, Skills and Contexts, 1996

Shukla S.K., Srivastava P.R., Human Environment: An analysis, 1992.

Shukla S.K., Srivastava P.R., Environmental Pollution and Chronic Diseases.

- Auf Der Heide. Disaster Response: Principles of Preparation and Coordination. St. Louis: Mosbe, 1989.
9. Canton, Lucien G. Emergency Management: Concepts and Strategies for Effective Programs. Hoboken NJ: Wiley Inter-Science, 2007.
- Cutter, Susan L. (Ed.). American Hazardscapes: The Regionalization of Hazards & Disasters. Wash DC: Joseph Henry Press, 2001.
- Godschalk, David R., Timothy Beatley, Philip Berke, David Brower, and Edward Kaiser. Natural Hazard Mitigation: Recasting Disaster Policy & Planning. Island Press. 1999.
- Haddow, George D. and Jane A. Bullock. Introduction to Emergency Management (2nd Ed.). Burlington, MA: Elsevier Butterworth-Heinemann, 2006.
- May, Peter J, et al. Environmental Management and Governance: Intergovernmental Approaches to Hazards and Sustainability. London & NY: Routledge, 1996.
- National Research Council. Facing Hazards and Disasters: Understanding Human Dimensions. Washington, DC: National Academies Press, 2006.
- Noji, Eric K. (Ed.). The Public Health Consequences of Disasters. New York and Oxford: Oxford University Press, 1997.
- Platt, Rutherford H. Disasters and Democracy: The Politics of Extreme Natural Events. Washington, DC: Island Press, 1999.
- Quarantelli, E.L. (ed.) What is a Disaster – Perspectives on the Question. London and New York: Routledge, 1998
- Tobin, Graham A. and Burrell E. Montz. Natural Hazards: Explanation and Integration. New York and London: The Guilford Press, 1997.
- Waugh, William L. Living With Hazards/Dealing With Disasters-An Introduction To Emergency Management. Armonk, NY: M.E. Sharpe, Inc., 2000.
- Wisner, Ben, Piers Blaikie, Terry Cannon, and Ian Davis. At Risk: Natural Hazards, People's Vulnerability and Disasters (2nd Ed.). London and New York: Routledge, 2004.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H		
CO 2	H		H	
CO 3		H		M
CO 4		M	H	

SWGS0039: GENDER STUDIES (3-0-0)

(3 Credit- 45 hours)

Course Outcomes

Understand the concept of gender, patriarchy, gender roles and relationships.

(Remembering and Understanding)

Study the feminist theories, women's movements, and women's development

(Remembering and Understanding)

Critically study the intersectionality i.e. how race/ethnicity, sexuality, class, age, citizenship, and other identities crosscut and shape gender identities and roles (Applying and Analysing)

Critically understand concerns of gender issues, and aim to analyze everyday gendered experiences from Social Work perspectives. (Evaluating and Creating)

Module I: Understanding gender, gender and society, gender studies (11 hours)

Introduction – Gender, Sex, Sexuality, Gender Perspectives of Body, Social Construction of Femininity, Social Construction of Masculinity, Patriarchy, LGBTQ, Gender roles, Gender Lens: Political and

Legal Systems, Gender and Education, Intersectionality, Social Dynamics of Gender, Women's Studies and Gender Studies

Module II: History, Theory and Women's Movement (11 hours)

Historical Overview of Feminist Movements, Feminist Movement in Europe and the US, Women's Movement in India, Changing profile of women in India- pre and post independent India, History of women's education; Theory- Feminism and types of feminism, Gender Schema theory, Queer theory; Approaches to understanding women and development

Module III: Gender Concerns (11 hours)

Violence against women, conflict, poverty, displacement, migration, disaster –impact on women, women working in organized and unorganized sector, reproductive health, social, cultural and political determinants of health

Module IV: Constitutional Rights of Women, Policies and Programmes (12 hours)

CEDAW, Dowry Prohibition Act 1961, Equal Remuneration Act 1976, Maternity Benefit Act 1961, Plantation Labour Act 1951, Medical Termination of Pregnancy Act 1971, Pre-natal Diagnostic Techniques (Regulation and Prevention of Misuse Act 2002, Protection of Women from Domestic Violence Act 2005, The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act 2013, Functions of National Commission for Women and State Commission for Women

Suggested Readings

- Bhasin, K. Understanding Gender. Kali for Women Publication. (2000).
Bhasin, K. What is Patriarchy? Kali for Women Publication. (2000).
Ckhakravati, U. Gendering Caste: Through a Feminist Lens (Theorizing Feminism). Stree; UK ed. edition (January) (2003).
Cook, R. Human Rights of Women: National and International Perspectives. Philadelphia, University of Pennsylvania Press (1994).
Harding, Sandra G(ed.). The Feminist Standpoint Theory Reader. New York: Routledge. (2004).
Gordon, L. P. Violence against Women. New York: Nova Publishers. (2002).
Kumar, Girish (ed.). Health Sector Reforms in India. New Delhi: Manohar (2009).
Lalkima, C. Lalneihzovi. Changing Status of women in north-eastern states. New Delhi: Mittal Publications. (2009).
Pandya, Rameshwari. Patel, Sarika. Women in the Unorganised Sector of India. New Delhi: New Century Publications.(2010).
Joshi, T.S. Women and Development. New Delhi, Mittal Publications. (1999).
Mies, M., Shiva, V. Eco-feminism. London: Zed Books.. (1993).
Agnes, Flavia. Law and Gender Inequality: The Politics of Women's Rights in India. Delhi: Oxford University Press. (2004).
Arya, Sadhna. Roy, Anupama. Poverty, Gender and Migration. New Delhi: Sage Publications. (2006).
Ramazanoglu, Caroline. Holland, Jannet. (ed). Feminist Methodology: Challenges and Choices. London: Sage Publications Inc. (2002).
Ganesamurthy, V,S. Empowerment of Women in India: Social, Economic and Political. New Delhi: New Century Publications. (2008).
Datar, Chaya. Integrating activism and academics. In Jain, Devika and Rajput, Pam (Eds.), Narratives from the Women's Studies Family: Recreating Knowledge (pp. 136-149). New Delhi: Sage Publication. (2003).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	
CO 2	M	H	H	
CO 3		M	H	
CO 4	M		M	H

SWPF0040: SOCIAL WORK PRACTICE WITH INDIVIDUALS AND FAMILIES(3-0-0)**(3 Credits – 45 hours)****Course Outcomes:**

Introduce the concept of social casework as a method of social work practice and the tools used in Case-work. (Remembering, Understanding & Applying)

Introduce the approaches to Case work. (Remembering, Understanding & Applying)

Introduce Casework process and the techniques used. (Understanding, Applying, Analyzing & Evaluating)

Discuss the application of social casework in different settings.

(Understanding, Analyzing, Evaluating & Creating)

Module I: Introduction to Nature and Development of Social Casework (11 hours)

Social Casework: Meaning, Nature, Assumptions, Principles, Ethics and Process of Social Casework; Tools – Observation, Listening, Relationship, Interview, Home Visit, Collateral Visit, Family group conferencing; Casework and Counseling, Casework and Psychotherapy

Module II: Approaches to Casework Practice (11 hours)

Diagnostic and Functional approach; Psycho-social approach; Problem solving approach; Task centered approach; Client centered approach; Pearlman approach

Module III: Process and technique of social casework (11 hours)

Phases of casework intervention: Intake, Problem identification, Diagnosis of the problem, Treatment, Assessment, Monitoring and Evaluation, Termination/ Follow up; Techniques of Casework Intervention -Supportive Techniques, Enhancing Resources Techniques; Casework recording: Types and Principles of recording

Module IV: Social Casework Practice (12 hours)

Application of Social Case Work in different settings and Clientele groups- Casework with Children, Correctional Settings, Clinical Settings, Geriatric Care, the Terminally Ill people, and Crisis Situations; Discussion of Case Records in different Agency Settings, Relations of Casework with other methods of social work.

Suggested Readings

Biestek Felix, The Casework Relationship, Unwin University Books, London, 1968

Government of India, Encyclopedia in Social Work, Publication Division (Social Welfare Ministry), New Delhi, 1987

Hamilton, Gordon, The New York School of Social Work: Theory and Practice of Social Case Work, Columbia University Press, New York and London, 1970

Holis, Florence and Woods, Mary E., Casework – A Psychosocial Therapy, Fantom House, New York, 1981

Kadushin, Alfred, The Social Work Interview, Columbia University Press, New York, 1990

Keats, Daphne, Interviewing – A Practical Guide for Students and Professionals, Viva Books Pvt. Ltd., New Delhi, 2002.

Mathew Grace, An Introduction to Social Case Work, Tata Institute of Social Sciences, Bombay, 1992

- Nelson Jones, Richard, Practical Counseling and Helping Skills, Harper and Row, London, 1984
- Nursten, Jean, Process of Case Work, Pitman Publishing Corporation, 1974
- O'Hagan, Kieran, Kingsley, Jessica, Competence in Social Work Practice – A Practical Guide for Professionals, London, 2003
- Perlman, Helen Harris, Social Case Work – A Problem Solving Process, University of Chicago Press, London, 1964
- Rameshwari Devi, Ravi Prakash, Social Work Methods, Practices and Perspectives (Models of Casework Practice), Vol. II, Ch.3, Mangal Deep Publication, Jaipur, 2004
- Richmond, Mary, Social Diagnosis, Free Press, New York, 1970
- Thompson, Neil, People Skills, 2nd Ed., Palgrave Macmillan, New York, 2006
- Aptekar Herbert, The Dynamics of Casework and Counseling, Houghton Mifflin Co., New York, 1955.
- Babara, J. G., Beyond Case Work, London, 1991
- Fisher Joe, Effective Case Work Practice – An Elective Approach, McGraw Hill, New York, 1978
- Garrett, Annett, Interviewing – Its Principles and Methods, Family Service Association of America, New York, 1972
- Lishman, Joyce, Communication in Social Work, Palgrave MacMillan, New York, 1994
- Sena, Fine and Glass, Paul H., The First Helping Interview Engaging the Client and Building Trust, Sage Publications, New York, 1966
- Sheafor, Bradford, Horejsi, Charles, Horejsi, Gloria, Techniques and Guidelines for Social Work Practice, Allyn and Bacon, London, 1997
- Timms, Noel, Social Case Work, Routledge and Kegan Paul, London, 1966

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	M
CO 2		H		H
CO 3			H	H
CO 4		H		H

SWPG0041: SOCIAL WORK PRACTICE WITH GROUPS (3-0-0)

(3 Credits- 45 hours)

Course Outcomes

Understand the concept of groups and its importance and influence on individuals (Remembering and Understanding)

Understand social group work as a method of social work (Remembering and Understanding)

Develop skills to apply group work methods in various settings (Creating and Evaluating)

Identify and acquire the skills needed to work with groups effectively (Applying and Analysing)

Module I: The Concepts (11 hours)

Concept of group: definition, characteristics, Classification of different social Groups, Functions of Groups and Group as a medium of Social change.

Module II: Methods of Social Group Work (11 hours)

Social group work as a method of social work: definition, values, principles, assumptions, ethics, and functions of social group work; Techniques and skills used in Social Group work practice, Roles of Social group workers.

Module III: Process and Phases of Social Group Work (11 hours)

Group work process; Identification of the needs and interest; Program Planning and Program Development; Criteria of effective process and programme in SGW; Phases of Group Work: Pre-group,

initial, treatment, and critical phase, evaluation and termination; Stages of Group Development (Forming, Norming, Storming, Performing and Adjourning) and Group Dynamics

Module IV: Social Group Work Practice in Agency Settings (12 hours)

Social Group Work in Different Settings: Self Help Groups, Groups in community setting, Groups in institutional settings (Hospitals, Rehabilitation Centers, Children's Home, Old Age Homes and Educational Settings); Discussion of Group records.

Suggested Readings

Cooper, Cary L, Theories of Group Processes, London: John Wiley and Sons, 1976

Douglas, Tom, Group Work Practice, London: Tavistock Publications, 1976

Douglas, Tom, Basic Group Work, London: Tavistock Publications, 1978

Ely, P.J. and M.K.McCullough, Social Work with Groups, London: Routledge and Kegan Paul, 1975

Kanopka G, Social Group Work – A Helping Process, Engelwood Cliff: Prentice Hall (later version), 1963

Siddiqui, H.Y, Group Work: theories and practice; India, Pakistan, Bangladesh and Sri Lanka, Jaipur: Rawat Publications, 2007

Toseland, W. and Rivas, R.S. An Introduction to Groups Work Practice, Boston: Allyn and Bacon, 2000

Trecker, H.B., Social Group, New York: Association Press, 1975.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	H		M
CO 2	H	M	H	
CO 3	H	M	H	
CO 4	M			H

SWRS0042: SOCIAL WORK RESEARCH AND STATISTICS(3-0-0)

(3 Credits- 45 hours)

COURSE OUTCOMES

Define and show social science research and social work research and the application of statistics in social work practice. (Remembering)

Explain and discuss social work research as a method of social work and its application in addressing social issues. (Understanding)

Apply the knowledge, skills for interpretation, documentation and presentation of results of social work research and statistics in carrying out applied research in addressing social issues. (Applying)

Analyze various social issues and use research methods, strategies and data to suggest solutions (Analyzing)

Assess relevant research methods and techniques in carrying out social work research. (Evaluating)

Create critical methods to carry out research in social work practice and suggest solutions to social issues. (Creating)

Module I: Introduction to Social Work Research (7 hours)

Research and Social Work Practice- Philosophical Foundations of Research.

Natural and social science research - characteristics and scientific attitude.

Social work research as a social research - relevance, ethics and values. Scope of social work research - basic and applied research.

Module II: Research designs, approaches and types (7 hours)

Research designs: Descriptive, Exploratory and Experimental: meaning, scope, characteristics, application in social work setting.

Research Approaches: Qualitative and Quantitative Research: meanings, scope, methods, steps, sampling, data collection, analysis, interpretation and reporting. Strengths and weaknesses.

Evaluative research: Programme and projects evaluation: concept, types, steps, reports.

Participatory research and action research: concepts, scope, application and steps.

Module III: Steps in Research Process (12 hours)

Problem Formulation: Identifying research issue, formulating research topic and problem, review of literature (library work), theoretical framework, formulating objectives, clarifying concepts, variables - conceptual and operational, formulating hypothesis.

Population and Sampling: Inclusion and exclusion criteria of population, the logic of sampling size and techniques: probability and non-probability sampling.

Tools for data collection: Levels, Types of measurements, reliability and validity of tools. Constructing tools for data collection: questionnaire, interview schedule, scales. Quantification of qualitative data.

Sources, Collection and Analysis of Data: Secondary and primary sources. Data collection data editing, coding, master sheet, analysis, report writing. Using a computer for data analysis: coding, analysis- graphs and results.

Module IV: Introduction to Statistics (12 hours)

Statistics: Definitions, Uses and Limitations. Classification and tabulation of data, univariate and bivariate, diagrammatic and graphical presentations. Measures of central tendency, Mean, Median and Mode and their uses; Measures of variability - range, variance and standard deviation.

Correlation: Meaning and computation of coefficient of correlation as product moment, Spearman's Rank Correlations, interpretation of correlations.

Test of Hypotheses: Basics, Probability distribution, normal distribution. t-test, Chi-Square Test

Module V: Application of Statistics and Reporting Research (7 hours)

Application of Statistics in Social Work Research.

Ethical guidelines in social work research.

Professional writing.

Introduction to software packages for statistical analysis.

Suggested Readings

Ahuja, Ram, Research Methods, Rawat, Jaipur, 2001

Alston, M. Bocoles, W., Research in Social Workers- An Introduction to the Methods, Rawat, Jaipur, Indian Edition 2003

Baker, T.L., Doing Social Research, McGraw Hill, Singapore, 1994

Dooley, D., Social Research Methods, Prentice Hall of India Pvt. Ltd., New Delhi, 1997

Goode, W.J. and Hatt, P.K., Methods in Social Research, McGraw Hill Singapore, 1981

Grinell, R. M., (Jr.), Social Work Research and Evaluation, F.E. Peacock Pub. Inc., Illinois, 1988

Gupta, C.B., Introduction to Statistical Methods, Vikas Publishing House, 1995

Gupta, S.C., Fundamentals of Statistics, Himalaya Publishing House, Delhi, 1997

Gupta, S.P., Statistical Methods, Sultan Chand and Sons, New Delhi 1997

Jacob, K.K., Methods and Fields of Social Work in India, Asia Publishing, Bombay, 1996

Kothari, C.R., Research Methodology: Methods and Techniques, 2nd edition reprint, New Age International New Delhi, 2004

Krishnaswamy, O.R., Methodology for Research in Social Science, Himalaya, Bombay, 1993

Laldas, D.K., Practice of Social Research, Rawat, Jaipur, 2000

Mikkelsen, B., Methods for Development Work and Research-A New Guide for practitioners, Sage,

New Delhi, 2005

Ramchandran, P., Social Work Research and Statistics, Allied Publishers, Bombay, 1968

Rubin, A. and Babbie, E., Research Methods for Social Work, 4th edition, Wadsworth, West, Brooks/Cole and Schirmer, 2001

Sarantakos, S., Social Research, Palgrave Macmillan, New York, 2005

Sharma, B.A.V., Prasad, R.D. and Satyanarayana, C., Research Methods in Social Sciences, Sterling, New Delhi, 2002

Sharma, K.R., Research Methodology, National Publishing House, Jaipur, 2002

Wilkinson, T.S. and Bhandarkar, P.L., Methodology and Techniques of Social Research, Himalaya, Bombay, 1984

Young, p., Scientific Social Surveys and Research, Asian Students edition, Asia Publishing House, Japan, 1960

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4	Module 5
CO 1	H				M
CO 2	M				H
CO 3			H	H	
CO 4		H	M	M	H
CO 5		H		M	
CO 6	M				H

SWWA0043: SOCIAL WELFARE ADMINISTRATION (3-0-0)

(3 Credits- 45 hours)

Course Outcome:

Develop an understanding of social welfare administration as a method of social work (Remembering)

Understand the various components of social welfare administration (Understanding)

Understand the concept and theories of Development (Analysing)

Familiarize the students with the concepts of Management of Organisations and its principles (Evaluating)

Module I: Social Welfare Administration (11 hours)

Social Welfare Administration: Definition, Characteristics, Principles and Functions of Social Welfare Administration; Types of

Social Welfare Administration: Social Welfare Administration and Public Administration; Establishment, Objectives and Importance of Central Social Welfare Board, State Social Welfare Board and International Organizations

Module II: Management of an Organization (11 hours)

Management: Principle and Significance of Management for Social Work; Components of Programme Management, Finance Management, Human Resource Management and Office Management

Module III: Strategies and Mechanisms of Administration (11 hours)

Processes related to Registration of Societies, Trust and Non-Profit Organization: Societies Registration Act 1860, Trusts and Non-Profit Organizations under Indian Companies Act: Foreign Contribution Regulation Act 1976 and Income Tax Rules applicable to Development / Charitable Organisations under Income Tax Act 1961; Role of Social Workers in Decision Making Process, Communication and Networking, and Sustainability of Programme

Module IV: Social Welfare Programmes (12 hours)

Social Welfare Programmes and Policies: Children, Youth, Women, Widows, Elderly and Differently- able and marginalized Groups; Recent trends and Changes in Social Welfare Administration

Suggested Readings

Chowdry, Paul, Social Welfare Administration, Atma R Ram and Sons, Delhi, 1992
 Sankaran and Rodrigues, Handbook for the Management of Voluntary Organisations, Alpha Publications Chennai, 1983
 Kulkarni, P.D., Social Policy and Social Development in India Association of schools of social work in India
 Fred, Luthans, Organization Behaviour, III and IV edition
 Rao, Subba, GCV. Family Law in Law, S. Gogia and Company, Hyderabad, 1999
 Sullivan, Michael, Sociology and Social Welfare, Allen and Unwin, Winchester, USA, 1987
 Reider, Dale, Evaluating Development Programmes and Projects, Second edition, Sage Publications, 2004
 Gupta, N.S. Organization Theory and Behaviour. Delhi, 2009
 Chaturvedi, A.N, Rights of the Accused under Indian Constitution.: Deep and Deep Delhi. 1984
 Donnison, D & Chapman, Social Policy and Administration. London. 1989
 P.J. Lukose, Inclusive Development : A Human Rights Approach, Media House, New Delhi, 2014

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2	H	H		
CO 3				
CO 4		M	H	

SWDS0044: INTRODUCTION TO DISABILITY STUDIES(3-0-0)**(3 Credits- 45 hours)****Course Outcomes:**

Introduce the concept and different types of disabilities.(Remembering, Understanding & Applying)
 Introduce the Legislations for Persons with disabilities. (Remembering, Understanding & Applying)
 Introduce the concept of Inclusive Education in India. (Understanding, Applying, Analyzing, Evaluating and Creating)
 Discuss the Preventive Measures and government programs for Persons with Disabilities. (Understanding, Applying, Analyzing, Evaluating & Creating).

Module I: Understanding Disability (11 hours)

Disability: Definition, Causes, Types of Disabilities; Magnitude of various disabilities and their impact on persons with disability and their families; Needs and problems of persons with disability and their families across the life span; Social attitudes towards persons with disability.

Module II: Legislation, Programme and Schemes for PWD (11 hours)

Legal instruments related to PWDs: Persons with Disability Act-1995; Rehabilitation Council of India Act – 1992; National Trust Act-1999; Mental health Act; Rights of the Person with Disability Act 2016,

Module III: Inclusive Education (11 hours)

Concept and Meaning, Needs and importance; issues and challenges in implementing Inclusive education in India; Planning and managing an inclusive curriculum in schools; Measures for implementing Inclusive Education.

Module IV: Management of Disability and Policies (12 hours)

Prevention and Management of Disabilities at Primary, Secondary and Tertiary levels; Models -Social, Medical, Educational and Institutional ; National Policy on Persons with Disabilities, UN Conventions and Declarations on Persons with Disabilities; Different Government Schemes and programmes for Persons with Disabilities.

Suggested Readings

- Albrecht G.L, Katherine D Seelman. & Michael Bury. Handbook of Disability (2001).
 Bacquer, A. and Sharma, A. Disability: Challenges vs Responses, Delhi: CAN Publications (2007).
 Hans, A. and Patri, A. Women and Disability, Delhi: Sage. (2003).
 Hegarty Seamus & Mithu Alur. Education and Children with special needs, London: Sage. (2002).
 Karanth, Pratibha & Joe Rozario. Learning disability in India, London: Sage (2003).
 Grant. Learning disability: A lifecycle approach to valuing people, London: Open University Press (2005).
 Moore. Researching disability issues, London: Open University Press. (2005).
 Rothman, J.C. Social Work Practice Across Disability. Boston: Allyn & Bacon. (2003).
 Oliver, M. & Sapey, B. (ed.) Social Work with Disabled People. London: Palgrave Macmillan. (1998).
 Banerjee, G. Legal Rights of a Person with Disability. New Delhi: Gyan Publishing House. (2001).
 WHO. Community-based rehabilitation: CBR guidelines. Geneva: WHO Press. (2010).
 Karna, G.N. Disability Studies in India: Retrospect and Prospects, New Delhi: Gyan Publishing House. (2001).
 NCF National Curriculum Framework. New Delhi: NCERT. (2005).
 Bhumali, A Rights of disabled Women and Children In India. New Delhi: Serials Publications (2010).
 Burke, Peter Disability and Impairment: Working with children and families. Jessica Kingsley Publications. (2008).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		M
CO 2	M	H		
CO 3		M	H	
CO 4	M	M		H

SWSJ0045: SOCIAL JUSTICE, HUMAN RIGHTS AND PARALEGAL EDUCATION(3-0-0)

(3 Credits–45 hours)

Course Outcomes

- Provide an understanding on social legislation and social action with relevance to social work practice (Remembering and Understanding)
 Develop an understanding about various social welfare legislations with specific reference to different groups of people; (Evaluating and Creating)
 Understand the provisions of the legal system and the mechanisms available in the country for addressing issues of social change. (Understanding, Applying and Analysing)

Module I: Social Justice and Human Rights (7 hours)

Meaning of Justice, Forms of Justice, Theories of Justice,
 Law and Social Justice, Human Rights and Social Justice, Issues in Social Justice.

Module II: Social Legislation and Social Work (7 hours)

Understanding concepts of law, social justice and social legislation, Legislation as an instrument of social justice and control.
 The Constitution of India: preamble and fundamental rights; Directive Principles of State Policy
 Classification of law: civil and criminal law. Relevance of law and legal systems to social work practice, partnership and interface between social workers and legal systems.

Module III: Reformatory Law and Laws related to Protection of Human Rights (7 hours)

Major provisions of the law for the protection of human rights, Structure, functions and powers of National and State Human Rights Commissions.

Major provisions in Indian Penal Code (IPC) related to family violence, murder, suicide, rape.
 Meaning of cognizable and non-cognizable offences and conditions and procedures for bail; Importance and Procedures for filing a First Information Report (FIR)

Module IV: Social legislations: Major Provisions (20 hours)

Laws Related to Children: Juvenile Justice Act, Laws relating to Adoption and Guardianship, Child Marriage Restraint Act, Prohibition and Regulation of Child Labour Act. Protection of Children from Sexual Offences (POCSO) Act Laws Related to Family: Personal laws and the Civil law related to Marriage, Divorce, Maintenance and Succession; Law against Domestic Violence; Law of Family Court. Laws Related to Women: Immoral Trafficking Prevention Act (ITPA), The Sexual harassment of Women at Workplace (Prevention, Prohibition, Redressal) Act, 2013. Medical termination of pregnancy, Prohibition against Prenatal diagnostic tests (for sex determination). Laws Related to Scheduled Castes and Scheduled Tribes: Protection of Civil Rights; Law against Atrocities. Laws Related to Disabled: Mental Health Act, Persons with Disabilities Act, National Trusts Act. Laws Related to Workers: Minimum wages, Workmen's compensation. Laws Related to Consumers and Citizens: Consumer protection, Food adulteration, Right to information, Project affected persons.

Protection of Children from Sexual Offences Act (POCSO) and Sexual harassment of women in workplace act.

Module V: Justice System and Legal Aid provisions (4 hours)

Agencies of the justice system: police, judiciary, correctional systems, their structure and functions
 Structure and jurisdiction of courts: district and sessions courts, high court, Supreme Court. Distinction between civil and criminal courts; Consumer courts Special courts/tribunals– accident, corruption
 Concept of legal aid, Lok Adalat; Public Interest Litigation (PIL)

Suggested Readings

- Samaddar Ranabir (Ed), State of justice in India-issues of social justice, sage publication, 2009.
 Acharya, Basu Durga Das: Introduction to the Constitution of India, New Delhi: Prentice Hall of India Pvt.Ltd. (7th. Edition)
 Ahuja, Ram: Criminology, Jaipur: Rawat Publications
 Biju, M. R, Human Rights in a Developing Society, New Delhi: Mittal Prakashan, 2005
 Diwan, Paras and Diwan, Peeyush, Child and Legal Protection, New Delhi : Deep and Deep Publications, 1994
 Flavia, Give us this Day, Our Daily Bread, Procedures and Case Law on Maintenance, 1997
 Gaikwad, P. E, Law Basic Concepts, Pune: YASHADA, 2004
 Galanter, Marc, Law and Society in Modern India, Delhi: Oxford University Press, 1992
 Gangrade, K.D, Social Legislation in India (Vol-1 and Vol.2), Delhi: Concept Publishing Company.
 Gaur K. D, A Textbook on the Indian Penal Code, Delhi: Universal Law Publication Co. Ltd., 2004
 Kant, Anjani, Women and the Law, New Delhi: APH Publication Corporation. 1997
 Matthew, P. D, Constitution of India Simplified, New Delhi: Indian Social Institute, 1993
 Pradhan, V. P, The Indian Constitution, New Delhi: Ombudsman Publishing House, (1st Edition).
 Prakash, Ravi, Constitution of Fundamental Rights and Judicial Activism in India, Jaipur: Mangal Deep Publications
 Purohit, B. R. and Joshi, Sandeep (Ed)) Social Justice in India, Jaipur: Rawat Publication, 2003
 Qureshi, M. A, Muslim Laws of Marriage, Divorce and Maintenance, New Delhi: Deep and Deep Publications, 1992
 Sastry, T. S. N, India and Human Rights, Delhi: Concept Publishing Company, 2005
 Saxena, D. R, Law Justice and Social Change, New Delhi: Deep and Deep Publications, 1996
 Shah, Ghanshyam, Social Justice- A Dialogue, Jaipur: Rawat Publication, 1998
 Sharma, S. S, Legal Aid to the Poor, New Delhi: Deep and Deep Publications, 1993

Siddiqi, Fatima E. and Ranganathan Sarala: Handbook on Women and Human Rights – A Guide for Social Activists (Part 1 and Part 2), New Delhi: Kanishka Publication.

Singh, Alka, Women in Muslim Personal Law, New Delhi: Rawat Publications, 1992

Singh, Shiv Sahai, Unification of Divorce Laws in India.1992

South Asia Human Rights Documentation Centre. Handbook of Human Rights and Criminal Justice in India, New Delhi: Oxford University Press, 2006

P J. Lukose, Inclusive Development: A Human Rights Approach, New Delhi: Media Publications, 2014

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		M
CO 2	M	H		
CO 3		M	H	

SWES0046: EMERGING TRENDS AND PERSPECTIVES IN INTEGRATED SOCIAL WORK PRACTICE (3-0-0)

(3 credits- 45 hours)

Course Outcomes

Define, identify and explain the meaning and concept of a social work perspectives

(Remembering and Understanding)

List, define and classify the perspectives that have prominently informed social work practice

(Applying and Analysing)

Locate and critically evaluate the relevance of perspectives in social work fields of practice

(Evaluating and Creating)

Apply social work perspectives in practice settings (Applying)

Module I: Perspectives on Social Problems (11 hours)

Meaning and concept of Social Work Perspective: its importance and implications for practice; Social problems, human systems and social work response- structural-functionalist perspective, Conflict perspective, symbolic interactionist perspective

Module II: International Social Work Perspectives (11 hours)

Integrated Social Work Practice Model; Systems Theory and Ecosystems Perspective- Conceptual Systems in Social Work

Practice; Strengths Perspective- Philosophy, Concept and Principles, Preparation for Strengths Approach to Practice; Assessing Clients' Strengths; Human Rights Perspective: Human Rights Based Approach

Module III Radical Social Work Perspectives (11 hours)

Marxist approaches- Critical and Structural Social Work; Freirian and Liberation theological perspectives- Conscientization and adult education; Feminist approach; Anti-discriminatory and anti- oppressive perspectives

Module IV Indian Social Work Perspectives (12 hours)

Gandhian Social Work Principles; Ambedkarite Social Work practice: Anti-caste intervention framework in India;

Tribal/Indigenous Social Work Perspective; Social Work Practice in North East India

Suggested Readings:

Freire, P. Cultural Action for Freedom New York: Penguin Books. (1972)

Goldstein, H. Social work practice: a unitary approach. Columbia: University of South Carolina Press. (1973)

- Gray, M., Coates, J., & Bird, M.Y. Indigenous social work around the world: towards culturally relevant education and practice. Burlington: Ashgate. (2008)
- Mapp, Susan C.. Human rights and social justice in a global perspective: an introduction to international social work. New York: OUP. (2008)
- Mooney, L. A., Knox, D., & Schacht, C. Understanding Social Problem, (2nd Edition). USA: Wadsworth/Thomson Learning. (2000).
- Miley, K. K., O'melia, M., & Dubois, B. L. Generalist Social Work Practice: An Empowering Approach. Boston: Allyn and Bacon. (1995).
- Mullaly, R. Structural social work: ideology, theory and practice. Toronto: McClelland & Stewart Inc. The Canadian Publishers. (1993).
- Nash, M., Munford, R., & O'Donoghue, K. (Eds). Social Work Theories in Action. London: Jessica Kingsley. (2005).
- Pardeck, J.T. Social work practice: an ecological approach. Westport, CT: Greenwood Publishing Group. (1996)
- Payne, M... Modern Social Work Theory, (2nd Ed). Chicago: Lyceum Books. (1997)
- Pincus, A., & Minahan, A. . Social work practice: model and method. Illinois: F.E. Peacock Publishers. (1993)
- Powell, F. The politics of social work. New Delhi: Sage. (2001).
- Saleeby, D. (Ed.). The strengths perspective in social work practice, (3rd Ed). Boston: Allyn and Bacon. (2002)
- Saulnier, C. F. Feminist theories and social work: approaches and applications. NY: Haworth Press. (1996).

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		M
CO 2	M	H		
CO 3		M	H	
CO4	H			M

SWRT0048: COMMUNITY DEVELOPMENT: RURAL, TRIBAL AND URBAN(3-0-0) (3 credits- 45hours)

Course Outcomes

Define the concepts, approaches, policies and strategies of community development (rural, tribal and urban) (Remembering)

Discuss and explain the development issues of communities – tribal, rural and urban (Comprehension)

Apply the knowledge and skills acquired in social work education to address issues of marginalisation, exclusion and oppression. (Application)

Able to analyse various developmental issues and address them by applying relevant empowerment and development models and approaches in social work practice (Analyse)

Able to assess development concerns, and adopt and apply models and approaches of development for alleviation and reduction of community inequities (Evaluating)

Able to design development practice for effective community development experiences (Creating).

Module I: Community and Community Development (11 hours)

Understanding Communities – Urban, Rural and Tribal; Concept, Definition and Objectives of Community Development; Aspects of Community Development – Social, Cultural, Economic, Political and Environmental; Approaches of Rural, Tribal and Urban Development.

Module II: Rural and Tribal Community Development (11 hours)

Rural Demography, Sociology and Economy; Tribal Identity and Ethnicity; Rural and Tribal Development Policies; Rights and Positive Discrimination; Governance Structures and Functions of Rural and Tribal Communities; Rural Reconstruction Experiments – Pioneering Period Sriniketan, Marthandam, Gurgaon; Probation period: Firka, Nilokheri and Etawah Projects.

Module III: Urban Community Development (11 hours)

Urban, Urbanization, Urbanism, Industrialization and Development; Urban Development Authority; Urban Governance; Urban Ecology and Growth of Cities; Concepts of Metropolis, Megapolis, Satellite Towns, Commuter Town / Bedroom Community, Suburbs, Metropolitan; Leisure Time Theories and Leisure Time in Cities.

Module IV: Issues of Rural, Tribal and Urban Development and Social Work Intervention (12 hours)

Rural and Tribal Development Concerns – Poverty, Migration, Education, Unemployment, Development Induced Displacement, Health and Livelihoods; Urban Development Concerns – Poverty, Migration, Slums, Homelessness, Eviction, Traffic Congestion and Accidents, Health, Human Trafficking and Crimes; Role of Social Worker in Rural, Tribal and Urban Development.

Suggested Readings

Desai, A. R., Rural Sociology in India, Bombay: Popular Prakashan, 1961
 Narang, A., Indian Rural Problems, Murari Lal and Sons, New Delhi, 2006
 Shah, Dilip., Rural Sociology, ABD Publisher, India, 2005
 Butter W Edgar, Urban Sociology- A Systematic Approach, Harper and Row Publishers, New York, 1976
 Lornis and Beegle, Rural Sociology (The Strategies of change), Englewood, Cliffs, New Jersey : Prentice Hall, Inc, 1957
 Sharma, K Rajendra, Rural Sociology, Atlantic Publishers and Distributors, New Delhi, 2004
 Sharma Ramnath, Indian Rural Sociology, Munshiram Manoharlal Publishers Pvt. Ltd. New Delhi, 1979
 Doshi S L, Rural Sociology, Rawat Publications, Jaipur, 2002
 Singh S, Rural Sociology, Prakashan Kendra, Lucknow, 1980
 Bhanti, Raj, Social Development (Analysis of some social work and field), Himanshu Publication, New Delhi, 2001
 Dasgupta, Bilap, Village Society and Labour Use, Oxford University Press, New Delhi 12. Doshi, S.L. and Jain, P.C., Social Anthropology, Rawat Publications, New Delhi 2001
 Dubey, S.C., Indian Society, National Book Trust in India, New Delhi.
 Jain, Netra Pal, Rural Reconstruction in India and China (A comparative study), Writers and Publishers Corporation, 1970
 Khadria, B., The Migration of Knowledge workers, New Delhi, London: Sage Publications, 1999
 Khan, Mumtaz Ali, Scheduled Caste and their status in India, Uppal, Publishing House, New Delhi, 1980
 Mishra, Anil Kant, Rural Tension in India, Discovery Publishing House, New Delhi, 1998
 Mishra, Omprakash (Ed.), Forced Migration, Manak Publication, Delhi, 2004

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M			H
CO 3			M	M
CO 4		H	M	M
CO 5	M	H		
CO 6				H

SWGC0049: GOVERNANCE AND COMMUNITY DEVELOPMENT (3-0-0)

(3 Credits- 45 hours)

Course Outcomes

Understand the context, meaning and relevance of decentralised governance for urban, rural and tribal areas. (Remembering and Understanding)

Develop knowledge about the structure and functioning of governing bodies at various levels. (Creating and Evaluating)

Develop an understanding to the various constitutional amendments for better governance and development (Creating and Evaluating)

Understand contemporary issues and challenges in accessing governance bodies for people's development. (Applying and Analysing)

Module I: Rural Governance (11 hours)

Democratic Decentralization: Meaning, objectives and Importance, Governance: Meaning and Structures; Concept and Evolution of Panchayati Raj: Historical Development of the Concept, National level Committees in the evolution of Panchayati Raj (Balwantrai Mehta, Ashok Mehta, Singhvi committees)

Module II: The Functions of Panchayati Raj Institutions/Traditional Institutions (11 hours)

Panchayati Raj/Traditional Institutions: Structure, Functions and Powers at each level; Revenue Sources at each level; its role and Importance, Community Participation in Governance.

Module III: Urban Governance: Urban Local Self-Government in India (11hours)

Types of Urban Local Self-Government in India, Municipal Corporation, Municipalities, Municipal Council/Nagar Palika; Structures, Functions and Powers at each level; Sources of Revenue at each level; System of Elections to Urban Local Self-Government; Relation of Urban Local Self-Government with bodies of Governance at the State level issues; Challenges in Developing Partnerships between Elected Bodies, Bureaucracy and Civil Society.

Module IV: Constitutional Amendments (12 hours)

The 73rd Constitutional Amendment; PESA (Panchayat Extension in Scheduled Areas): Context of its Emergence and its Significance; Issues and Challenges in its implementation; 74th Constitutional Amendment

Suggested Readings

Chahar, S.S. (Ed.), Governance of Grassroots Level in India, Kanishka Publishers, New Delhi, 2005

Devas, N. et. al., Urban Governance, Voice and Poverty in Developing World, Earthscan, London, 2006

Hooja, Prakash and Hooja, Meenakshi, Democratic Decentralization and Planning, Rawat Publications, Jaipur, 2007

Mishra, S.N., Mishra Sweta and Pal, C., Decentralized Planning and Panchayati Raj Institutions, Mittal Publications, New Delhi, 2000

Singh, Amita (Ed.), Administrative Reforms (towards sustainable practice), Sage Publications, New Delhi, 2005

Baluchamy, S. Panchayat Raj Institutions, Mittal Publication, New Delhi, 2004

Bevir, Mark (Ed.), Encyclopedia of Governance in United Kingdom, Sage Publication, 2007

Bevir, M., Governance: A Short Introduction. United Kingdom, Oxford University Press, 2011

Chhotray, Vasudha and Stoker, G., Governance Theory and Practices: A Cross-Disciplinary Approach, UK: Palgrave Macmillan, 2009

Goel, S.L., Good Governance: An Integral Approach. New Delhi: Deep & Deep Publication Ltd., 2007

Grindle, Merilee S., Going Local: Decentralization, Democratization, and the Promise of Good Governance, New Jersey: Princeton University Press, 2007

Anwar Shah (ed.), Local Governing in Developing Countries (Public Sector Governance and Accountability Series). Washington: World Bank

Sivaramakrishnan, K C., Revisiting the 74th Constitutional Amendment for better Metropolitan Governance, Economic and Political Weekly Vol. 48 (13), 2013

Srivastava, OM Prie., Municipal Government and Administration in India, Allahabad: Chuch Publications, Contribution to Indian Sociology 45 (2), Pp. 157- 187, 1980

Stoker, Gerry., Governance as Theory: Five Preposition, International Social Science Journal Vol 50 (155), Pp 17-28, 2008

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		M	M
CO 4		H	M	M

SWCS0050: FAMILY CENTERED SOCIAL WORK PRACTICE (3-0-0)

(3 credits- 45 hours)

Course Outcomes:

Define family and marriage, and theories associated with these concepts in the context of prevalent customary, legal instruments and social processes and explain how the differential structure of families affect its dynamics and processes (Remembering and Understanding)

Assess and present the gender relations in society in the context of patriarchal social structure (Evaluating and Creating)

Apply social work theoretical models for conceptualizing intervention plans that are best-suited for addressing problems located in different family structures (Applying and Analysing)

Identify and evaluate the different plans and schemes of the government of India pertaining to family development and welfare (Evaluating)

Module I: Concept and Forms of Family and Marriage (11 hours)

Concept of family- Origin, Traditional Forms Family; Concept of marriage- Types of Marriage; Alternative Forms of Family and Marriage Patterns and Structures- Dual earner/Career Families; Single Parent families, Reconstituted/Step families; Childless Families; Same-sex Families, Adoptive family & Foster Family.

Module II: Theories and Dynamics of Family (11 hours)

Family theories – Developmental theory, Systems theory, Social Exchange theory, Structural Functionalist theory, Feminist theory, Ecological theory; Family Dynamics – Power, Myths, Role, Relationships; Gender and Patriarchy; Implications of Patriarchal Social Structure in Families-Global, National and Local.

Module III: Social Processes and Changes in Family Structure (11 hours)

Social Processes and Factors for Change- Industrialisation, Urbanisation, Modernisation, and Globalisation; Technology and

Media; Migration; Displacement and Disaster (War, Conflict, riots and Natural Calamities)& Pandemics; Changes in the Family Structure - Family Demography&Determinants of Change in Family Structure- Fertility change, Change in at marriage & age at first birth, Change in size and structure of the households, Change in Marital Unions, Marital Dissolution, Widowed, Remarriages, Non-Marital Unions & Sexual Behaviours, and Alternative family formation behaviours

Module IV: Social Work with Families- Interventions, Techniques and Skills (12 hours)

Family Social Work, Assumptions & Principle of Family Social Work; Practical Aspects of Family Social Work- Family Assessment- Qualitative-Genogram, Quantitative-Self-Anchored and Self-Monitoring Instruments; Problem Solving Approach;

Developmental Approach- Family life-cycle & life enrichment programmes; Strengths & Resilience Perspective; Efforts of Government and Non-Government Agencies in strengthening families – Policy, Legislations and Programmes

Suggested Readings

- Barnett, O.W., Miller-Perrin, C.L., & Perrin, R.D., Family violence across the lifespan: an introduction, New Delhi: Sage, 2011
- Carter, B., & McGoldrick, M., The changing family life cycle: a framework for family therapy, (2nd Ed.), London: Pearson, 1989
- Coontz, S., Marriage, a history: how love conquered marriage, New York: Penguin, 2005
- Devine, E. T., The family and social work, New York: Andesite Press, 2017
- Peoples, J., & Bailey, G., Humanity: an introduction to cultural anthropology, 7th ed., Belmont, CA: Thomson Wadsworth, 2006
- Strong, B., DeVault, C., & Cohen, T.F., The marriage and family experience: intimate relationships in a changing society, Australia: Cengage, 2011
- Yuen, F.K.O., Skibinski, G.J., & Pardeck, J.T., Family health social work practice: a knowledge and skills casebook, New York: Routledge, 2002
- Collins, D., Jordan, C., & Coleman, H., An Introduction to Family Social Work, CA: Brooks/Cole, Cengage Learning, 2010
- Hepworth, D., Rooney, R., Rooney, G., Strom-Gottfried, K., Direct Social Work Practice, 10th ed. Belmont, CA: Brooks/Cole, 2013 • Chapter 10: Assessing family functioning in diverse family and cultural contexts
- White, J.M., Klein, D.M., Martin, T.F., Family Theories. An Introduction. New Delhi: Sage, 2015
- Uberoi, P., Family, Kinship and Marriage in India, New Delhi: Oxford University Press, 1993
- Parekh, S., Banerjee, G., & Kashyap, L., Family Life Education and Enrichment Programmes, The Indian Journal of Social Work, 70(2): 227-303, 2009
- Chakravorty, S., Goli, S., & James, K.S., Family Demography in India: Emerging Patterns and Challenges, Sage Open: 1-18, 2021, <https://doi.org/10.1177/21582440211008178>

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		M	M
CO 4		H	M	M

SWPC0051: SOCIAL WORK PRACTICE WITH CHILDREN (3-0-0)

(3 Credits- 45 hours)

Course Outcomes:

- Understand the process of socialization of a child (Remembering and Understanding)
- Understand health and children's' health i.e. Both mental and physical well-being. (Remembering and Understanding)
- Analyze the difficult situations faced by children in the present context. (Analysing)
- Know the national and international efforts for child welfare and the child related laws. (Remembering and Understanding)
- Understand and acquire the skills for working with children. (Applying and Analysing)

Module I: Understanding Child and Childhood (11 hours)

Understanding Child- Childhood Development, Scope of Child Development, Meaning and Importance of different stages of Growth and Development - Heredity and Environment – Salient features of different

stages in life - Factors influencing Growth and Development - Principles of Child Development; Child Rearing Practices, Socialization of Children with special needs- Special Schools/ Inclusive Schools; Theories: Cognitive Development Theory, Psycho-Social Theory, Personality Theory, Learning Theory

Module II: Concerns and Issues faced by Children (11 hours)

General Health of Children: Common Diseases, Malnutrition, Infant mortality and morbidity, health of Adolescent Girls; Concept of Mental Health, Child mental health and Psycho-Social Development. Mental health needs and mental health problems and disorders in Children of various age groups, Learning Disabilities, Pervasive Developmental Disorder; Children in need of care and Protection- Street Child, Destitute, Abandoned, Orphaned, Child abuse, Child labour, Child trafficking, Natural calamity affected children, Children in Conflict situation, HIV-AIDS affected and infected children, Special problems of Girl child and Children in conflict with law.

Module III: Child Rights, Policies and Programmes (11 hours)

Working with Children – From charity to rights holders, Declaration of rights of the child 1924, UN Conventions and declarations - UNCRC, National Charter for Children, National Action Plan for Children, History of child development programs in India.; Constitutional Provisions, National Policy for Children, Commissions for Protection of Child Rights, Juvenile Justice (Care and Protection of Children) Act, 2015, Protection of children from sexual offences Act, 2012, Central Adoption Regulatory Agency (CARA guidelines), Child Labour (Prohibition and Regulation) Act 1986. Current initiatives- ICDS, ICPS, SSA and RTE, NRHM

Module IV: Fields of SWP and Skills for working with Children (12 hours)

Family, Child Welfare Organizations, School Settings, Children's Home, Adoption Agency; Communication Skill, Interpersonal Skills, Imagination and creativity- Art and Craft, and relationship building Skills, Counseling, and Discipline and Behavior Management; Good Practices by Organizations- CRY, Action Aid, Aide-Et-Action, UNICEF, RED CROSS and SOS Children's Village.

Suggested readings

Anandaraj, H., Children at Risk, Hyderabad: Neelkamal Publications, 2007
 Banerjee, B. G., Child Development and Socialisation, New Delhi: Deep and Deep Publication, 1987
 Baroocha, P. P., Handbook on Child, New Delhi: Concept Publishing Com, 1999
 Berk, Laura E., Child Development (8th edition), New Delhi: Pearson Prentice Hall, 2009
 Bhalla, M. M., Studies in Child Care, Delhi: Published by NIPCCD, 1985
 Bossare, James H. S., The Sociology of Child Development, New York: Harper and Brothers, 1954
 Chandra Kulshreshtha Jinesh, Child Labour in India, New Delhi: Ashish Publishing House, 1978
 Chaturvedi, T. N., Administration for Child Welfare, New Delhi: Indian Institute of Pub., 1979
 Choudhari, D. Paul., Child Welfare / Development, Delhi: Atma Ram and Sons, 1980
 Ghathia, Joseph, Child Prostitution in India. New Delhi: Concept Publishing Company, 1999
 Gokhale, Sharad D. and Sohoni, Neera K., Child in India, Mumbai: Somaiya Pub., 1979
 Gopalakrishnan B., Rights of Child, Jaipur: Aavishkar Publishers, 2004
 Hugh, Jolly, Diseases of Children, Oxford: The English Language book society and Blackwell Scientific Publications, 1981
 Hurlock, Elizabeth B., Child Development, New Delhi : Tata McGraw Hill Pub; Com; Ltd., 1968
 Kumar, Arvind, Fundamentals of Child Rights: Concepts, Issues and Challenges, Lucknow: Laxmi Shikshan Sansthan, 2002
 Nanda, V. K., Nutrition and Health for child Development, New Delhi: Anmol Publication Pvt. Ltd., 1998
 Pandya, K. C., Element of Child Development. New Delhi: Kalyani Pub., 1988
 Pimpley, P. N., Singh K. P., A. Mahajan, Social Development Process and Consequences, Jaipur: Rawat Publication, 1989

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		M	M
CO 4		H	M	M
CO5	H	M		H

SWMS0052: MEDICAL SOCIAL WORK (3-0-0)**(3 credits-45 hours)****Course Outcome:**

Introduce the historical development of medical social work in western countries and in India.

(Remembering)

Students will develop an insight on the impact of disease on the individual and his/her social system. □

(Understanding)

Students would learn to implement social work intervention strategies in medical and psychiatric settings.

(Applying)

Students will develop competencies in the roles and functions of medical social workers in various settings.

(Applying)

Module I: Historical overview (11 hours)

Medical Social Work:- Historical development of Medical Social Work in Western Countries and in India; Social Workers in General Health Care System in India; Challenges in the field of Medical Social Work in India.

Module II: Disease, Illness and Sickness and Concept of Care (11 hours)

Illness as a social problem and its effect on the individual, family and community, the concept of Patient as a Person; Social and

Emotional factors involved in disease; Social Work with terminally ill, Social Work with dying and bereaved, Palliative Care, Hospitalization and its implications on patient and the family members; Rights of Patients; Modern trends in treatment of illness; Care in different Medical Settings – Hospitals, Outpatient Departments, Emergency, Crisis care, Hospice, Special Clinics.

Module III: Skills (11 hours)

Skills and Qualities of Medical Social Worker; Teamwork and multidisciplinary approach in the treatment of illness; Role and functions of a Medical Social Worker, Organization and Administration of Medical Social Work Department in Hospitals; Assessment and Diagnosis- Interviews, Reporting and Record maintenance; Medical Social Worker and Public Relations.

Module IV: Medical Social Work in different Departments in Hospitals (12 hours)

Medical Social Work in different Departments in Hospitals: Oncology, Nephrology; Reproductive Health, Family Welfare and Family Planning; Sexual Health (STD, HIV/AIDS); Geriatrics, Diabetology, Cardiology, Accident, Disability and Burns Department.

Suggested Readings

Anderson R. and Bury M. (Eds.), Living with Chronic Illness – the Experience of Patients and their Families, Unwin Hyman: London, 1988

Bajpai P.K., Social Work Perspectives in health, Rawat Publications: New Delhi, 1997

Barlett H.M., Social Work Practice in the Health Field, New York: National Association of Social Workers, 1961

Dimatteo, M. Robin and Leslie R. Martin, Health Psychology, Dorling Kindersley (India) Pvt. Ltd.:

New Delhi, 2007

Field M., Patients are People – A Medical – Social Approach to Prolonged Illness, Columbia University Press: New York, 1963

Narasimhan, M. C. and Mukherjee, A.K., Disability – A Continuing Challenge, Wiley Eastern Ltd. New Delhi, 1987

Pathak S. H., Medical Social Work in India, New Delhi: DSSW, 1961

Pokarno K.L., Social Beliefs, Cultural Practices in Health and Diseases, Rawat Publications, New Delhi, 1996

Park, J.E., Textbook of Social and Preventive Medicine, 17th edition, Jabalpur: Banarsidas Bhanot, 2006
World Health Organization, World Health Report, Geneva, 2001

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	
CO 2		H		M
CO 3	M	M	H	M
CO 4		M	M	H

SWHS0053: MENTAL HEALTH AND SOCIAL WORK (3-0-0)

(3 credits-45 hours)

Course Outcome:

Introduce the concept of mental health, normal and abnormal behaviour, meaning of psychiatry and its history. (Remembering)

Students will develop the skills of assessment of mental illness. (Applying)

Students will learn about various mental illnesses affecting people. (Applying)

Introduce the concept of Community Psychiatry and significance of community mental health. (Analyzing)

Module I: Understanding mental health and mental illness (10 hours)

Mental health: A Conceptual Framework: Historical background of the concept. Definitions of mental health components. Mental health in the changing society. Concept of normal and abnormal behaviour. Psychiatry – definition, history and growth of psychiatry. Traditional and modern attitude towards psychiatric illness. Symptomatology – Disorders of perception, thought, speech, memory, emotion.

Module II: Psychiatric assessment (10 hours)

Assessment in psychiatry. Psychiatric interviewing, case history recording and mental status examination (MSE). Classification in psychiatry- need, types - ICD and DSM.

Module III: Major Psychiatric disorders (15 hours)

Prevalence, etiology, clinical manifestation, course and outcome and different treatment modalities of the following disorders:

Neurotic and somatoform disorders – Phobia, anxiety disorders, Obsessive compulsive disorders, dissociative (conversion) disorders, somatoform disorders

Mood (affective) disorders

Organic mental disorders – dementia, (Alzheimers), Amnesic syndrome, delirium

Schizophrenia and Delusional disorders

Disorders of adult personality and behaviour _ paranoid, schizoid and histrionic personality disorders.

Gender identity disorders, disorders of sexual preference

Disorders of psychological development – developmental disorders of speech and language and scholastic skills; learning disability, mental retardation, pervasive developmental disorders – autism, Rett's and Asperger's syndrome

Behavioural and emotional disorders in childhood and adolescence – Hyperkinetic and conduct disorders, anxiety, phobia and depression Disorders due to substance use

Module IV: Community mental health (10 hours)

Community psychiatry – concept and meaning, evolution of community psychiatry; Community mental health in India, Social – cultural factors in psychiatric disorders with special reference to India, culture bound syndrome.

Suggested Readings

- American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, 4th Edition. DSM –IV-TR, APA, Washington DC, 2000
- Carlson R. Neil, Foundations of Physiological Psychology, 6th Ed, Pearson Education, India, 2007
- Chaube S.P., Abnormal Psychology, Educational Publishers
- Clifford T. Morgan, Richard A. King, John R. Weisz, John Schopler, Introduction to Psychology, Tata Mc. Graw Hill Edition
- Colman. M. Andrew, Oxford Dictionary of Psychology, Oxford University Press, New York, 2009
- Correy Gerald, Theory and Practice of Counseling and Psychotherapy, Student Manual, 8th Ed, Brooks Cole Cengage Learning, USA, 2005
- Fernald/Fernald, Munn's Introduction to Psychology, 5th Edition, AITBS Publishers, India
- James D. Page, Abnormal Psychology, Tata McGraw Hill Edition,
- Kring M. Ann, Johnson L. Sheri, Davison C. Gerald, Neale M. John, Abnormal Psychology, 11th Ed, Wiley India Pvt. Ltd, New Delhi, 2010
- Kumar Updesh, Mandal, Manas (Editors), Suicidal Behaviour, Assessment of People-at-Risk, Sage Publications India Pvt. Ltd, New Delhi, 2010
- Maxmen S. Jerrold, Ward G. Nicholas, Essential Psychopathology and its Treatment, 2nd Ed. Revised for DSM IV, W.W. Norton and Company, New York, 1995
- Mishra. A.K., Psychology of Aging, Sublime Publications, Jaipur, 2007
- Patel Vikram, Thara R. (Editors), Meeting the Mental Health Needs of Developing Countries, NGO Innovations in India, Sage Publications, New Delhi, 2003
- Ranjana, Cognitive Psychology, RBSA Publishers, Jaipur, 2010
- Robert A. Baron, Psychiatry, 5th Edition, Pearson Education
- Robert C. Carson, James N. Kutcher, Susan Minela, Jill M. Hooley, Abnormal Psychology, 13th edition, Pearson Education
- Santrock W. John, Educational Psychology 2nd Ed, Tata McGraw- Hill Edition, New Delhi, 2006
- Scileppi A. John, Teed L. Elizabeth and Torres D. Robin, Community Psychology: A common sense approach to mental health, Prentice Hall, USA, 2000
- Shepherd, Michael et al., Childhood Behaviour and Mental Health, University Press. London, 1971
- World Health Organization, the ICD 10 Classification of Mental and Behavioural Disorders, Clinical Description and Diagnostic Guidelines, Oxford University Press, Geneva, 1992

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			
CO 2		H	H	
CO 3		H	H	
CO 4	M			H

SWOD0054: ORGANISATIONAL STRUCTURE, BEHAVIOUR AND DEVELOPMENT (3-0-0)

(3 credit: 45 hours)

Course Outcome

Understanding the structure and functioning of an organization (Remembering and Understanding)

To develop the skills for Organisation Development Process (Evaluating and Creating)

To establish and manage any development organisation. (Evaluating and Creating)

To introduce the students to organisational structure and management (Remembering and Understanding)

To familiarize the students with the skills and legal base for managing the workforce of an organisation. (Applying and Analysing)

Module I: Organizational Structure (10 hours)

Organizational Structure: Definition, Concept and Nature Formation of Organizational Structure; Types of organizational Structure

Module II: Basic concepts in Organisational Behaviour (10 hours)

Organizational Behaviour: concept and theories; Models of Organizational Behavior: Development and Types; Organisation

Climate, Culture and Team building; Employee counseling, Work life balance, managing occupational stress

Module III: Basic skills for Organisational Development (10 hours)

Leadership - traits, typology and theories; Motivation: need, significance, theories, methods and practices; Communication - concept, significance, modes, channels, impact

Module IV: Legal Base for Practice (15 hours)

Legislations for industrial relations-Factories Act, 1948, Industrial Dispute Act, 1947, Industrial Employment Standing Orders Act, 1946; Legislations related to Wages – Minimum Wages Act, 1948, Payment of Wages Act, 1936, Equal Remuneration Act, 1976, The Payment of Bonus Act, 1965, Payment of Gratuity Act, 1972; Equal Opportunities, Protection of Rights & Full Participation) Act, 1995; Provisions related to employees behaviour : discharge, misconduct, domestic enquiry and disciplinary action; sexual harassment at workplace; Legislations related to employment- Inter-state Migrant Worker's Act, 1979, Contract Labour Act, 1970

Suggested Readings

Daft, R.L., Organization: Theory and Design, Mason: OH, South Western Publishing, 2004

Jacoby, S.M. (Ed.). The Workers of Nations: Industrial Relations in Globalized Economy, New York: Oxford University Press, 1994

Mallick, P.L., Industrial Law, Lucknow : Eastern Book Company, 2002

Mathis, R. L., & Jackson, J.H., Human Resource Management, U.K: Prentice Hall International, 1997

Pareek. U., & Rao, T.V., Designing and Managing HR Systems, New Delhi: Oxford & IBH Publishing, 1992

Ramnarayan, S., Rao, T.V., & Singh, K., Organization Development: Interventions and Strategies, New Delhi: Sage Publications, 1998

Robbins, S.P., Organizational Behaviour (10thEd.), New Delhi: Prentice Hall of India, 2002

Silvera, D.M., Human Resource Management: The Indian Experience, New Delhi: New India Publications, 1990

Sivananthiran, .A. & Venkatratnam, C.S., Best Practices in Social Dialogue, New Delhi: ILO, 2003

Veena, A.K., Kochan R.D., & Lansbury, R.D., Employment Relations in the Growing Asian Economics, London: Routledge, 1995

Ramnarayan, S., Rao, T.V., & Singh, K., Organization Development: Interventions and Strategies, New Delhi: Sage Publications, 1998

Robbins, S.P., Organizational Behaviour (10thed.), New Delhi: Prentice Hall of India, 2002

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2		H	H	

CO 3		H	H	
CO 4	M		M	H
CO5	H	M		H

SWDO0055: POLICIES FOR DEVELOPMENT ORGANISATIONS - URBAN, RURAL AND TRIBAL COMMUNITIES (3-0-0)

(3 credits- 45 hours)

Course Outcomes

Develop an understanding about the social policies and decision making process of the government in planning for development in India. (Evaluating and Creating)

Understand the Governmental efforts for development of Rural, Tribal and Urban communities (Remembering and Understanding)

Understand and analyze Governance issues at local, regional, state and national levels

(Applying and Analysing)

Module I: Introduction to Social Policies (8 hours)

Meaning and Definition of Policy and social policy; History and process of Social Policy development in India; Evolution of planning – Planning commission, NITI Aayog.

Module II: Policies and Schemes in Urban Areas (8 hours)

Challenges for urban development; urban poverty management; urban governance systems; Government schemes and policies

Module III: Policies and Schemes in Rural Areas (8 hours)

Challenges for rural development; rural poverty management; rural governance systems - decentralization processes; Government schemes and policies

Module IV: Policies and Schemes in Tribal Areas (8 hours)

Challenges for tribal development; Poverty management; Governance systems; Government schemes and policies

Module V: Issues of Governance and Planning (13 hours)

Issues of Development and Displacement; Diversity and Citizenship Issues

Suggested Readings

Akhup, A., Identities and their struggles in Northeast India (TAS 2), Kolkata: Adivaani, 2015

Bodhi, S.R., Social Work in India: Tribal and Adivasi Studies- Perspectives from Within, Kolkata: Adivaani, 2016

Dreze, J., & Sen, A., An uncertain glory: India and its contradictions, London: Princeton University Press, 2013

Fernandes, W., Bharali, G., Uprooted for whose benefit? Development-induced displacement in Assam, Guwahati: NESRC Press, 2011

Jacob, K.K., Social Policy in India, Udaipur: Himalaya Publications, 1989

Shivaramkrishnan, K.C., Kundu, A. & Singh, B.N., Handbook of Urbanization in India, New Delhi: Oxford University Press, 2007

Mishra, R., Globalisation and the welfare state, London: Edward Elgar, 1999

Singh, K. (2009). Rural Development: Principles, Policies and Management, 3rd Ed. New Delhi: Sage.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	
CO 2		H	H	M

CO 3	M	H	H	

SWCP0056: INTRODUCTION TO CHILD PSYCHOLOGY AND DEVELOPMENT (3-0-0)**(3 Credits- 45 hours)****Course Outcomes**

Introduce and help students understand the psychological, legal and cultural definitions of child and childhood (Remembering and Understanding)

Introduce students to the major personality theories of psychology thus enabling them to understand human behaviour. (Applying and Analysing)

Help students discover the different factors that influence development and behavior of children (Evaluating and Creating)

Understand the principles, values and code of ethics for working with children (Remembering and Understanding)

Module I: Introduction to Child and Childhood (11 hours)

Understanding Child and Childhood- Definitions and Notions of Childhood across varying Cultural, Political, Social, Historical, Biological and Philosophical Contexts; Legal and Constitutional Definitions: Different Age based definition in the Juvenile Justice (Care and Protection of Children) Act, 2000; Child Labour (Prohibition and Regulation) Act 1986; The Right of Children to Free and Compulsory Education Act, 2009; United Nations Convention on the Rights of the Child (UNCRC); Development Stages of Childhood- Human Life Cycle Approach: Development Stages, Socialization and Agents of Socialization, Child Rearing Practices; Common Illness and ailments

Module II: Theories on Child Development (11 hours)

Theories of Child Behavior; Emotional Theories; Learning Theories; Intellectual Theories; Psycho-Social Theories; Personality Theories; Moral Theories; Implications of Theories.

Module III: Situational Child Psychology (11 hours)

Factors Determining Well-Being and Development of Children – Adult Child Relationships- Age, Gender, Caste, Class, Education, Social and Cultural Practices, Ethnicity, Religion, Region, Language, Influence of Technology on Family Relationships; Family dynamics, Peer relationships, Sibling relationships and birth order; Effects of separation, divorce, bereavements; Power Dynamics- Protection, Care and Support; Punishments and Threats; General Adult Attitudes; Effect of Cultural Practices; Laws and Institutional Practices; Representation in Literature and Media; Factors enabling Healthy Adult Child Relationships

Module IV: Values and Principles of Working with Children (12 hours)

Code of ethics- Responsibility for Self, Responsibility to Children, Young People and their Families, Responsibility to Colleagues, Responsibility to Employers, Responsibility to the Profession, Responsibility to Society; Principles and Values- Seven International Ethical Principles for People Working with Children and Young People; Psychiatric rehabilitation principles and values by Psychiatric Rehabilitation Association (PRA)

Suggested Readings:

- Ahuja, N., A Short textbook of Psychiatry, Himalaya Publishing House, New Delhi, 2005
 Banerjee, B. G., Child Development and Socialisation, New Delhi, Deep and Deep Publication, 1987
 Archambeault, J., Social Work and Mental Health, UK: Learning Matters Pvt Ltd, 2009
 Baroocha, P.P., Handbook on Child, New Delhi: Concept Publishing Com, 1999
 Berk, Laura E., Child Development (8th edition), New Delhi: Pearson Prentice Hall, 2009
 Bhalla, M. M., Studies in Child Care, Delhi: NIPCCD, 1985
 Bossare, James H. S., The Sociology of Child Development, New York: Harper and Brothers, 1954
 Berk, Laura E., Development through the Lifespan, 5th edition, Allyn and Bacon, London, 2009

Bhattacharya, S., Social Work: Psycho-Social and Health Aspects, New Delhi: Deep and Deep, 2008
 Clifford T. Morgan, Richard A. King, John R. Weisz, John Schopler, Introduction to Psychology, Tata Mc.Graw Hill Edition.
 Coleman James. C, Abnormal Psychology and Modern Life, D.B. Taneporevela, Mumbai, 1975
 Feist Jess, Feist J. Gregory, Theories of Personality, 7th Edition, McGraw Hill, Primis, 2008
 Fernald/Fernald, Munn's Introduction to Psychology, 5th Edition, AITBS Publishers, India
 Feshback Seymour, Weiner Bernard, Bohart Arthur, Personality, 4th Edition, D.C. Health and Company, Lexington, 1996
 Hurlock, Elizabeth, Developmental Psychology, Tata Mc Graw Hill, New York, 2001
 Giddens, Anthony, Social Theory and Modern Sociology, Stanford University Press, 1987
 Steinberg, Laurence, Adolescence, McGraw Hill Inc, New York, 1993
 WHO, the ICD – 10 Classification of Mental and Behavioural Disorders, Diagnostic Criteria for Research, AITBS Publishers and Distributors (Regd.), Delhi, 2004
 Theories of Personality, Hall and Goindzey

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	H		H	M
CO 4		H	M	M

SWRC0057: RIGHTS OF THE CHILD – LEGAL FRAMEWORK, NATIONAL AND INTERNATIONAL INSTRUMENTS(3-0-0)

(3 Credits- 45 hours)

Course Outcomes:

Make the students well abreast of the International. National and other relevant instruments on Child Rights and get to know the legal sanctions and safeguards regarding children's rights (Remembering and Understanding)

Get to know the provisions enshrined in the Indian constitution which safeguard the rights of children and ensures a life of dignity for them (Remembering and Understanding)

Make the students understand the role, functions and powers of the UN agencies and their mandate in working towards the cause of children(Analysing)

Familiarize the students with the working of the statutory bodies and their role in providing justice to children. (Evaluating and Creating)

Module I: Introduction to Human Rights and Children's Rights (11 hours)

Theoretical Foundation of Human Rights, Historical Evolution of Human Rights; Child Rights as Human Rights of Children;

Evolution of Child Rights, Children as objects of Charity to rights holders; Specialized instruments on the Rights of the Child & Foundational Principles- Declaration of the Rights of the Child 1924, Declaration of the Rights of the child 1959, Beijing Rules, 1985; UN Convention on the Rights of the Child 1989 (Survival Rights, Development Rights, Protection Rights and Participation Rights), United Nations Convention on the Rights of Persons with Disabilities.

Module II: Legislations relating to Children in India (11 hours)

Introduction to the Indian Constitution, Fundamental Rights and Directive Principles of State Policy;; National Policy for Children, 1974 and 2013, Child Labour (Prohibition and Regulation Act, 1989), The Plantations Act, The Prohibition of Child Marriage Prevention Act, Immoral Trafficking (Prevention) Act, Pre-natal Diagnostic Techniques Act, 1994, Right to Education

Act, POCSO Act, Juvenile Justice (Care and Protection) Act 2016; Central Adoption Resource Agency, Rights of Children with Disabilities.

Module III: Child Protection (11 Hours)

The Legal Foundation of Child Protection, Defining Child Protection; Concept and definition of vulnerability, Settings or Habitats of Children and its Effect on Vulnerability: (Family, Streets or Public Places, Institutions); Magnitude of Abuse, Neglect, Violence and Exploitation Cases Child in need of care and protection or vulnerable groups- Child Labour, street Children, abused Children, Children With disability, Trafficked Children, Children in Institutions and Children in "Families At Risk". Child Poverty: Multi-dimensional Deprivation; Children and the Law- Children in Conflict with the Law, A System's Approach to Child Protection- Components of a Child Protection System, Identifying Problems in Child Protection System, Global and Local Action to Strengthen Child Protection Systems

Module IV: Child Rights, Protection and its Applications (12 hours)

Role of duty bearers in ensuring child rights and protection- Role in Protection, Prevention, Intervention and Rehabilitation by Family, Community, Civil Society, Media, and State; Structure, Functions and Role of UN and its specialized agencies for the protection of child rights, UNICEF, WHO, Red Cross; National and State Commissions for Protection of Child Rights - Their role and Functions; Government Schemes: Integrated Child Protection Scheme, Integrated Child Development Scheme; Programs and interventions for Child Protection- Family strengthening, Institutional Services and Non-Institutional services, Alternative Care

Suggested Readings

Acharya, B., & Das, D., Introduction to the Constitution of India, (7th. Edition), New Delhi: Prentice Hall of India Pvt.Ltd, 2008

Ahuja, R., Criminology, Jaipur, Rawat Publications

Biju, M. R., Human Rights in a Developing Society, New Delhi: Mittal Prakashan, 2005

Diwan, Paras and Diwan, Peeyush, Child and Legal Protection, New Delhi: Deep and Deep Publications, 1994

Nirmal C. J., Human Rights in India: Historical, Social and Political Perspectives (Oxford University Press, India)

Bajpai Asha, Child Rights in India: Law, Policy and Practice, Oxford University Press, USA, 2005

Leister Erich and Nanda Sujata, Human Rights of Children, Kalinga, New Delhi, 2009

KumariVed , The Juvenile Justice System in India: From welfare to Rights, Oxford University Press, New Delhi, 2004

Brien Damick, ed, Child Labour in India: Realities and Issue, London, OUP, 2010

Sinha Santa, Child Labour and Education Policy in India, Administrator Vol XII, July-September, 1996

Arun Kumar, Child as a Human Resource, Sarup& Sons, 2002

Myron Weiner, NeeraBurra, AshaBajpai, Born Unfree, OUP, 2006

JyotsnaTiwari, Child Abuse and Human Rights, Isha Books, 2011

Samaddar Ranabir (Ed), State of justice in India-issues of social justice, sage publication, 2009.

Sastry, T. S. N, India and Human Rights, Delhi, Concept Publishing Company, 2005

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	H		M	H
CO 4		H	M	M

SWSP0058: SOCIAL DEVELOPMENT AND SOCIAL POLICY (3-0-0)

(3 Credits- 45 hours)

Course Outcomes

Understand the key concepts and issues related to Social Development (remembering and Understanding)
Promote alternative paths of Social Development that promotes the wellbeing of Individuals, families and communities (Creating and Evaluating).

Develop an understanding of social policy in the perspective of the national goals as stated in the constitution. (Creating and Evaluating)

Develop the capacity to recognize the linkage between the developmental issues and social policy, plans and programmes related to social work practice. (Applying and Analysing)

Module I: Social Development (11 hours)

Definition, meaning and concepts; Approaches to Social Development; Developmental Indicators; Measurement of Development; Models of Development; Economic growth and Social Development; Human Development; Relationship between Social Development and Sustainable Development .

Module III: Theories of Social Development (11 hours)

Baran's Theory; World System Theory; Dependency Theory; Theory of Unequal Exchange; Theory of Economic Growth; Theory of Positivistic Development; Theory of Realistic Development.

Module III: Social Policy (11 hours)

Concept and Objectives; Values underlying Social Policy based on Constitutional provisions (i.e. Directive Principles of State Policy, Fundamental Rights and Fundamental Duties); Instruments of Social Policy; Approaches to Social Policy – Residual Welfare, Unified, Integrated, Sectoral; Models: Industrial achievement and Institutional Redistributive Model and their applicability to the Indian situation.

Module IV: Evolution of Social Policy (12 hours)

Process of Social Policy formulation; Methods of evaluation of Social Policy; Critical review of Policies concerning Education, Health, Youth, Welfare of Backward Classes, Tribal development and Poverty alleviation

Suggested Readings

Blakemore, Kenneth, Social Policy: An Introduction, Mc Graw- Giriggs, E, Hill Education, New York, 2007

Bogo Marion, Social worker Practice: concept, processes and interviewing, New Delhi, Rawat, 2007

Bose, A.B., Social Welfare Planning in India, New Delhi: ECAEF

Gilbert, N and Specht, H Planning for Social Welfare: Issues, Models and Tasks, Prentice Hall Inc.

Englewood cliffs, New Jersey

Goel, S.L. and Jain, P.K., Social Welfare Administration, Vol. 1 and 2, New Delhi: Deep & Deep Publication, 1988

Huttman, E.D., Introduction to Social Policy, New YorkMcGraw Hill, 1981

Hills J., Making Social Policy Works, Rawat Publications, New Delhi, 2007

Hudson J., Understanding the Policy Process, Rawat Publications, ND, 2007

Jones, Kathleen and others, Issues in Social Policy, Routledge and Paul, Kogan London, 1983

Kulkarni, P.D., Social Policy in India, Tata Institute of Social Sciences, Bombay, 1965

Kulkarni, P.D., Social Policy and Social Development in India: Madras, Association of Schools of Social Work in India, 1979

Lavalette Michael, Alam, Social Policy-Theories, Concepts and Issues, Sage, New Delhi.

Livingstone, A., Social Policy in Developing Countries, London: Routledge and Kogan Paul, 1969

Modison, Bernice and George, Meaning of Social Policy: A Comparative Dimension in Social Welfare, London, 1980

Mishra, R., Society and Social Policy, Macmillian Ltd., London, Allen and Unwin, 1977

Mullard, M, Social Policy in Changing Society London: Routledge, Spicker, 1998.

Simpson, G., Social Policy for Social Welfare Professionals, 2011

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2		H	H	
CO 3		H	H	
CO 4	M			H

SWPM0059: PROJECT CYCLE MANAGEMENT AND RESOURCE MOBILISATION(3-0-0)

(3 Credits- 45 hours)

Course Outcomes

Understand the importance and process of planning, methodology for planning and formulating projects using the Logical Framework Analysis (Remembering and Understanding)

Develop an understanding of the problems and issues faced by the poor and the marginalized (Creating)

Develop an insight into the different strategies and approaches commonly adopted by Development Organisations for Project Management (Applying and Analysing)

Learn Skills to develop project proposals, implement, monitor and evaluate project, enhance process documentation and reporting skills (Evaluating and Creating)

Module I: Overview (7 hours)

Concept of Results Based Management; Planning and its importance for PCM; Overview of Project Cycle Management: Identification, Design, Implementation, Monitoring, Evaluation, Identification of the best practices.

Module II: Project Identification (8 hours)

Needs assessment: Situational analysis; Capacity assessment: Human, Social, Natural, Physical, Economic and Cultural; Stakeholders analysis, types: Primary and Secondary Stakeholders and mapping of Stakeholders; Importance of Stakeholder participation and different levels of participation

Module III: Project Design (10 hours)

Problem Tree analysis; Objective Tree analysis and formulation of objectives; Hierarchical results: Impact, outcome, Outputs, Inputs; Assumptions, Indicators, Means of Verification; Activities and scheduling; Budget preparation

Module IV: Monitoring and Evaluation (10 hours)

Concept and definition of monitoring and evaluation; Difference in Monitoring and Evaluation; Learning the lessons; documentation and reporting; PERT and Critical Path Method (CPM) of Monitoring

Module V: Resource Mobilization (10 hours)

Internal and External Resources; Fundraising – principles, sources, ethics, methods and their implications. International sources for Funding – Concept note; application, procedure and FCRA, record keeping, documentation and legal compliance

Suggested Readings

Lukose P J, A to Z in Projects Cycle Management: A Results Based Approach, Media House, Publications, New Delhi, 2015

Capezio, P., Powerful Planning Skills. Mumbai: Jaico Publishing House, 2000

Smith, S., Plan to Win. New Delhi: Kogan Page India, 2002

Dale, R., Evaluation Frameworks for Development Programmes and Projects. New Delhi: Sage Publications, 2001

Loehle, C., Thinking Strategically, New Delhi: Foundation Books, 2000

Padaki, V., Development Intervention and Programme Evaluation, New Delhi: Sage Publications, 1995

Dadrawala, N.H., The Art of Successful Fundraising, New Delhi: CAP

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		H	M
CO 2		H	H	
CO 3		H	H	
CO 4	M			H

SWHP0060: COMMUNITY HEALTH AND POPULATION MANAGEMENT (3-0-0)

(3 credit- 45 hours)

Course Outcomes

Define health, disease, epidemiology, health policies, health education and related terms of community health and population studies (Remembering)

Explain the concepts of health, health indicators and relevance of social work in health (Understanding)

Apply and knowledge and understanding of the concepts of community health in social work practice for development (Application)

Able to analyse various health issues in communities, and suggest and apply solutions to community health concerns (Analyse)

Able to assess and choose health intervention plans and policies for community needs (Evaluate)

Able to combine effectiveness of health interventions, approaches, policies and programmes for effective intervention for healthy communities (Creating).

Module I: Health, Disease and Epidemiology (11 hours)

Meaning and Scope of Health and Epidemiology; Concepts and Models of Health and Disease; Factors associated with health and diseases; Concepts of sickness, illness and diseases; Environmental Health, Nutritional Health, Occupational Health, Mental Health and Reproductive Health, Tribal Health.

Module II: Health Indicators, Health Statistics and Management System (11 hours)

Health Statistics and Health Indicators – Morbidity and Mortality: MMR, IMR, TFR; Communicable and Non-communicable diseases; HMIS – Computer systems, Data sources, Collection, Analysis and uses; Primary, Public and Community Health Care Services: Structure, Organization, and Community Participation; Physical and psychological aspects of Community Health; Preventive and Promotive Health care in Indian context. Community Health Concerns: Drugs and Alcoholism.

Module III: Health and Population Policies (11 hours)

Health and Population Policies: Health Policy; Alma Ata Declaration, National Health Policy; Mental Health Act; NRHM, Assam Public Health Act; Population Policy; Population Dynamics- National and the North East Context.

Module IV: Health Education and Role of Social Worker in Health Service (12 hours)

Health Education, Consumer Health and Health Products; Meaning, importance, principles and components of health education; IEC for health: mass media, audio-visual; Agencies for Health Education Programmes-Voluntary and Government; Analysis of Health Education in India. Formal and Informal health care provider; Modern and traditional practices, safe and risk health behavior and practices. Quackery,

Consumer Law on health, consumer agencies; Role of Social Work in Preventive, Promotive and Rehabilitative Programmes in Communicable and Non-Communicable Diseases.

Suggested Readings

Abelin, T., Brzenski Z.J., and Carstairs, V.D., Measurement in Health Promotion and Protection, WHO, Copenhagen, 1987

AIDS Prevention through Health promotion by WHO, end of pub.

Alderson, M., An Introduction to Epidemiology, 2nd edition, Mac-Millan, London, 1983

Anssi. Perakyla, AIDS Counseling – Institutional Interaction and Clinical Practice, Cambridge, University Press, 1995

Bhore, J., Report of the Health Survey and Development Committee. Vol. 2. Government of India., New Delhi, 1946

Dutta, I. and Bawari, S., Health and Healthcare in Assam: A Status Report, CHEAT and OKD, Mumbai, 2007

Francis, C.M., Promotion of Mental Health with community participation- The center for Health Care Research and Education, Kerala, 1991.

Government of India (GOI). Operational Guidelines for Programme Managers and Service Providers for Strengthening STI/RTI Services, GOI, Ministry of Health and Family Welfare, New Delhi, 2011

Green L.W and Anderson, C.L., Community Health 5th edition, Times Mirror Mosby, St. Louis 1986

Park, K., Park's Textbook of Preventive and Social Medicine, 20th edition, Bhanot, 2009

Thomas, G., AIDS and Family Education – Gracious Thomas, Rawat, Jaipur, 1995

Thomas, G., Sinha, N.P. and Thomas, K.J. AIDS'S Social Work and Rawat, Jaipur, 1997

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	M	M
CO 2	M	M	M	M
CO 3	M			H
CO 4	M	H		
CO 5			H	M
CO 6				H

SWDC0061: COMMUNITY DEVELOPMENT PRACTICE WITH THE DISEMPOWERED COMMUNITIES (3-0-0)

(3 credits- 45 hours)

Course Outcomes:

Understand the issues of marginalization, oppression and disempowerment of vulnerable communities such as the dalits, tribes and the indigenous peoples and women (Remembering and Understanding)

Build capacity among the students for critical reflection and analysis of community development issues pertaining to the disempowered (Applying and Analysing)

Build upon the existing understanding of community dynamics, structures and experiences (Evaluating and Creating)

Strengthen skills and capacity of the students for intervention at different levels taking an “empowerment” and antioppressive stance. (Applying)

Module I: Power, Privilege and Oppression (11 hours)

Conceptual Frameworks and Theoretical Perspectives; Systems Theory; Critical Theories; Understanding oppression, privilege and oppression in Indian context.

Module II: Political Economy of the Dalit Development (11 hours)

Social stratification; Caste; Casteism; Colonialism and State; Ambedkar and the Annihilation of Caste

Module III: Political Sociology of the Tribes and Tribal Development (11 hours)

Perspectives on Tribes; History of Tribes/Adivasis in India; Evolution of Tribal Policy; Administration and Local Governance;

Politics of Tribal Welfare and Development; Critical Social Work; Anti-oppressive Approach; Structural Social Work

Module IV: Specific Identity Constructs and Populations at Risk (12 hours)

Gender and Sexism; Gender, Culture, and Society; Race, Sexuality, and Culture (Intersections); Gendered Relations; Health, Sex, and Gender.

Suggested Readings

Chacko, P.M. (Ed.), Tribal Communities and Social Change

Freire, A. M. A., and Macedo, D. (Eds.), The Paulo Freire reader. New York: Continuum, 1995

Freire, P., Pedagogy of the oppressed, (M. B. Ramos, Trans.) New York: Continuum, 1990

Freire, P., Education for critical consciousness. New York: Continuum, 1969/1998

Freire, P., Pedagogy of freedom: Ethics, democracy, and civic courage. (P. Clarke, Trans.) Lanham, MD: Rowman and Littlefield Publishers, Inc., 1998

Freire, P., and Macedo, D. P., A dialogue: Culture, language, and race. Harvard Educational Review, 65(3), 1995

Fultner, B. (ed.), JurgenHabermas: Key Concepts. Rawat Publications. Jaipur, 2012

Taylor, D. (ed.), Michael Foucault: Key Concepts. Rawat Publications. Jaipur, 2011

Elwin, V., The Philosophy of NEFA

Bartlett and Kennedy eds., Feminist Legal Theory , 1991

Wing ed., Critical Race Feminism: A Reader, 1997

Ortner, S., Is Female to Male as Nature is to Culture? In M. Rosaldo and L. Lamphere (eds.), Women, Culture and Society, Stanford University Press, pp. 67-88., 1974

Moore, H.L., Feminism and Anthropology, Ch.2, Cambridge: Polity Press, pp. 12-41, 1988

Kimmel M., the Gendered Society. Introduction and Chapters 1, 2 and 4, 2000

Hollway, W., 'Gender difference and the production of subjectivity', in Helen Crowley and Susan Himmelweit (eds.) Knowing Women, p240 - 275, Oxford: Polity, 1984

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		M	M
CO 4		H	M	M

SWWE0062: DEVELOPMENT CONCERNS AND WOMEN EMPOWERMENT (3-0-0)

(3 Credits- 45 hours)

Course Outcomes:

Develop an understanding of the feminist perspective of women empowerment
(Remembering and Understanding)

Understand the status of women in the present social, political and economic context (Remembering and Understanding)

Develop an understanding of the women's problems and issues (Analyse)

Know the national and international efforts for the welfare of women and gender parity

(Evaluating and Creating)

Module I: Understanding Gender, Patriarchy, and Society (11 hours)

Gender, Sex and Patriarchy- Meaning; Social Construction of Femininity, Social Construction of Masculinity, Patriarchy, Intersectionality and Gender roles; Feminism – Meaning, Feminist Theories- Liberal, Radical, Marxist, Socialist and Eco-

Feminism, Feminist Research Methodology; Feminist Economics and Introduction to Women's Studies

Module II: Women's Movement and Women's Development (11 hours)

Women's Movement in the USA, UK and India- Seneca Fall Declaration, the Suffragettes; Women in Indian Society - Women in early India, pre-colonial period and modern India, Women's Movement in India and its impact, The history of women's education; Theories of Development (Empowerment, Alternative Approaches: Women in Development, Women and Development and Gender and Development)

Module III: Concerns, Issues and Laws (11 hours)

Concerns relating to Women – Social, Economic and Political determinants of women's health; Women's right and Legal Advocacy; Violence against Women; Women in Conflict Areas; Migration, Displacement, Disaster – Impact on women; Women and Climate change; Working women in organized and Unorganized Sector; Sexual Harassment at Work place, Women and Globalization, PRIs and Women in India; Constitutional Rights of Women, Policies and programmes for empowerment of women, CEDAW, Dowry Prohibition Act 1961, Equal Remuneration Act 1976, Maternity Benefit Act 1961, , Medical Termination of Pregnancy Act 1971, Protection of Women from Domestic Violence Act 2005, The Sexual Harassment of Women at Workplace (Prevention, Prohibition and Redressal) Act 2013, National Commission for Women and State Commission for Women.

Module IV: Social Work Practice with Women (12 hours)

Social Action- Saul Alinsky's Theory, Advocacy, Examples of Social Action by women's groups, Recent Trends; Good Practices by INGOs and NGOs- UN Women, SEWA, NEN, The Ant, ABWJF, MGSN, Meira Paibis, Assam Mahila Samitti, Naga Mothers Association, Mizo Hmichhe Insuihkhawm Pawl, Impulse, Achik Mothers Association.

Suggested Readings

Agnes, Flavia., Law and Gender Inequality: The Politics of Women's Rights in India. Delhi: Oxford University Press, 2004

Arya, Sadhna. Roy, Anupama, Poverty, Gender and Migration. New Delhi: Sage Publications, 2006

Addlakha, Renu., Deconstructing Mental Illness: An Ethnography of Psychiatry, Women, and the Family. New Delhi: Zubaan, 2008

Datar, Chaya., Integrating activism and academics. In Jain, Devika and Rajput, Pam (Eds.), Narratives from the Women's Studies Family: Recreating Knowledge (pp. 136-149). New Delhi: Sage Publication, 2003

Ferber, A, Marriane. Nelson, A, Juie., Feminist Economics Today: Beyond Economic Man. London: The United Chicago Press Inc., 2003

Ganesamurthy, V, S., Empowerment of Women in India: Social, Economic and Political. New Delhi: New Century Publications, 2008

Gordon, L. P., Violence against Women. New York: Nova Publishers, 2002

Harding, Sandra G (Ed.). the Feminist Standpoint Theory Reader. New York: Routledge, 2004

Iralu, E., A Terrible Matriarchy. Zubaan Publications. New Delhi, 2007

Lalkima, C. Lalneihzovi., Changing Status of women in north-eastern states. New Delhi: Mittal Publications, 2009

Kols, A., Women, Peace and Security in Northeast India. Zubam Publication, New Delhi, 2018

Kumar, Radha., The History of Doing. New Delhi: Zubaan, 1993

Kumar, Girish (Ed.), Health Sector Reforms in India. New Delhi: Manohar, 2009

Mies, M., Shiva, V., Ecofeminism. London: Zed Books, 1993

Pandya, Rameshwari. Patel, Sarika., Women in the Unorganised Sector of India. New Delhi: New Century Publications, 2010

Ramazanoglu, Caroline.Holland, Jannet. (ed)., Feminist Methodology: Challenges and Choices. London: Sage Publications Inc., 2002

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	H		M	M
CO 4		H	M	M

SWSN0063: FAMILIES WITH SPECIAL NEEDS (3-0-0)

(3 credits- 45 hours)

Course Outcomes:

Understand the context, responses and practice framework for special-care-needs families (Remembering and Understanding)

Imbibe and become familiar with practice principles, values and ethics while dealing with families with special needs (Remembering and Understanding)

Develop skills required for meaningful intervention (Applying and Analysing)

Promote care-planning for families with special needs (Evaluating and Creating)

Module I: Understanding the Context (11 hours)

Understanding Early Childhood Development: Disabilities, Diseases, Gender; Issues Of Care Planning For Children, Youths, Women, Men With Special Care Needs; Special Needs of families in Northeast India: Families in Conflict, Disasters, Displacement, Superstition, Homelessness and Poverty; Emerging Concerns Of Seniors and Elderly: Global, National And Regional Contexts.

Module II: Understanding the Responses (11 hours)

Understanding the theoretical foundations for Social Work Support, Counseling, Resource Coordination and Advocacy Services for Families With Special Care Needs; Overview of service systems for special need groups; Issues, challenges and practice approaches with children and parents in Adoptions and Foster care; Clients and care-providers in Institutional Care; Adoption System: pregnant women, Adoptive Parents And Adopted Children; Disability, Pregnancy, LGTBs, geriatric care, Long-term care needs of terminally ill; Social Work Practice Principles and values in these settings.

Module III: Advanced Practice Skills (11 hours)

Case/Care Management of families with special needs: Terminally ill person, Mental Health Care, Addictions, Long-Term Care, Aging, HIV/AIDS, Disabilities, Occupational services, Child Welfare, and Immigrant/Refugee Families; Assessment; Care planning, and Resource linkages: programmes, schemes and services; Family Therapy: Communication-pattern Approach; Family subsystem Approach; Cognitive Behavioral Approach: cognitive restructuring, contingency contracting, skills.

Module IV: Working with Parents in families with Special Needs (12 hours)

Child Development Knowledge and Care; Positive Interactions with Child, Responsiveness, Sensitivity; Nurturing, Emotional Communication, Disciplinary Communication, Discipline and Behavior Management; Promoting Children's Social Skills or Prosocial Behavior; Promoting Children's Cognitive or Academic Skills.

Suggested Readings

Bhumali, A., Rights of disabled women and children in India. New Delhi: Serials Publications, 2009

Bindra, A., HIV/AIDS health care and human rights. Delhi: Mangalam Publishers, 2010

Boyd-Franklin, N., Steiner, G.L., and Boland, M.G., Children, Families, and HIV/AIDS: Psychosocial and Therapeutic Issues. The Guilford Press, 1995

Burke, Peter, Disability and Impairment: Working with Children and Families. Jessica Kingsley Publishers, 2008

Cambridge, P., and Carnaby, S. eds., Person centered planning and care management with people with learning disabilities. Philadelphia: Jessica Kingsley Publishers, 2005

Cosis-Brown, H., and Cocker, C., Social Work with Lesbians and Gay Men. New Delhi: Sage, 2011

Dasgupta, S., and Lal, M. (eds.), The Indian family in transition: reading literary and cultural texts.

New Delhi: Sage, 2007

Emmatty, L.A., An insight into dementia care in India. New Delhi: SAGE, 2009

Gorman, J.C., Working with challenging parents of students with special needs. New Delhi: Sage, 2004

Grobman, L.M., and Bourassa, D.B., Days in the Lives of Gerontological Social Workers: 44 Professionals Tell Stories from "Real-Life" Social Work Practice with Older Adults. White Hat Communications, 2007

Humphrey, G.M., and Zimpfer, D.G. (eds.), Counselling for grief and bereavement, 2ndEd. New Delhi: Sage, 2012

Lobo, A., and Vasudevan, J., The penguin guide to adoption in India. Delhi: Penguin Books, 2002

McInnis-Dittrich, K., Social Work with Older Adults (3rd Edition). Pearson, 2008

McKenzie, R.B., Rethinking orphanages for the 21st century. New Delhi: Sage, 1998

Nayar, U.S. (Ed.). Child and adolescent mental health. New Delhi: Sage, 2012

Riddick-Grisham, S., and Deming, L., Pediatric life care planning and case management, second edition. Taylor and Francis Group, 2011

Satia, J., Misra, M., Arora, R., and Neogi, S., Innovations in maternal health: case studies from India.

New Delhi: Sage, 2013

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	H	H		H
CO 3	M		M	H
CO 4		H	M	M

SWPW0064: PSYCHIATRIC SOCIAL WORK (3-0-0)

(3 credits- 45 hours)

Course Outcomes:

Introduce the field of psychiatric social work and comprehend the roles and responsibilities of psychiatric social workers (Remembering and Understanding)

Introduce the concept of rehabilitation and the application of different therapeutic interventions (Understanding and Applying)

Introduce different non-pharmacological therapeutic approaches used in psychiatry (Understanding, Analyzing and Applying).

Introduce National Policies and Programs related to Mental Health and discuss (Understanding, Analyzing, Evaluating & Creating)

Module I: Psychiatric Social Work and its Application in the Field (11 hours)

Psychiatric Social Work - Definition and Historical development in UK, USA and India; Present status and challenges in the field; Multi-disciplinary team approach in the treatment of Psychiatric Illness; Role and Functions of Psychiatric Social Worker in the team; Psychiatric social worker in the Field Of Community Mental Health; Skills and Techniques used in Psychiatric Social Work Practice.

Module II: Rehabilitation and Practice of Psychiatric Social Work in various Clinical settings (11 hours)

Psychiatric rehabilitation - definition, psychosocial rehabilitation, principles and strategies; The concept of social diagnosis and social work interventions in psychiatric settings.- psychiatric departments /hospitals/clinics, halfway homes, day care centers, child guidance clinics and de-addiction centers.

Module III: Therapeutic Approach to Mental Illness (11 hours)

Treatment and after care of mentally ill patients, application of social work methods in the treatment of mental disorders;

Various therapeutic methods: Psychotherapy, Electroconvulsive Therapy, Occupational Therapy, Group Therapy, Client Centered Therapy, Gestalt Therapy, Reality Therapy, Behaviour Therapy, Play Therapy, Rational Emotive Therapy, Therapeutic Community, Motivational Enhancement Therapy, Psycho education and Family Therapy.

Module IV: Policies and Programmes in the Field of Mental Health (12 hours)

Mental health policies and legislation in India; National Mental Health Programmes; Designing and implementing programmes on mental health in communities, monitoring and evaluation of programmes; Research – qualitative and action research on mental health issues.

Suggested Readings:

Bhattacharya, Sanjay Dr., Social Work: Psycho-Social and Health Aspects. Deep and Deep New Delhi: 2008

Carson C. Robert, Kutcher N. James, Minela Susan, Hooley M. Jill, Abnormal Psychology. 13th Edition. Pearson Education. 2010

Francis, C. M., Promotion of Mental Health with Community Participation. The Center for Health Care Research and Education. Kerala: 1991

Hudson Barber, Social Work with Psychiatric Patients. Macmillan Publishers. New Delhi: 1960

Maxmen S. Jerrold, Ward G. Nicholas, Essential Psychopathology and its Treatment, 2nd Edition. W.W. Norton and Company. USA: 1994

Patel Chhaya, Social Work Practice – Religio – Philosophical Foundations. Essays in Honour of Professor Indira Patel. Rawat Publications. Jaipur: 2009

Patel Vikram, Thara R., Meeting the Mental Health Needs of Developing Countries – NGO Innovations in India. SAGE Publications. New Delhi: 2003

Pritchard Colin, Mental Health Social Work, Routledge. USA: 2006

Rukadhikar A., Rukadhikar P., Mental disorders and You, Psychiatric Centre. Miraj: 2007

Scileppi A. John, Teed L. Elizabeth, Torres D. Robin, Community Psychology, A Common Sense Approach to Mental Health, Prentice Hall. New Jersey: 2000

Segal, E. A., Gerdes, K.E. and Steiner, S., Professional Social Work... Rawat Publications. New Delhi: 2010

Stroup H. Herbert, An Introduction to the Field. 2nd Edition, Surjeet Publications. New Delhi: 2008

Verma, Ratna, Psychiatric Social Work in India. Sage Publications. New Delhi: 1991

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2		H	M	
CO 3		M	H	
CO 4	M			H

SWCH0065: COMMUNITY HEALTH AND SERVICES (3-0-0)

(3 credits: 45 hours)

Course Outcomes

Define the concept of health, community health and health care services. (Remembering)

Explain the administration of basic health infrastructure and services in the country; and illustrate the important national health policy, health programmes, their implementation, advocacy and lobbying. (Understanding)

Make use of the knowledge on health education and health promotion in the field of work. (Applying)

Analyze the important strategies and approaches of social work in community health. (Analyzing)

Assess the health problems and health services with specific focus on marginalized and vulnerable groups and determine the role and specific skills required for social work practice in community health. (Evaluating)

Build the skills of communication, community mobilization, organization, counselling and referrals; and formulate approaches for prevention and promotion of health, curative and rehabilitative services in Indian context. (Creating)

Module I: Understanding the concept of Health and Community Health (11 Hours)

Understanding Health and epidemiology. Components of Health: Physical, psychological, Emotional, Social and Spiritual. Determinants of Health and Indicators of Health; Socio political, Economic and Cultural factors influencing health. Community Health: Aspects of community Health, Models of Intervention and the role of Professional Social Worker. Rural and Urban health in India: Health Status, Health Problems and Health Services with specific focus on marginalized and vulnerable groups.

Module II: Health education and health promotion (11 hours)

Meaning, importance, principles and components of health education. Agencies for Health education programme – voluntary and Governmental Organizations, Health Network, Educational and Religious Institutions. Approaches for prevention and promotion of health, curative and rehabilitative services in Indian context. Prevention levels and modes of intervention.

Module III: National Health Programmes (11 hours)

Health Policies and Committees – National Health policy, National Health Mission, Health programs; their implementation, advocacy and lobbying. Health administration and Planning: Structure and Functions at National and State and District levels- Primary Health Centers - Corporation and Municipal health services. Hospital Administration and Management.

Module IV: Strategies and approaches of social work in Community health (12 hours)

Understanding health from the Human Rights perspective – Environment issues and health – Media and health. Health Movements and Campaigns. Role and Specific skills required for Social Work Practice. Health education and communication, counseling and referral, Community mobilization and organization, Health system restructuring and reform, Capacity building and training, Resource mobilization and application

Suggested Readings

Park, J. E., Textbook of Preventive and Social Medicine, 17th edition. Jabalpur: Banarsidas Bhanot, 2006
Ministry of Health and Family Welfare, National Health Policy, New Delhi, 1983

Department of Health Ministry of Health and Family Welfare, National Health Policy, New Delhi, 2002

Breslow, L., Encyclopedia of Public Health. New York: Macmillan Reference USA, 2002

Duggal R. and Gangolli L., Review of Healthcare in India. Mumbai: CEHAT, 2005

Gibson Robert, Counselling and Guidance, Merrill, 595,199 New Jersey, Fleet-2, 2003

Schneider, Mary- Jane, Introduction to Public Health. London: Jones and Bartlett, 2006

Abelin, T., Brzenski Z.J., and Carstairs, V.D., Measurement in Health promotion and protection, WHO, Copenhagen, 1987

Alderson, M., An introduction to Epidemiology, 2nd Edition, Mac-Millan, London, 1983

Green L.W and Anderson, C.L, Community Health 5th edition, Times Mirror Mosby, St. Louis, 1986
 Government of India (GOI), Operational Guidelines for Programme Managers and Service Providers for Strengthening STI/RTI Services, GOI, Ministry of Health and Family Welfare, New Delhi, 201

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		
CO 2	M		H	
CO 3			M	M
CO 4		M		H
CO 5	M			M
CO 6		M	M	H

SWHR0066: HUMAN RESOURCE MANAGEMENT: SOCIAL WORK PERSPECTIVE (3-0-0) **(3 Credits- 45 hours)**

Course Outcomes

Understand HRM as a profession. (Remembering and Understanding)

Understand the role of HRM in business. (Remembering and Understanding)

Equip learners with knowledge, skills, attitude, professional competencies and social sensitivities essential for a successful career in HRM. (Applying and Analyzing)

Integrate the knowledge obtained from theory with the practice. (Evaluating and Creating)

Module I: Introduction to Human Resource Management (11 hours)

Concept, scope and applicability of Human Resource Management- HR as a profession (Strategic Role – Basics); Structure, functions, mechanisms of HRM; Functional area of Human Resource Management; Role, characteristics and skill essentials of Human Resource Managers; International HRM; HRM in a dynamic environment – Basic concepts and trends.

Module II: Basics of Human Resource Management Practice (11 hours)

Procurement of Personnel – Human Resource Planning, Recruitment, selection; Talent Management – Acquiring, nurturing and retaining talent in knowledge based economy- issues, challenges and approaches; Mobility of people – concept of promotion, transfer, separation – Management and issues; Wage determination and Administration – Payroll management, and deductions – issues and challenges. Fringe benefits, profit bonus, pay for performance and competency based pay; Social Compliance Audit and HR Audit; Competency Development and Management.

Module III: Contemporary Human Resource Management (11 hours)

Process, benefits and relevance of strategic HR; Human Resource - The Strategic Business Partner; Mergers and acquisitions – Concept, meaning, process and issues; Human Factors in mergers and acquisitions; Employee engagement and Climate /Engagement Surveys – Meaning, concept and best practices; Benchmarking – Meaning, concept and purpose.

Module 1V: Career Development (12 hours)

Career development and succession planning - Concept and changing aspects; Mentoring and employee development – Concept and issues; Performance Management System – Meaning, Methods, Merits and limitations; Quality Management System and its significance – ISO Standards; Employee Counseling – Relevance and Practice.

Suggested Readings

K.B Akhilesh, Enabling execution excellence - Himalaya Pub House, 2006

Abraham, E, Alternative approaches and strategies of Human Resource Development, Jaipur: Rawat

Publications, 1988

Agarwal, Naik Banerjee, Personnel Management & Industrial Relations, Meerat: Pragathi Publications, 2003

Aquinas, P.G., Personnel Management, Mangalore: Sita Publishing House, 2005

Aswathappa K, Human Resource & Personnel Management, Tokyo: Tata McGraw Hill, 2002

Alan Barkar, How to hold better meetings – Magan Page Ltd, 1997

Alan Barkar, Creativity for Managers Excel books. Magan Page Ltd, 2005

Armstrong Angela, Strategic HRM - Barn Jaico Pub house, 2007

Armstrong and Murlis, Reward Management – Kagan Page, 2007

K Ashwathappa, Human Resource and Personnel Management Tata – McGraw Publication 3rd Edition, 2002

Britt and Boyd, Marketing and Administrative Action 3rd Edition – Mac Glaw, 1999

Bhaskar Chatterjee, Human Resource Management Sterling Publishers, 2004

Bhargava P.P, Issues in Personnel Management, Print well Publishers, 1990

Beardwell Ian Len Holden, Human Resource Management, De Montfort University, 1995

Bhagoliwal T.N., Personnel Management & Industrial Relations, Agra: SahithyaBhavan Publications, 1996

BhaskarChattergi, Human Resource Management, New Delhi: Sterling Publications Pvt. Ltd, 2004

Cole, G.A. Personnel Management, Theory & Practice, London: D.P. Publications

Cushway& lodge, Organizational Behaviour and Design, New Delhi: Inst Publishing house, 2001

Cushway, Human Resource Management, New Delhi: Crest Publishing house, 2001

Cascio F Waynes, Managing Human Resources, New Delhi: Tata McGraw Hil, 2004

Chaudhri K.K, Personnel Management for Executives, New Delhi: Himalaya Publishing House, 1998

Cynthia D. Fisher, Human Resource Management, Chennai: All India Publishers and Distributors, 1998

Davis, Keith, Human Behaviour at work, New Delhi: Tata McGraw Hill, 1983

Rao, V.S.P, Human Resource Management Text and Cases, Excel Book, New Delhi, 2006

Sharma K.K. Organization Behaviour, New Delhi: Deep & Deep Publications

SubrotoBagchi, Go kiss the world. Penguin India, 2008

SubrotoBagchi, The Professional. Penguin India, 2009

SubrotoBagchi, The High Performance Entrepreneur. Penguin India, 2006

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M		H
CO 2	M		H	
CO 3	H		M	M
CO 4		M		H

SWCI0067: CORPORATE SOCIAL RESPONSIBILITIES - CONCEPTS & IDEOLOGIES (3-0-0)

(3 Credits- 45 hours)

Course Outcome

Introduce students into CSR concepts (Understanding)

Develop competencies for effective field interventions, research and management of CSR interventions (Applying)

Develop an insight into present CSR strategies and model business organization (analysing)

Enable students with conceptual clarity on need, purpose and relevance of research applicability in CSR practice (Creating)

Module I: Concepts (11 hours)

CSR: Definition, Concept and scope; Evolution of CSR; CSR and Social Legitimacy; The evolving role of stakeholders; Moral and Economic arguments for CSR; History of CSR in India; Dimensions & importance of CSR; Understanding CSR: Responsibility, Accountability & Sustainability.

Module II: CSR Policy and Governance (11 hours)

Stakeholder engagement; Environmental assessments; Theories & Models of CSR; CSR in emerging market; Limitation of CSR; Strategic Context of CSR.

Module III: Community Investment and Evaluation (11 hours)

CSR and Human Resource Management; Reporting and communication; Implementing CSR programmes; Monitoring and measuring the impact of CSR programs; Company Act: 2013; CSR: Global Perspective; Roles of institutions in CSR: Government, NGOs, Education institutions & role of Media.

Module IV: - Introducing a Systems-Based Approach to Developing CSR (12 hours)

Assessing the current state of a company's CSR activities; Linking CSR to brands and reputation; Stakeholder engagement; Current and future Trends & Practices in CSR; Indian CSR: Selected Case Studies.

Suggested Readings

Bali. C. and Prasad. A., Corporate Social Responsibility, Concept & Cases: The Indian Experience, Excel Books, New Delhi, 2013

Modi. P. K., Corporate Social Capital Liability, Arise Publishers & Distributors, Delhi, 2009

Prasenjit M., Corporate Social Responsibility - Vol. – I & II, Sharda Publishing House, Jodhpur (India), 2010

Reddy S., Corporate Social Responsibility, The Environmental Aspects, The ICFAI University, ICFAI Books, Hyderabad, 2010

Raj S., Corporate Social Responsibility Cases, The ICFAI University, ICFAI Books, Hyderabad, 2012

Sharda M., Corporate Social Responsibilities. - Vol. – I & II, Publishing House, Jodhpur (India), 2010

Vara V., Case study on Corporate Social Responsibility. – Vol. – I [ICFAI Business School Case Development Centre.] ICFAI Books, Hyderabad, 2011

Werther. B.W. & Chandler D., Strategic Corporate Social Responsibility, Stake holders in a global Environment, Sage Publication, 2009

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H			M
CO 2	H	M		M
CO 3		H	H	
CO 4	H		H	H

SWSP0068: CHILDREN WITH SPECIAL NEEDS (3-0-0)

(3 Credits – 45 hours)

Course Outcomes

Understand the children with special needs and develop skills in social work intervention (Remembering and Understanding)

Understand the context, responses and practice framework for inclusive programs and special-care-needs families (Remembering and Understanding)

Imbibe and become familiar with practice principles, values and ethics while dealing with families with special needs (Applying and Analyzing)

Apply a number of assessment procedures that identify internal and external risk protective and promotive factors that may affect children and adolescents. (Applying and Creating)

Module I: Understanding Children with Special Needs (11 hours)

Developmental Disabilities- Causes, Classifications and Labeling of children with special needs; Sensory Impairments- Vision, Hearing, And Speech; Physical disabilities and health problems; Learning, Behaviour and Emotional disorders; Understanding the Environment- Bronfenbrenner's ecosystem perspectives.

Module II: Best Practices in Inclusion (11 hours)

Definition and History of Inclusion; Benefits and challenges of Inclusion for Children with and without Disabilities; Elements of Good quality, inclusive programs for Infants, Toddlers, And Preschoolers; Six key aspects of best practices for Working with Children with Special Needs; Public Policy and Advocacy for inclusive practices; History and Impact of legislations affecting Children with Special Needs; Landmark court cases on Services for Children with Special Needs.

Module III: Documenting and Assessing to Support Families with Special Needs (11 hours)

Knowing about and using Observation, Documentation, and other appropriate Assessment Tools Understanding and practicing responsible Assessment, Knowing about Assessment Partnerships with Families and other Professionals; Documenting Case History; Family Assessment- Understanding the Goals, Benefits, and uses of Assessment; Problems-Strengths Identification.

Module IV: Partnerships with families and caregivers (11 hours)

Knowing about and understanding Family, Family in transition, and Community characteristics; Impact of Disabilities on

Families- Understanding Families, Family Crises; Supporting and Empowering Families and Communities through Respectful,

Reciprocal relationships; Involving Families and Communities in their Children's Development and Learning- Transitions and Adapting Materials and use of Adapting Technologies; Individualized Education Programs (IEPs); Individualized Transition Plans (ITPs) and; Individualized Family Service Plans (IFSPs); Community Resources and Cultural Sensitivity; Services by Government and Non-government agencies in India.

Suggested Readings

K. Eileen Allen, Glynnis E. Cowdery, The exceptional child: inclusion in early childhood education, 6th edition. United States: Delmar Thompson Learning, 2009

Bhumali, A., Rights of disabled women and children in India. New Delhi: Serials Publications, 2009

Boyd-Franklin, N., Steiner, G.L., and Boland, M.G., Children, Families, and HIV/AIDS: Psychosocial and Therapeutic Issues. The Guilford Press, 1995

Burke, Peter, Disability and Impairment: Working with Children and Families. Jessica Kingsley Publishers, 2008

Berk, Laura E. Development through the Lifespan, 5th edition. Allyn and Bacon. London: 2009

Cambridge, P., and Carnaby, S. eds., Person centered planning and care management with people with learning disabilities. Philadelphia: Jessica Kingsley Publishers, 2005

Dasgupta, S., and Lal, M. (eds.), The Indian family in transition: reading literary and cultural texts. New Delhi: Sage, 2007

Hurlock, Elizabeth, Developmental Psychology, Tata Mc Graw Hill. New York: 2001

Gorman, J.C., Working with challenging parents of students with special needs. New Delhi: Sage, 2004

Nayar, U.S. (Ed.), Child and adolescent mental health. New Delhi: Sage, 2012

Riddick-Grisham, S., and Deming, L., Pediatric life care planning and case management, second edition. Taylor and Francis Group, 2012

Venkatesan, S., Children with developmental disabilities: a training guide for parents, teachers and caregivers. New Delhi: Sage, 2005

Webb, Nancy Boyd., Social work practice with children (2nd Ed.). New York: Guilford, 2003

Yuen, Francis K.O., Social Work Practice with Children and Families: A Family Health Approach (Haworth Health and Social Policy). Routledge, 2005

WHO, The ICD – 10 Classification of Mental and Behavioural Disorders, Diagnostic Criteria for Research, AITBS Publishers and Distributors (Regd.). Delhi: 2004

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	H		M	M
CO 4		H	M	H

SWRP0070: CHILD RIGHTS AND CHILD PROTECTION (3-0-0)

(3 Credits – 45 hours)

Course Outcomes

Understand different social work perspectives on working with children. (Remembering and Understanding)

Recognize the role of families and other stakeholders in child protection and demonstrate methods of strengthening families for child protection. (Applying and Analysing)

Develop advanced intervention skills in working with children, adolescents and their families. (Evaluating and Creating)

Help students practice effective communication, networking and collaboration skills with different stakeholders related to child protection. (Applying and Analyzing)

Module I: Social Work Perspectives on Working with Children (11 hours)

Ecological Model; Strengths based Perspectives; Child-centered Approach; Children's Perspective to Life; Family Centered Social Work, Problem Solving Approach; Developmental approach.

Module II: Governance and Child Rights (11 hours)

Understanding Governance, Child Rights Governance from Global Perspective; Governance in North East; Child Poverty and Good governance; Public finance and Child Budgeting, Child Rights Programming; Planning and Advocacy for Child Rights, Activism and Networking with Allied systems.

Module III: Working with Families and other Stakeholders (11 hours)

Working with Families- Families in the Indian Context (Diverse Functions, Structure and Size of Families) , Family Dynamics , Family Work and Parenting Skills, Strengthening Family's ability to Protect Children (Assessment, Identifying Needs and Life Stage of Each Member, Impact of Family Conditions on the Child, Linkages with Schemes for Family Strengthening); Working with Other Stakeholders (Child Protection Committees, Panchayats, Police, Government Departments, Schools, Residential Care Institutions, Community Groups, Self-Help Groups, Youth Groups), NGOs, Statutory Committee)

Module IV: Skills in Working with Children (12 hours)

Counseling and guidance - Counseling Techniques – Client-centered, Counselor Centered and Eclectic Counseling; Types of

Counseling and Tools Required – Individual and Group counseling, Family Group Counseling, Individual Counseling Tools– Interview, Case study, Tests and Clinical; Assessment; Group Counseling–Informal Discussion; Group Reports, Lectures,

Dramatics, Case conference; Communication Skills - Individual and Group, Use of Creative Activities like Storytelling, Play, Art, Music and Dance Movement; Skills in Behavior Modification techniques, Advocacy and Campaigning for Children, Relationship Building; Skills in working with different Vulnerable Groups; Facilitating Child Participation.

Suggested Readings

- Barnes, V., Child-Centered Social Work: Theory and Practice. Red Globe Pres, Kingston University, 2018
- Tait, A. & Wasu, H., Direct Work with Vulnerable Children: Playful Activities and Strategies for Communication, London: Jessica Kingsley Publishers, 2012
- Nigudkar, M.; Kashyap, L., Skills of Communicating With Children, Mumbai: TISS. Brahmane, P. (2003) Making Best of Childhood, Pune: Personality School, 2009
- Ruch, G., Post-qualifying Child Care Social Work - Developing Reflective Practice, London: Sage, 2009
- Hanh, T. N., Planting Seeds: Practicing Mindfulness with Children, California: Parallax Press, 2013
- Nigudkar, M. & Kashyap, L., Skills of Communicating With Children, Mumbai: TISS, 2009
- Alan, S. K.; Nancy, M.; Nadeen L.K.; Elizabeth, O. L., Essentials of Assessment Report Writing, New Jersey: John Wiley and Sons, Inc, 2004
- Gangrade, K. D., working with Community at the Grassroot level: Strategies and Programmes, New Delhi: Radha Publications, 2001
- Datar, S.; Baviskar, R. (et al), Skill Training for Social Workers: A Manual, London: Sage, 2010
- D'Souza, B. & Sonawat, R., Handbook for Children in Difficult Situations: Activity Manual for Marginalised Adolescent (Vol. 1) Mumbai: Tej-Prasarni, 2003
- Graves, D. H., Writing: Teachers and Children at Work. 20th Anniversary Edition, Portsmouth: NH Heinemann, 2003
- Butler, I. & Roberts, G., Social Work with Children and Families: Getting into Practice (2nd Ed), London: Jessica Kingsley Publishers Ltd., 2004
- Komanduri A. & Vennam U., Family-Centred Interventions in Indian Journal of Social Work (70) 2, 2009
- Sanders, P., First Steps in Counselling: A Students' Companion for Basic Introductory Courses. PCCS Books, 2002
- Jones. N. Richard., Theory and Practice of Counselling and Therapy. Sage Publication, 1995
- Jones. N. Richard, Basic Counselling Skills: A helper's Manual. Sage Publication, 2003

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	M	H	M
CO 2	M	H		H
CO 3	M		H	H
CO 4		H	M	H

VALUE ADDED COURSES**SWAW6015: ACADEMIC WRITING, RESEARCH PROPOSAL DEVELOPMENT AND DISSERTATION WRITING COURSE (15-0-15)****(2 credits -30 hours)****Course Outcomes**

- Remember the concepts and meaning related to academic and professional writing. (Remembering)
- Understand the different components, stages and steps of academic writing, research proposal development and dissertation writing. (Understanding)
- Able to apply the skill of professional and academic writing into practice. (Applying)
- Able to analyse different types of writing in professional life. (Analyzing)
- Able to review and evaluate writing styles in keeping with the framework of different professional and academic writing. (Evaluating)
- Able to write academic articles, develop research proposal, dissertations and professional reports. (Creating)

Module 1: Introduction to academic writing and publication (8 hours)

Academic writing – academic writing, citations, referencing – APA, MLA, Chicago etc., peer review process and types – single blind, double blind, open peer review; publishing in journals (Indexed and UGC CARE List), edited books and books; authorship and ethics of publication.

Module 2: Research Proposal Development, Presentation and Approval (14 hours)

Research proposal – Background of study, review of literature, statement of the problem/research concern, significance of the study, rationale of the study, research hypotheses, research questions, research objectives, definition of terms, research methodology – design, population, sampling, tools and techniques of data collection, sources of data, analysis, interpretation and representation of data, ethical concerns of research (Academic Integrity and Ethical Review Board), likely outcomes, limitation of the study and research timeline. Process of research proposal approval – presentation, feedback, revision, representation and approval. The role of research guide in research process.

Module 3: Dissertation Writing, Presentation and Defense (8 hours)

Dissertation writing - scientific setting, sections of research dissertation, declarations and consent forms, chapterisation, annexures and reference. Drafts, mentoring by guide, printing, final submission, presentation, defense and viva voce examination.

Suggested Reading

American Psychological Association. (2020). Publication Manual of the American Psychological Association, Vol. 7. APA: Washington DC.

Ethical Principles of Psychologists and Code of Conduct. (2021), American Psychological Association.

Source: <https://www.apa.org/ethics/code>

First Steps Toward Your Dissertation. (ND). Sage Publications, UK. Source: https://us.sagepub.com/sites/default/files/upm-assets/7155_book_item_7155.pdf.

UGC. (2019). Consortium for Academic Research and Ethics (CARE). UGC. New Delhi.

UGC. (2020). Guidance Document Good Academic Research Practices. UGC: New Delhi.

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	H	M
CO 2	M	H	M
CO 3	H	H	H
CO 4	M	M	M
CO 5	M	M	M
CO 6	M	M	H

SWRB6014: RESULTS BASED MANAGEMENT OF PROJECTS AND PROGRAMMES (15-0-15)

(2 Credits 30 hours)

Course Outcomes:

Understand the importance and process of Result based management of projects and programmes and formulating projects using the Logical Framework Analysis

Develop an understanding of the problems and issues faced by the poor and the marginalized

Develop an insight into the different strategies and approaches commonly adopted by Development Organisations for Project Management

Learn Skills to develop project proposals, implement, monitor and evaluate project, enhance process documentation and reporting skills

Module 1: Overview (5 hours)

Overview of Results based Management and Project Cycle Management: Identification, Design, Implementation, Reviewing, Monitoring, Evaluation, Learning the lessons

Module 2: Project Identification (5 hours)

Project Identification : (Situational Analysis and Problem Tree Analysis)

Module 3: Project Design (10 Hours)

Capacity assessment: human, social, natural, physical, economic, cultural: Stakeholder analysis: user groups, interest groups, beneficiaries, decision makers; Primary and Secondary stakeholders: Identifying appropriate stakeholders for participation; levels of participation: Logical Framework Approach:

Module 4: Monitoring and Evaluation (4 Hours)

Methods and process of Monitoring and Evaluation

Module 5: Resource Mobilisation (6 Hours)

Internal and External Resources; Fundraising – principles, sources, ethics, methods and their implications. International sources for Funding – Concept note; application, procedure and FCRA, record keeping, documentation and legal compliance

Suggested Readings

Lukose P J, Results Based Management of Projects and Programmes and Fundamentals of Resource Mobilization: DVS Publications, Guwahati 2021

Capezio, P., Powerful Planning Skills. Mumbai: Jaico Publishing House, 2000

Smith, S., Plan to Win. New Delhi: Kogan Page India, 2002

Dale, R., Evaluation Frameworks for Development Programmes and Projects. New Delhi: Sage Publications, 2001

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3
CO 1	M	H	M
CO 2	M	H	M
CO 3	H	H	H
CO 4	H	M	H

SWWD6016: WORKING WITH DIVERSITY (15-0-15)

(2 Credits 30 hours)

Course Learning Objectives:

Reflect on your own diversity (reflection), how it impacts on others (reflexivity) and how it informs to the development of critical cultural competence

Understand the key theories related to the concept of diversity

Critique the theoretical approaches of Equality, Human Rights and Diversity as they are applied in practice

Apply the Diversity approach to current global issues including Covid-19

Raise awareness of diversity through an application of theory to a co-created project promoting social change and human rights (Diversity Project and seminars)

Module – I (7 hours)

Defining Diversity and Difference; Theoretical and Conceptual understanding of Diversity; Models and Approaches; Levels of intervention in Diversity; Intersectionality and Structures of Diversity; Equality, Human Rights and Diversity.

Module – II (7 hours)

Perspectives of Diversity; Diversity, Difference and Disadvantage; Cultural Competence in Social Work and its Critiques; Current Strategies in Managing Diversity and its implications in Social Work;

Module III (7 hours)

Global Examples: Pandemic & Inequality; Black Lives Matter (Anti-Racism); Migration and Inclusion; Climate change and environmental issue; Resistance and solidarity in the context of indigenous (tribal/adi-vasi) development in India.

Module IV (9 hours)

Co-creation of Projects on Diversity and its management for social development in different global context.

Suggested Reading:

Thompson, N. (2011). Promoting Equality: Working with Difference and Diversity. Palgrave Macmillan. (Electronic book ordered for UEF students)

Thompson, N. (2016). Anti-discriminatory practice: Equality, diversity and social justice. Macmillan International Higher Education.

Hugman, R. (2012). Culture, values and ethics in social work: Embracing diversity. Routledge. Gast, L. E., & Patmore, A. (2012). Mastering approaches to diversity in social work. Jessica Kingsley Publishers. (Available online)

Marsiglia, F. F., Kulis, S. S., & Lechuga-Peña, S. (2021). Diversity, Oppression, & Change: Culturally Grounded Social Work. Oxford University Press, USA.

Online Journals:

Journal of Ethnic and Cultural Diversity in Social Work

Journal of Multicultural Social Work

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	M	H	M	H
CO 2	M	H	M	H
CO 3	H	H	H	M
CO 4	H	M	H	M
CO5	M	H	M	H

SWLS6017: Life Skills for competency development (15-0-15)

(2 Credits 30 hours)

Objectives:

The basic objective of the course is to introduce the students to the:

Basic concepts and core life skills and its application

Strategies for developing personality and competency

Practice life skills for self-enrichment and well-being

Module 1: INTRODUCTION TO LIFE SKILLS [6 hours]

Definition and importance of life skills

Evolution and development of the concept of life skills:

Report of the Education Commissions of UNESCO: Faure Report and Delors'

Report UN Inter-Agency

Report Hamburg Declaration Dakar Framework: Quality education and life skills

Module 2: CORE LIFE SKILLS: SOCIAL SKILLS, THINKING AND COPING SKILLS [12 hours]**Self-Awareness and Empathy**

Self-awareness: self-concept, self-image, self-esteem; techniques for self-exploration: Jo-Hari window,

SWOT analysis Empathy: sympathy, empathy & altruism; practising empathy

Effective Communication and Interpersonal Relationship

Effective communication: types and elements of communication; barriers of communication; presentation skills; questioning skills, Interpersonal relationship: building, sustaining and ending relationships; factors affecting relationships; conflict resolution

High order thinking skills: Critical & Creative thinking

Critical thinking: Process; strategies to enhance critical thinking

Creative thinking: Stages of creative thinking; strategies to enhance creative thinking

Problem Solving & Decision Making o Problem solving: concept, stages in problem solving; models in problem-solving Decision Making: process; models of decision making; decision making in a group □

Coping Skills: Coping with Emotions and Stress

Coping with emotions: concept and types of emotions; coping with negative emotions and cultivating positive emotions, Coping with Stress: concept and meaning; types and sources of stress, strategies to manage stress

Module 3: LIFE SKILLS FOR PERSONALITY DEVELOPMENT AND PRACTICUM [12 hours]

Life Skills for Personal Effectiveness

Values: Punctuality, honesty, loyalty, dependability, reliability, integrity, respect, Constitutional values

Building self-confidence and self-motivation

Goal setting: types, steps, personal vision and goal

Time management

Topics prescribed for workshop/Skill lab

Group discussion, Team building and team work, Facing interviews, Creativity

Leadership, Self-expression, Self-branding

Suggested Readings

Nair. A. Radhakrishnan & Gauri Hardikar, (2021), Mahatma Gandhi's Philosophy of Education and Life Skills Education: A Conceptual Study, *IOSR Journal of Research & Method in Education (IOSR-JRME)* e-ISSN: 2320-7388, p- ISSN: 2320-737x Volume 11, Issue 3 Ser. VII (May – June 2021), PP 01-11

Nair. A. Radhakrishnan & Gauri Hardikar, (2021), Swami Vivekananda's Philosophy of Life Skills Education, *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, Volume 26, Issue 5, Series 10 (May. 2021) 01-07 e-ISSN: 2279-0837, p-ISSN: 2279-0845.

www.iosrjournals.org CYP (2003), *Adolescence and Life Skills*, Commonwealth Youth Programme Asia Centre, Tata Mc Graw- Hill

UNESCO (April 2000), *Dakar Framework for Action, Education for All: Meeting our Collective Commitments*, Dakar, Senegal.

Family Health International, NACO, USAID (2007), *Life Skills Education tool kit for Orphans and vulnerable children in India 6*. Hilgard, E, Atkinson R C & Atkinson R L (1976), *Introduction to Psychology (6th Ed)*, IBH Publishing Co. Pvt Ltd. New Delhi.

Mangal S.K. (2008), *An Introduction to Psychology*, Sterling Publishers Pvt. Ltd., New Delhi.

Morgan and King (1993) *Introduction to Psychology*, Tata McGraw-Hill Publishing Company Ltd, New Delhi.

Rao P.L. (2008) *Enriching Human Capital through Training and Development*, Excel Books, Delhi.

RGNIYD. (2008). *Facilitators Manual on Enhancing Life Skills. Tamil Nadu*

Singh Madhu (2003), *Understanding Life Skills*, Background paper prepared for *Education for All: The Leap to Equality*

Stella, Cottrell (2008), *The Study Skills Handbook*, Palgrave Macmillan Ltd. (3rd Ed), New York

UNESCO and Indian National Commission for Co-operation with UNESCO (2001): *Life Skills in Non-formal Education: A Review*

Wallace R. Masters (2001) *Personal Development for Life and Work*: UK, South Western.

YUVA School Life Skills Programme: Handbook for Teachers, Vol. I – IV, (2008), Department of Education and State Council of Educational Research and Training, Delhi.

Web Sites:

UNESCO – <http://www.unesco.org/>

UNFPA - <http://www.unfpa.org/>

UNICEF - <http://www.unicef.org/>

United Nations - <http://www.un.org/>

WHO - <http://www.who.int/en/>

www.oecd.org

SWFT6018: FAMILY THERAPY (15-0-15)

(2 Credits 30 hours)

Module 1

Introduce the concept of Family and family therapy (7 Hours)

Family: Concept of family – Homeostasis, Family Rules, Content and Process of interaction, sequence of interaction, Specific dimensions – family context, Boundaries, Power, Decision making, Family affect, family goals, family myths and cognitive pattern, family roles, family strengths, Pathology of – boundaries, alliances, triangles, hierarchies, Characteristics of family, family life cycle, Family Therapy – Brief History of Family Therapy, definition of Family Therapy, Challenges faced by a family therapist.

Module 2

Theoretical Perspectives of Family Therapy (8 Hours)

Key Concepts, Goals and Techniques used in **Structural Family Therapy and Systemic Family Therapy**

Module 3

Basic Concepts of Family Therapy (7 Hours)

Assessment –Family Assessment Performa – family structure, leadership patterns, Role structure and function, Communication, Reinforcement, Cohesiveness, Adaptive patterns, Exploring the presenting problem, assessing for attempted solutions, The process of family therapy- Pre-session, planning and task, Initial sessions, Middle Phase of Treatment, Termination

Module 4

Techniques Used (8 Hours)

Genogram- different symbols, Asking Questions – Lineal questions, Circular Questions, Strategic Questions, Reflexive Questions, Placating, Blaming, Super-reasonable, Irrelevant Behaviour, Family Reconstruction, Reframing, Boundaries, Unbalancing, channeling, specifying, tracking and linking, filtering, Normalizing, Providing support, Confronting, Pacing, Complementarity, Realities, Constructions, Strengths, Paradoxes

Tools- Family Sculpting, Family Genograms, Ecomap

Suggested Readings

Gladding, Samuel T. Family Therapy. 7th Edition, Pearson Education, Inc. NY : 2011

Patterson, JoEllen., Lee, Williams., Edwards, Todd, M., Chamow, Larry & Grauf-Grounds, Claudia.

Essential Skills in family Therapy: From the first Interview to Termination. 3rd Edition, The Guildford Press, NY: 2018

Nicholas, Michael, P. & Davis, Sean, D. Family Therapy: Concepts and Methods, 11th Edition, Pearson Education, Inc. USA:2017

Rivett, M., Buchmuller, Joanne & Oliver, Karon. Family Therapy: Skills and Techniques in Action. Routledge, NY:2018

Antony, D., John., Psychotherapies in Counselling, Anugraha Publications. Tamil Nadu:2003

SWCD6019: INTRODUCTION TO COMMUNICATION FOR DEVELOPMENT (C4D) FOR SOCIAL WORK(15-0-15)

(2 Credits 30 Hours)

Course description

This course will introduce students to the field of communication for development (c4d). C4d is an evidence-based process that utilizes a mix of communication tools, channels and approaches to facilitate participation and engagement with children, families, communities, networks for positive social and behaviour change in both development and humanitarian contexts. It draws on learnings and concepts from the social, behavioural and communication sciences.

This course will bring together ideas of activists/professionals and academicians in the field to cover the theoretical and practical components of the subject. The students will learn the theory, history and practice of communication for development and its application for social and behaviour communication through puppet-making, or street-play or grassroots' comics. The students will be assessed while showcasing their skills in a community setting.

Learner objectives

Understand, define and describe key theories around communication, development, culture, behaviour and social change

Learn from organizations/practitioners/activists who effectively use different media techniques for disseminating development results, awareness-raising and public debate; and

Showcase the skills of communication for development and social change in a community setting.

Participants

The course is open to everyone pursuing post-graduate study programme at assam don bosco university. A maximum of 30 students will be able to enroll in the course per batch.

Module 1: principles and concepts in communication for development (5 hours)

Introduction to c4d, planning, implementation and management of c4d projects

Module 2: behavior and social change theories in c4d (5 hours)

Behavior and social change theory in c4d, interpersonal-level change theories, community-level change theories, theory-led c4d research and planning

Module 3: c4d research, monitoring, and evaluation (5 hours)

Research, monitoring and evaluation concepts; participatory research; the c4d research, monitoring and evaluation framework

Module 4: presentation of a c4d project in a community setting (15 hours)

The learners will work in groups on a communication for development and social change project (using puppetry/street play/grassroot comics) and present it in a community setting.

Course outcomes

The learner is able to state the meaning and applications of communication for development in social work practice and research. (remembering)

The student is able to explain the uses of communication for development and its use in social work practice.(understanding)

The learner is able to apply the knowledge and skill of communication for developmentfor intervention projects aimed at social change. (applying)

The student is able to analyse and adopt appropriate media for carrying out communication for development applications in appropriate contexts. (analysing)

The learner is able to assess the appropriate use of communication for development to find participatory solutionsto different social and cultural issues affecting communities. (evaluating)

The learner is able to design and execute a communication for development project for social and behaviour change communication. (creating)

Mapping of cos to syllabus

Course Outcomes	MODULE 1	MODULE 2	MODULE 3	MODULE 4
CO 1	H	H	H	H
CO 2	M	M	M	
CO 3	M	M		M
CO 4			M	M
CO 5		M		
CO 6	M			M

Suggested readings

Consortium for education communication (2014). *Development communication*.

Youtube: <https://www.youtube.com/watch?v=3zxoo0c0nmu>

Kumar, s. (2002). *methods for community participation: a complete guide for practitioners*. Delhi: vistaar.

Steeves, h. L., & melkote, s.r. (2015). *Communication for development: theory and practice for empowerment and social justice*. New delhi: sage.

Unicef (2018). *communication for development (c4d) - case study compendium 2013-17*. Delhi: unicef india. (available at: <https://www.unicef.org/india/media/1421/file/c4d-compendium.pdf>)

Wilkins, k.g., tufte, t., & obregon, r. (2014). *the handbook of development communication and social change*. Delhi: wiley.

PRACTICUM

SWFR6008: CONCURRENT FIELDWORK I (6 credits):200 hours of Fieldwork in 15 weeks(0-0-16)

Expected Outcomes:

Students are exposed to the community and community issues

The students understand the dynamics and issues in the community and become aware of the sensitivities of people while working with them.

Students get a close feel of the community and community settings

They also get a firsthand experience of the programmes and projects implemented in the communities by NGOs and government agencies and the impact that these have on the community.

Understand the tension between tradition and change that the communities in the region are likely to experience, and how it is handled.

Process

The field work practice in the first semester consists of orientation visits, lab sessions for skills training and placement.

In the first semester, the focus of field work is the community.

The students are placed in communities and in NGOs, Service Organizations and Government Agencies working with communities, and in those settings where they can be.

They also interact with the agency personnel and the community members

They, with the help of the agency and the field work supervisor, identify an issue and work on it following the principles of community organization. The students are expected to be creative and innovative in assisting the agency and community in whatever way possible.

Normally a student spends fifteen hours over two days per week in field work. However, keeping in mind the peculiar situation of transport and communications in the region and the expenses involved, the field work practice may be arranged in other convenient ways as the department deems fit.

After each session of field work the students write a report of their activities and submit to the concerned field work supervisor. The supervisor conducts individual and group field work conferences regularly.

At the end of the semester the student submits a summary report for the semester and an external viva voce examination is conducted.

SWFW6009: CONCURRENT FIELD WORK II (0-0-16)

(6 credits- 200 hours of fieldwork in 15 weeks)

Expected Outcome:

Ensures that the student understands the way these institutions and agencies function and practice the skills of working with individuals and different groups.

Process

The field work practice in the second semester will consist of lab sessions for skills training and placement. The focus will be on the practice of Social Case Work and Group works.

The students shall be placed in NGOs, Government Departments, Service Organizations and Communities working with individuals and families, and in those settings where they can be exposed to issues related to individuals and groups. Normally a student spends fifteen hours over two days per week in field work.

The student is expected to complete 5 cases in casework and follow up one group with at least 5 sessions. Besides this, the student shall be involved in the activities of the institution and fulfill the responsibilities that are asked of him/her by the agency/ field supervisor.

After each session of field work the students shall write a report of their activities and submit to the concerned field work supervisor. The supervisor shall conduct individual and group field work conferences regularly.

At the end of the semester the student shall submit a summary report for the semester and an external viva voce examination is conducted.

SWCA0047/SWCA6010: COMPUTER APPLICATIONS FOR SOCIAL SCIENCES (Lab)(0-0-2)

(2 Credits- 30 hours)

Course Outcome:

Learn the basic computer applications; those are useful for a social worker. (Remembering)

Learn and do data analysis for research using a Statistical Analysis Package. (Applying)

Module I (7 hours)

Word Processing: Meaning, Features, advantages; Structure of a Word Processor window; Creating document, saving opening and printing, find and replace. Creating table; Mail merge - main document, data source and merging

Module II (8 hours)

Spreadsheet Package: Cell, rows and columns; Range, structure of a spreadsheet window; Creating, saving opening and printing a spreadsheet, creating tables, charts; data analysis using formulae in a spreadsheet.

Module III (5 hours)

Presentation package: Creating presentations in a presentation package, text, tables, charts, Animation, running slide show, saving the slides, printing presentations; Internet and browsing, E-Mail, blogging, use of Internet in Research

Module IV (10 hours)

Data analysis using statistical software packages.

Suggested Reading:

Simon Slavin (Author), Richard Schoech. Human Services Technology: Understanding, Designing, and Implementing Computer and Internet Applications in the Social Services. NY: Haworth. (1999).
 Connie Morrison, Dolores Wells. Computer Literacy Basics: A Comprehensive Guide to Ic3. www.Ali-bris.com

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H	H	H	
CO 2	H	M		H

SWFW6010: CONTINUOUS FIELD WORK I (0-0-200)**(6 credits; 200 hours of Fieldwork in one month)****Expected Outcome:**

The students focus on their Area of Concentration / Specialization .

Enable the students to become more proficient in the field and apply relevant skills and techniques in handling real situations.

Opportunities to implement programmes

The process

The students shall be placed in the field for twenty five days of consecutive field work.

The field work settings shall be Communities, NGOs, Service Organizations, Hospitals, Clinics and Governmental Agencies.

The students will identify Organisations or Communities which will be approved by the Department.

The students are expected to apply all the methods of social work such as Social Casework, Group Work, Community Organization, Research and Administration, wherever applicable depending upon the organization and their services.

The students shall be involved in the activities of the Institution and fulfill the responsibilities as requested by the Agency Supervisor.

The students shall prepare a daily report of the field work activities implemented and share them through e-mail with the concerned Faculty Supervisor at the end of each day.

The Supervisor shall provide the necessary feedback and guidance to the students by also making personal visits if possible, to the field where they are placed.

At the end of the continuous field work placement, the students shall submit a consolidated or summary report highlighting the main activities implemented and the major learning from the field placement.

Every student shall also appear for an external viva voce examination at the end of the semester.

SWCF6012: CONTINUOUS FIELD WORK II (0-0-200)**(6 credits: 200 hours fieldwork in one month)****Expected Outcome:**

The students focus on their Area of Concentration / Specialization.

Enable the students to become more proficient in the field and apply relevant skills and techniques in handling real situations.

Opportunities to implement programmes

The process

The students shall be placed in the field for twenty five days of consecutive field work.

The field work settings shall be Communities, NGOs, Service Organizations, Hospitals, Clinics and Governmental Agencies. The students will identify Organisations or Communities which will be approved by the Department.

The students are expected to apply all the methods of social work such as Social Casework, Group Work, Community Organization, Research and Administration, wherever applicable depending upon the organization and their services.

The students shall be involved in the activities of the Institution and fulfill the responsibilities as requested by the Agency Supervisor.

The students shall prepare a daily report of the field work activities implemented and share them through e-mail with the concerned Faculty Supervisor at the end of each day.

The Supervisor shall provide the necessary feedback and guidance to the students by also making personal visits if possible, to the field where they are placed.

At the end of the continuous field work placement, the students shall submit a consolidated or summary report highlighting the main activities implemented and the major learning from the field placement.

Every student shall also appear for an external viva voce examination at the end of the semester.

SWIN6013: INTERNSHIP (0-0-200)

Pass/No Pass (200 hours fieldwork in one month)

Process

After the Examinations at the end of the 4th Semester or as per the prevailing socio-political situations, the students shall be placed with an NGO or Agency for a period of not less than one month for practical experience and application of their skills.

While Internship is not credited, it is mandatory for the completion of the MSW programme.

The students shall contact an agency of his/her choice and get the choice of agency approved by the department.

Students shall endeavor to choose an agency that is primarily in tune with their AOC and which has credentials in the concerned field.

At the end of every week the student shall send a brief report to the supervisor and at the end of the internship a summary report shall be submitted.

The summary report shall contain the short description of the agency, the social service skills applied in his/her work and the student's learning outcome.

The report shall be submitted in the format prescribed by the department and shall be submitted together with the certificate from the agency confirming his/her internship in a prescribed format.

SWRP6020: RESEARCH PROJECT PHASE I

(3 credits)

Every student shall undertake a research project work which has bearing on his/her AoC under the supervision and guidance of a faculty member. The preliminary work may begin at the end of the second semester. The students are expected to complete the Literature Survey followed by a Synopsis presentation during the Phase I. The dates, the mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester.

SWRP6021: RESEARCH PROJECT PHASE II

(3 credits)

Every student shall undertake a research project work which has bearing on his/her AoC and present a written thesis on the research work under the supervision and guidance of a faculty member. The preliminary work may begin at the end of the second semester. The students are expected to complete the data collection before the fourth semester. The thesis is to be submitted to the department before the date notified. The mode and components of evaluation and the weightages attached to them shall be published by the Department/Institute at the beginning of the semester. There shall be a viva voce examination on the research project.

SWSL0200: PARTICIPATORY SERVICE LEARNING-RURAL PRACTICUM (30-0-50)**Credits: 2 (30 Hours)****Course Outcomes**

Understanding the meaning and objectives of service learning and participatory approach to social development (Remembering and Understanding)

Learn and apply various methods, techniques and strategies for participatory rural/urban mapping, development and communication (Applying)

Appraising the spatial, temporal and relational aspects of communities in the village/urban settings by application of participatory learning, action and reflection (Evaluating)

Being familiar with culture, tradition, customs and social change and transformation processes of a rural/urban locality (Creating);

Engage in inter-cultural teamwork to study, understand and promote development in rural areas (Applying)

Module I: Introduction to Service Learning (5 Hours)

Concept of Service Learning— definition, principles, models of different Higher Education Institution Service Learning; Service Learning as a medium of Social change.

Module II: Introduction to participatory learning, action and reflection (5 Hours)

What is participation? Participatory approach to social development; Principles of community participation; Participatory Appraisal Methods.

Module III: Participatory community mapping (10 Hours)

Spatial maps- social map, transect, resource map, mobility map; Temporal maps- historical timeline, seasonal maps, daily activity maps, trends analysis; Relational maps- chapatti diagram, well-being ranking, pair-wise ranking, problem tree analysis. Community Dream Map.

Module IV: Participatory community development practice (10 Hours)

Rapport building, project identification, definition and planning, participatory implementation and monitoring, evaluation and Exit.

Suggested Readings

Chambers. R. (1983). Rural development: putting the last first. New Delhi: Routledge.

Jacoby, B. (2010). Service learning in higher education: concepts and practices. Michigan: Jossey-Bass Publishers.

Jacob, Islary. (2020). Pregnancy and Pregnancy care Practice: The lived Experience of the Bodos Mittal Publications, New Delhi.

Kelly, A., & Westoby, P. (2018). Participatory development practice: using traditional and contemporary frameworks. London: Practical Action Publishing.

Kumar, S. (2002). Methods for community participation: a complete guide for practitioners. New Delhi: Vistaar

Lukose P J, (2015) Social analysis: A guide for the Social Workers, Media House Publications, New Delhi

Lukose P J, (2015). A to Z in Projects Cycle Management: A Results Based Approach, Media House, Publications, New Delhi

Speck, B.W., & Hoppe, S.L. (2004). Service-learning: history, theory and issues. Connecticut: Greenwood Publishing Group.

<https://www.washington.edu/carlson/students-3/browse-service-learning-positions/>

<https://ccel.umn.edu/>

Mapping of COs to Syllabus

Course Outcomes	Module 1	Module 2	Module 3	Module 4
CO 1	H		M	H
CO 2	M	H	H	

CO 3		M	H	
CO 4	M		M	H
CO5	M		H	

SWCP6022: Community Development Project I**SWCP6023: Community Development Project II****EDPC0201: INDIAN POLITY AND CONSTITUTION****Course Outcomes**

At the end of this course students are able to:

Understand and analyse different governmental systems, the historical background and philosophy of the Indian Constitution

Understand and compare Indian Constitution with Constitution of other countries

Understand and analyse the Constitutional provisions for the Indian territory, citizenship, fundamental rights and duties and the procedure to amend the Indian Constitution

Understand and analyse the Indian federal structure, different levels of government and the Administration of special areas

Understand and analyse the Judicial system of India, rights and liabilities of the government and public servants, the functionalities of public service commissions and the electoral process in India

Understand and analyse the Constitutional provisions for the protection of SCs, STs and minorities and the contemporary issues of languages and cultures in India

Module - I

Governmental systems: Monarchy, Plutocracy, Theocracy, Democracy, Oligarchy, Authoritarianism, Totalitarianism, Parliamentary & Presidential, Unitary & Federal; The historical background and making of Indian Constitution; The philosophy and Features of the Indian Constitution; The Preamble; Comparison of Indian Constitution with Constitution of USA, UK, Australia and France

Module – II

Territory of the Indian Union; Citizenship; Fundamental Rights and Fundamental Duties; Directive Principles of the State Policy; Procedure of Amendment to the Constitution

Module – III

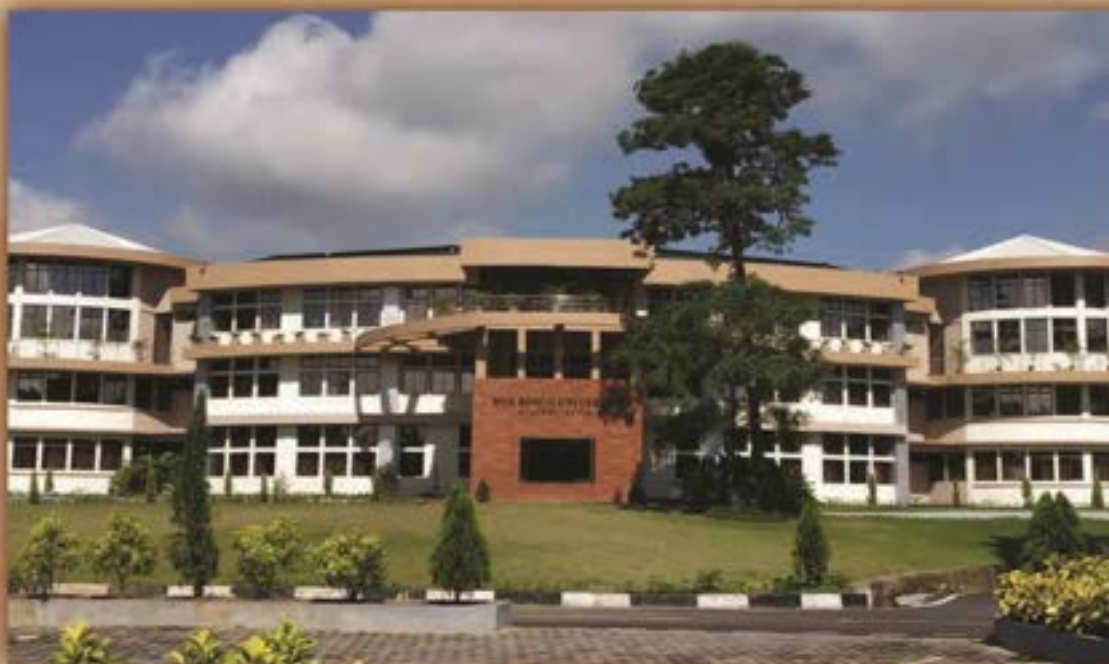
Polity: The Nature of the Federal system; Government of the Union; Government of the States; Administration of the Union
Territories; Local Government; Administration of special areas (Scheduled areas and Tribal Areas)

Module – IV

The Judicature: The Supreme Court; The High Court; Subordinate Courts; Rights and liabilities of the government and public servants; Public Service Commissions; Elections; Constitutional provisions for the protection of Minorities; Scheduled Caste and Scheduled Tribes; The issues of Languages and culture.

Suggested Readings:

- Austin, Granville. *Working A Democratic Constitution: The Indian Experience*. Oxford University Press, 2000.
- Basu, Durga Das. *Introduction To The Constitution Of India*. Lexis Nexis Butterworths Wadhwa Nagpur, 2020. 3. Basu, Durga Das, and S. S Subbramani. *Commentary On The Constitution Of India: Articles 79 To 123*, 1950
- Bhatia, Gautam. *The Transformative Constitution: A Radical Biography In Nine Acts*. 2019.
- Boyron, Sophie. *The Constitution of France: A Contextual Analysis*, Bloomsbury Publishing, 2012
- Chandrasekhar Rao, R. V. R, and V Sivalinga Prasad. *Indian Constitution And Polity*. Sterling Publishers, 1991.
- Cheryl, Saunders. *The Constitution of Australia: A Contextual Analysis (Constitutional Systems of the World Book 4)*. Hart Publishing; 1st edition, 2010
- Choudhry, Sujit et al. *The Oxford Handbook Of The Indian Constitution*. 2016.
- Courtney, Leonard Henry Courtney. *The Working Constitution Of The United Kingdom*. J.M. Dent, 1920.
- Katju, Justice Markandey. *Whither Indian Judiciary*. 2018
- Khosla, Madhav. *India'S Founding Moment: The Constitution Of A Most Surprising Democracy*. 2020.
- Thiruvengadam, Arun K. *Constitution Of India - A Contextual Analysis*. 2017.
- Wood, Gordon S. *The Creation Of The American Republic, 1776-1787*. The University Of North Carolina Press, 2011.



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